Support to the evaluation of Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure

Final report

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CONTENTS

ABBREVIATIONS, AND ACRONYMS

Abbreviation	Definition
AC	alternating current
ACER	Agency for the Cooperation of Energy Regulators
ACON	Again Connected Networks
B/C (ratio)	benefit–cost (ratio)
BBPIG	Federal Requirement Plan Act (Bundesbedarfsplangesetz)
BEMIP	Baltic Energy Market Interconnection Plan
CAPEX	capital expenditure
CBA	cost–benefit analysis
CBCA	cross-border cost allocation
CCS	carbon capture and storage
CCUS	carbon capture, utilisation and storage
CEER	Council of European Energy Regulators
CEF	Connecting Europe Facility
CEP	Clean Energy Package
CESEC	Central and South-Eastern European Energy Connectivity
CIRCABC	Communication and Information Resource Centre for Administrations, Business and Citizens
CO2	carbon dioxide
COVID-19	coronavirus disease 2019
DC	direct current
DG ENER	European Commission Directorate-General for Energy
DMB	decision-making body
DSO	distribution system operator
EBRD	European Bank for Reconstruction and Development
ECS	Energy Community Secretariat
EEFP	energy efficiency first principle
EEMM	European Electricity Market Model
EGMM	European Gas Market Model
EIA	environmental impact assessment
EIB	European Investment Bank
ENPV	economic net present value
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSOG	European Network of Transmission System Operators for Gas
ENTSOs	ENTSO-E and ENTSOG referred to collectively
EQ	evaluation question
EQM	evaluation question matrix
ESIA	environmental social impact assessment
EU	European Union
EUR	euro
FEED	front-end engineering design
FID	final investment decision
FTE	full-time equivalent
GHG	greenhouse gas
GIPL	gas interconnection Poland–Lithuania
HV (level)	high voltage (level)
HVDC	high-voltage direct current
IA	impact assessment
IAP	Ionian–Adriatic Pipeline
INEA	Innovation and Networks Executive Agency
IP	interconnection point
JRC	Joint Research Centre
KPI	key performance indicator
LNG	liquefied natural gas
LTS	Long-Term Strategy
LV (level)	low voltage (level)
MACZT	margin available for cross-zonal trade
MMR	market monitoring report
MSPS	multi-sectoral planning support

Abbreviation	Definition
MV (level)	medium voltage (level)
NCA	national competent authority
NDP	national development plan
NECP	national energy and climate plan
NGO	non-governmental organisation
NNDP	national network development plan
NRA	national regulatory authority
NSCOGI	North Seas Countries Offshore Grid Initiative
NSI East Electricity/Gas	north–south electricity/gas interconnections in central, eastern and south-eastern Europe
NSOG	North Seas Offshore Grid
OHL	overhead line
OPC	online public consultation
OPEX	operating expenditure
PCI	project of common interest
PECI	project of Energy Community interest
RAB	regulatory asset base
REA	rapid evidence assessment
RES	renewable energy sources
SA	single authorisation
SCP-X	South Caucasus Pipeline extension
SGC	Southern Gas Corridor
SOS	security of supply
TANAP	Trans-Anatolian Natural Gas Pipeline
TAP	Trans-Adriatic Pipeline
TEN-E	Trans-European Network for Energy
TEN-T	Trans-European Transport Network
TFEU	Treaty on the Functioning of the European Union
ToR	terms of reference
TPA	third-party access
TSO	transmission system operator
TYNDP	Ten-Year Network Development Plan
UGS	underground gas storage

ABSTRACT

Regulation (EU) No 347/2013 (the Trans-European Network for Energy (TEN-E) Regulation) is part of a larger regulatory framework adopted to tackle barriers to the implementation of European energy infrastructure and integration of energy networks. The evidence base of this study has been used to evaluate the Regulation against the five evaluation criteria: effectiveness, efficiency, relevance, coherence and EU added value.

The study finds that the projects of common interest (PCIs) facilitated by the Regulation have contributed to security of supply and integration of energy markets. The organisation of PCI selection in regional groups is an important factor towards these results. Permit-granting procedures have shortened, but their effectiveness strongly depend on national implementation. Cross-border cost allocation (CBCA) is beneficial in some cases but CBCA processes are often triggered to obtain access to CEF funding and are often concluded with no costs allocated across borders. Provisions on regulatory incentives are scarcely used. The Connecting Europe Facility (CEF) grants (EUR 3.7 billion) contributed to the development of 95 PCIs to date.

Although the Regulation has been generally effective, efficient and a clear added value of EU intervention, there is a need to improve the relevance and coherence of the Regulation, in the context of the European Green Deal, by prioritising sustainability aspects.

EXECUTIVE SUMMARY

Introduction to Regulation (EU) No 347/2013 and the evaluation

Energy infrastructure is crucial for the uninterrupted availability of energy at a price which is affordable for consumers, and also contributes to the EU wider social welfare and climate goals. The development of large-scale energy infrastructure is complex, especially when networks cross borders. Regulation (EU) No 347/2013 on guidelines for a Trans-European Network for Energy (hereinafter referred to as the 'TEN-E Regulation'), is part of a larger regulatory framework adopted to tackle a number of barriers to the implementation of European energy infrastructure and integrated energy networks.

At the time when the Regulation came into force in the field of gas, concerns about security of supply (SOS) were setting the agenda. For electricity, the integration of renewable sources into the market was (already) the main concern. Investments in infrastructure were also needed to foster market integration and maintain SOS. The following main obstacles were to be addressed via the Regulation:

- **extensive time required for projects to acquire building permits**, which can impede the timely implementation of energy infrastructure projects, and **opposition of the affected population**;
- **regulatory challenges** involved in building cross-border projects; and
- **lack of commercial viability of some energy infrastructure projects**, including limited financing capacities of transmission system operators (TSOs) and difficulties for energy infrastructure investments in attracting new investors such as pension funds and insurance companies.

The goals of the Regulation are:

- to ensure the functioning of the internal energy market and SOS in the Union;
- to promote the development of new and renewable forms of energy, energy efficiency and energy savings; and
- to promote the interconnection of energy networks.

The TEN-E Regulation has established a process for the selection of projects of common interest (PCIs). The latest 'PCI list' (the 4th) contains 149 PCIs. PCIs are categorised by sector; the majority of list entries are electricity PCIs (100 projects), followed by gas PCIs (32), oil PCIs (6), smart grids PCIs (6) and carbon dioxide (CO2) PCIs (5). The TEN-E Regulation contains a number of provisions, including:

- provisions on (priority status in) permit-granting procedures and public participation;
- provisions on monitoring of project implementation;
- provisions on cross-border allocation of project costs and regulatory incentives; and
- provisions on eligibility for funding from the Connecting Europe Facility (CEF).

In December 2019 the European Commission published the Communication of the European Commission COM(2019) 640 ([1]) (hereinafter, the 'European Green Deal') with an aim to include the objective of achieving climate neutrality by 2050 in the proposed European Climate Law. The European Green Deal explicitly refers to the need for a review of the TEN-E Regulation to ensure consistency with climate neutrality objectives. In May 2020, the Commission published an inception impact assessment of a revision of the TEN-E Regulation to align the policy framework with the new policy context. As a result, the Commission has decided to undertake a 'back-to-back' evaluation and revision based on a fully-fledged impact assessment. The study, therefore, contains

([1]) European Commission (2019), The European Green Deal, https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf.

a retrospective evaluation with formative elements for an assessment of the extent to which the current Regulation is fit-for-purpose and relevant in the future.

Approach and methodology of the evaluation

The study complies with the Commission's Better Regulation Guidelines and therefore assesses the TEN-E Regulation against five core evaluation criteria: effectiveness; efficiency; relevance; coherence; and EU added value. The **approach** to the study followed the typical four evaluation stages: structuring (evaluation matrix, intervention logic, inception); observing (data collection); analysis; and judging and reporting.

The **methodology** included:

- desk research – extensive desk research providing insight on backward- and forward-looking elements;
- interviews – 82 semi-structured interviews with representatives of project promoters, including TSOs and distribution system operators, national regulatory authorities (NRAs), national competent authorities (NCAs), industry associations, non-governmental organisations (NGOs), the Agency for the Cooperation of Energy Regulators (ACER), the European Network of Transmission System Operators for Electricity (ENTSO-E), the European Network of Transmission System Operators for Gas (ENTSOG) and the European Commission;
- a targeted survey – an online survey to gather additional information, receiving 112 responses;
- case studies – six case studies of specific PCIs;
- webinars – in June 2020 four webinars were organised with various stakeholders invited to share their views on the evaluation and revision of the Regulation;
- modelling – the net benefits of gas and electricity PCIs have been assessed with models developed by REKK;
- open public consultation – 103 responses were obtained via the open public consultation, and an additional 169 emails were received via the functional mailbox for the consultation.

Main conclusions

In terms of its overall goals, the TEN-E Regulation has effectively improved market integration and competitiveness, as shown in the evidence on interconnection targets and energy prices and their convergence across the EU. SOS has also improved; PCIs in electricity and gas as well as market circumstances and other regulations (e.g. Security of Supply Regulation and Network codes) contributed to this. For gas, infrastructure and supply resilience has improved substantially since 2013 with almost all Member States being compliant with the N-1 rule which means that demand can be covered even if infrastructure fails.

The focus on cross-border projects that increase interconnection made an effective contribution to these goals. In this respect, the organisation of PCI selection in regional groups, under the coordination of the Commission, is found to be an important factor, as is the approach of sharing costs among Member States to enable projects with benefits across borders. The financing support provided by the CEF also contributed to this, mainly by supporting electricity projects but also by providing targeted support to gas interconnectors in Central and Eastern European Member States that helped end energy isolation and successfully decrease dependence on dominant external suppliers.

The impact of the Regulation on energy and climate targets, energy efficiency and reduction of greenhouse gases emissions is less significant, mostly reflecting the intervention rationale of the TEN-E Regulation at the time it was established. Electricity interconnection PCIs are key elements for the integration of renewable energy sources into the European market. The contribution of gas projects to sustainability is less clear and difficult to assess as there is no robust assessment methodology currently. Due to a lack of a robust methodology, the sustainability criterion for selection of gas PCIs has played a less significant role than criteria related to the other three overall objectives of market integration, competitiveness and SOS. The sustainability criterion, therefore, has not always been effective in the pursuit of the 2020 energy and climate targets.

Permit-granting procedures have shortened since the entry into force of the TEN-E Regulation, but the effectiveness of permit-granting procedures strongly depends on national implementation. Provisions on cross-border cost allocation (CBCA) are beneficial in some cases but less effective in others. While stakeholders generally support the idea of sharing costs in relation to benefits between Member States, the details of this mechanism (such as timeline and data requirements) as well as its complexity reduce its attractiveness. CBCA processes are often triggered to obtain access to CEF funding and are regularly concluded with no costs allocated across borders. Provisions on regulatory incentives are rarely used.

The modelling in this study shows that the net benefits of commissioned gas PCIs are highly positive. Commissioned gas PCIs have substantially increased market integration and SOS for the EU. Results also underpin that only limited investment into the gas network should be provided in the future. Net benefits of electricity PCIs increase in scenarios with a higher CO2 price, which in turn shows that these projects have benefits in the context of the European Green Deal. Commissioned PCIs in both electricity and gas had a higher impact on the periphery and smaller markets; therefore, they contributed to energy market integration in both sectors.

The benefits of the Regulation outweigh the costs. The Regulation brings EU added value, as the results could not have been achieved by action at Member State level. Opportunities to improve the efficiency of the Regulation are limited, but the study has identified potential options to reduce the administrative burden for project promoters of the PCI application process and in terms of monitoring requirements.

Although the Regulation has been generally effective and efficient with clear added value of EU intervention, there is a need to revise the Regulation to bring it in line with the climate neutrality objective.

The context of the European Green Deal requires the prioritisation of sustainability aspects in the TEN-E Regulation. The emphasis of the Regulation needs to shift to energy system integration. This requires more system flexibility and storage, integration of a higher share of low-carbon fuels (including hydrogen) and digitalisation. There is a need to prioritise electricity infrastructure investment alongside investments in infrastructure for low-carbon and synthetic fuels (e.g. biogas, biomethane and low-carbon hydrogen) for those sectors where full electrification is not feasible. Some stakeholders (e.g. NGOs) are of the opinion that oil and gas projects should not be eligible for the PCI label in the future. Although gas may still play an important role in the transition towards a more decarbonised energy system for some Member States our modelling shows that the European network infrastructure (including the PCI projects for which an investment decision has been taken) is already adequate to serve the demand. Stakeholders have mentioned numerous projects that should fall within the scope of the TEN-E Regulation and encourage the revision of the Regulation to fit these emerging technologies into the PCI scheme by introducing new thematic areas or modifying current restrictive criteria (e.g. extending smart grid to gas and low-voltage projects, including thematic areas on hybrid offshore wind, hydrogen infrastructures and clean gases). Regulators, in contrast, argue that the TEN-E Regulation should keep a focus on large-scale projects with a cross-border impact.

Recommendations

The following recommendations for the revision of the Regulation are based on the issues identified.

Recommendations on the scope of the Regulation and the PCI selection process

Changes to the scope of the Regulation, including selection criteria and the PCI selection process, are needed to align the TEN-E Regulation with the new climate objectives.

Priority corridors and thematic areas may need to be updated in view of future challenges for the network infrastructure. These challenges may be addressed by new types of project. This revision may consider adding, modifying or dismissing priority corridors and thematic areas. In view of the uncertainty about the development of emerging technologies, it might be necessary to have some flexibility in the definition of priority corridors and thematic areas, i.e. more open definitions or periodic revisions.

Selection criteria have to be adapted to ensure projects are also in line with climate objectives. A positive contribution to sustainability ('sustainability first') should be a prerequisite for all projects.

As for gas infrastructures, sustainability roadmaps can be used to ensure they can be refurbished to transport hydrogen or other decarbonised gases.

The inclusion of the 'energy efficiency' first principle (EEFP) should be explicitly considered in the TEN-E Regulation. Energy efficiency could be explicitly included among the specific criteria in Article 4 and/or Annexes II and IV in order to ensure that the most efficient conversion, transmission and distribution of energy infrastructures are deployed. Another alternative to account for EEFP, and in line with Article 51.3 of the Electricity Directive, could be to enforce that grid infrastructure projects are evaluated against energy efficiency / demand response solutions as alternatives to system expansion.

The cross-border criterion could be redefined to expand the concept of cross-border impact, with the aim of facilitating the deployment of decentralised infrastructures in single Member States. A potential definition of 'cross-border impact' is a quantifiable positive impact on the TEN-E objectives. If this definition would be used, more projects would fulfil the cross-border criterion which could make the number of PCIs unmanageable. For this reason, we recommend setting impact thresholds that can only be attained by relatively large projects.

The specific selection criteria for smart grids from Annex IV.1.e and especially the 10 kV threshold might be hindering the full deployment of smart grid projects. These criteria may need to be reconsidered if projects at lower voltage levels are seen as necessary for the fulfilment of the TEN-E objectives.

In view of potential conflict in the roles of ENTSO-E and ENTSOG (the ENTSOs) – as project promoters and developers of the scenarios and cost–benefit analysis (CBA) methodology against which projects are evaluated – and given the shared perception among stakeholders that ENTSOs have predominant roles that are not seen as fully independent, some mitigation measures must be taken to ensure trust in the PCI selection process from all stakeholders. Two different approaches can be taken: (1) enhance stakeholder engagement in all relevant steps of the PCI selection process, in particular, scenario development and CBA methodology revisions; or (2) consider providing ACER or another independent entity with the power to approve and amend scenarios and CBA methodology guidelines. A drawback of the first approach is that there is still a (perceived) risk of ENTSOs not acting in the best interests of all stakeholders. However, it is acknowledged that the ENTSOs have the required expertise and their members are also involved in development of national development plans in Member States. Regardless of the approach taken, the PCI selection process should continue to be transparent and based on a solid CBA methodology.

Recommendation on CBCA

CBCAs are beneficial in some cases but less effective in others. Ineffectiveness of the CBCA process can result in projects that are not realised due to a lack of funding or to the 'unnecessary' use of EU funding where projects could also be funded from tariffs in Member States. Due to the ineffectiveness of CBCA, project promoters, NRAs and ACER consider it as an administrative burden with, in many cases, little or no direct benefits.

The effectiveness of the CBCA process can be improved by including stricter guidelines in the TEN-E Regulation on the steps to be taken in the process. The objective of the guidelines would be to ensure a harmonised approach for considering all costs and benefits to identify the financing gap for which European funding may be needed. The guidelines should, at the least, refer to the CBA methodology, the input data to be used, the interpretation of CBA results and allocation of investment costs (it should be clear if and when EU funding can be assumed). If the benefits of a project in other Member States are below a certain threshold (and there are limited opportunities to allocate costs across borders), the CBCA process should be as brief and efficient as possible.

Recommendations on the permitting process

Project promoters describe varying experiences with the permitting process which are essentially shaped by the national implementation of the permitting rules of the TEN-E Regulation. This relates to national permit-granting legislation as well as the provisions of the TEN-E Regulation on the creation of one-stop shops for permit granting. With such diverging national contexts and rules that are beyond the scope of the TEN-E Regulation, there seems to be limited scope for additional EU action to reduce the duration of permit-granting procedures. However, there seems to be potential for developing mechanisms to improve the European performance, especially as cross-border projects are the focus of the Regulation. As project set-ups and contexts differ for each PCI, the experiences gained in other Member States can be of value to national authorities both at a general

level concerning the organisation of responsibilities and obligations and at the level of specific projects regarding the implications on the permitting process.

Therefore, it is recommended that the TEN-E Regulation should improve the monitoring of implementation of permitting schemes in the Member States and develop further incentives and guidance to national authorities on how to achieve streamlined and shortened permitting durations. This can be achieved by promoting platforms to share best practices between NCAs with a view to shortening the permitting processes in countries that have not yet been able to.

Recommendations to reduce administrative costs of specific provisions

The following three recommendations aim mainly to reduce the administrative burden for project promoters.

Reapplication for PCI list

Project promoters consider it too burdensome that all projects go through the full application process for every PCI list. The renewal process also creates uncertainty for the projects.

The rationale for assessing all projects (including existing PCIs) for each new PCI list is that all projects can be assessed on an equal basis and changes in (market) circumstances can be taken into account. We recommend reducing the burden of reapplication for all projects and infrastructure categories by using data from previous applications and monitoring results as much as possible.

Monitoring costs

Monitoring costs were most frequently mentioned as an administrative burden by project promotors. Monitoring costs can be reduced by decreasing the frequency of reporting, by narrowing the scope of monitoring or by making it easier and more user-friendly to submit data. We recommend reviewing on a continuous basis whether data requirements are still fit for purpose and seeking opportunities to make the submission process easier. Monitoring on a biennial basis (once per PCI list) instead of yearly would reduce the administrative burden, but it would also result in a loss of transparency.

Regulatory incentives

Provisions on regulatory incentives are rarely used. For this reason, we recommend not including the regulatory incentives in their current form in a revised version of the Regulation. However, the benefits of removing those provisions are limited, as the administrative burden for project promoters and NRAs is low. Some stakeholders, especially project promoters, think that regulatory incentives might be effective for specific projects. If provisions on regulatory incentives are part of a revised version of the Regulation, we recommend that they are more prescriptive about when (e.g. for specific infrastructure categories such as offshore electricity networks or if the regulatory framework in a Member State provides a disincentive to allocate costs to other Member States or to use CEF funding) and how they have to be used.

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RESUME EXECUTIF

Introduction au règlement (UE) n° 347/2013 et à l'évaluation

Les infrastructures énergétiques sont essentielles pour assurer la disponibilité ininterrompue de l'énergie à un prix abordable pour les consommateurs, et contribuent également à la réalisation des objectifs de l'UE en matière de bien-être social et d'objectifs climatiques. Le développement d'infrastructures énergétiques à grande échelle est complexe, en particulier lorsque les réseaux traversent les frontières. Le règlement (UE) n° 347/2013 concernant des orientations pour les infrastructures énergétiques transeuropéennes (ci-après dénommé "règlement RTE-E") fait partie d'un cadre réglementaire plus large adopté pour lever un certain nombre d'obstacles à la mise en œuvre des infrastructures énergétiques européennes et des réseaux énergétiques intégrés.

Au moment où le règlement est entré en vigueur dans le domaine du gaz, les préoccupations relatives à la sécurité de l'approvisionnement étaient à l'ordre du jour. Pour l'électricité, l'intégration des sources renouvelables dans le marché était (déjà) la principale préoccupation. Des investissements dans les infrastructures étaient également nécessaires pour favoriser l'intégration du marché et maintenir la sécurité d'approvisionnement. Les principaux obstacles suivants devaient être abordés par le biais du règlement:

- **le temps considérable nécessaire à l'obtention des permis de construire**, qui peut entraver la mise en œuvre en temps voulu des projets d'infrastructures énergétiques, et **l'opposition de la population affectée** ;
- **les défis réglementaires** liés à la construction de projets transfrontaliers ; et
- **le manque de viabilité commerciale de certains projets d'infrastructures énergétiques**, notamment les capacités de financement limitées des gestionnaires de réseaux de transport (GRT) et les difficultés pour les investissements dans les infrastructures énergétiques à attirer de nouveaux investisseurs tels que les fonds de pension et les compagnies d'assurance.

Les objectifs du règlement sont les suivants :

- assurer le fonctionnement du marché intérieur de l'énergie et la sécurité de l'approvisionnement dans l'Union ;
- promouvoir le développement de formes d'énergie nouvelles et renouvelables, l'efficacité énergétique et les économies d'énergie ; et
- promouvoir l'interconnexion des réseaux énergétiques.

Le règlement RTE-E a établi un processus de sélection des projets d'intérêt commun (PIC). La dernière "liste PIC" (la 4e) contient 149 PIC. Les PIC sont classés par secteur ; la majorité des entrées de la liste sont des PIC pour l'électricité (100 projets), suivis par les PIC pour le gaz (32), le pétrole (6), les réseaux intelligents (6) et le dioxyde de carbone (CO2) (5). Le règlement RTE-E contient un certain nombre de dispositions, notamment:

- des dispositions relatives aux (statut prioritaire dans les) procédures d'octroi de permis et à la participation du public ;
- des dispositions relatives au suivi de la mise en œuvre des projets ;
- des dispositions sur la répartition transfrontalière des coûts des projets et les incitations réglementaires ; et
- des dispositions sur l'éligibilité au financement de la facilité Connecter l'Europe (FCE).

En décembre 2019, la Commission européenne a publié la communication de la Commission européenne COM(2019) 640 ([2]) (ci-après, le "Green Deal européen") dans le but d'inclure l'objectif de neutralité climatique d'ici 2050 dans la proposition de loi européenne sur le climat. Le "Green Deal" européen fait explicitement référence à la nécessité d'une révision du règlement RTE-E pour assurer la cohérence avec les objectifs de neutralité climatique. En mai 2020, la Commission a publié une première évaluation de l'impact d'une révision du règlement RTE-E afin d'aligner le cadre

([2]) Commission européenne (2019), The European Green Deal, https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf.

politique sur le nouveau contexte politique. En conséquence, la Commission a décidé d'entreprendre une évaluation et une révision "dos à dos" sur la base d'une analyse d'impact à part entière. L'étude contient donc une évaluation rétrospective avec des éléments formateurs pour évaluer dans quelle mesure le règlement actuel est adapté à son objectif et pertinent à l'avenir.

Approche et méthodologie de l'évaluation

L'étude est conforme aux orientations de la Commission en matière d'amélioration de la réglementation et évalue donc le règlement RTE-E en fonction de cinq critères d'évaluation fondamentaux : efficacité, efficience, pertinence, cohérence et valeur ajoutée européenne. L'**approche** de l'étude a suivi les quatre étapes d'évaluation habituelles : structuration (matrice d'évaluation, logique d'intervention, phase de lancement du projet), observation (collecte de données), analyse, jugement et rédaction du rapport.

La **méthodologie** comprenait:

- une recherche documentaire - une recherche documentaire approfondie fournissant un aperçu des éléments rétrospectifs et prospectifs;
- des entretiens - 82 entretiens semi-structurés avec des représentants des promoteurs de projets, notamment des gestionnaires du réseau de transport (GRT) et des gestionnaires de réseaux de distribution, des autorités nationales de régulation (ARN), des autorités nationales compétentes (ANC), des associations industrielles, des organisations non gouvernementales (ONG), de l'Agence de coopération des régulateurs de l'énergie (ACRE), du Réseau européen des gestionnaires de réseaux de transport d'électricité (REGRT-E), du Réseau européen des gestionnaires de réseaux de transport de gaz (REGRT-G) et de la Commission européenne;
- une enquête ciblée - une enquête en ligne visant à recueillir des informations supplémentaires, recevant 112 réponses;
- des études de cas - six études de cas sur des PIC spécifiques;
- des webinaires - en juin 2020, quatre webinaires ont été organisés avec différentes parties prenantes invitées à partager leurs points de vue sur l'évaluation et la révision du règlement;
- une modélisation - les avantages nets des PIC pour le gaz et l'électricité ont été évalués à l'aide de modèles développés par le REKK;
- une consultation publique ouverte - 103 réponses ont été collectées via la consultation publique ouverte, et 169 courriels supplémentaires ont été reçus via la messagerie fonctionnelle rien que pour la consultation.

Conclusions principales

En ce qui concerne ses objectifs généraux, le règlement RTE-E a effectivement amélioré l'intégration du marché et la compétitivité, comme le montrent les données relatives aux objectifs d'interconnexion et aux prix de l'énergie et à leur convergence dans l'UE. La sécurité d'approvisionnement s'est également améliorée ; les PIC dans le domaine de l'électricité et du gaz ainsi que les conditions du marché et d'autres réglementations (par exemple, le règlement sur la sécurité d'approvisionnement et les codes de réseau) y ont contribué. Pour le gaz, la résilience des infrastructures et de l'approvisionnement s'est considérablement améliorée depuis 2013, presque tous les États membres étant conformes à la règle N-1, ce qui signifie que la demande peut être couverte même en cas de défaillance des infrastructures.

L'accent mis sur les projets transfrontaliers qui augmentent l'interconnexion a contribué efficacement à ces objectifs. À cet égard, l'organisation de la sélection des PCI en groupes régionaux, sous la coordination de la Commission, s'avère être un facteur important, tout comme l'approche consistant à partager les coûts entre les États membres pour permettre la réalisation de projets dont les avantages dépassent les frontières. Le soutien financier apporté par le FCE y a également contribué, principalement en soutenant des projets dans le domaine de l'électricité, mais aussi en apportant un soutien ciblé aux interconnecteurs gaziers des États membres d'Europe centrale et orientale qui ont contribué à mettre fin à l'isolement énergétique et à réduire avec succès la dépendance vis-à-vis des fournisseurs extérieurs dominants.

L'impact du règlement sur les objectifs énergétiques et climatiques, l'efficacité énergétique et la réduction des émissions de gaz à effet de serre est moins important, reflétant principalement la logique d'intervention du règlement RTE-E au moment de sa mise en place. Les PIC d'interconnexion électrique sont des éléments clés pour l'intégration des sources d'énergie renouvelables dans le marché européen. La contribution des projets gaziers à la durabilité est moins claire et moins facile à évaluer, car il n'existe actuellement aucune méthode d'évaluation solide. En raison de l'absence

d'une méthodologie solide, le critère de durabilité pour la sélection des PIC gaziers a joué un rôle moins important que les critères liés aux trois autres objectifs généraux que sont l'intégration du marché, la compétitivité et la sécurité d'approvisionnement. Le critère de durabilité n'a donc pas toujours été efficace dans la poursuite des objectifs énergétiques et climatiques de 2020.

Les procédures d'octroi de permis ont été raccourcies depuis l'entrée en vigueur du règlement RTE-E, mais l'efficacité de ces procédures dépend fortement de la façon dont elles sont mises en œuvre au niveau national. Les dispositions relatives à la répartition transfrontalière des coûts sont bénéfiques dans certains cas, mais moins efficaces dans d'autres. Si les acteurs concernés soutiennent généralement l'idée d'un partage des coûts par rapport aux avantages entre les États membres, les détails de ce mécanisme (tels que le calendrier et les exigences en matière de données) ainsi que sa complexité réduisent son attractivité. Les processus de la répartition transfrontalière des coûts sont souvent déclenchés pour obtenir l'accès au financement du MIE et sont régulièrement conclus sans qu'aucun coût ne soit réparti entre les États membres. Les dispositions relatives aux incitations réglementaires sont rarement utilisées.

La modélisation effectuée dans cette étude montre que les avantages nets des PIC pour le gaz mis en service sont très positifs. Ils ont considérablement renforcé l'intégration du marché et la sécurité d'approvisionnement de l'UE. Les résultats montrent également que seuls des investissements limités dans le réseau gazier devraient être réalisés à l'avenir. Les bénéfices nets des PIC pour l'électricité augmentent dans les scénarios où le prix du CO2 est plus élevé, ce qui montre que ces projets présentent des avantages dans le cadre du "Green Deal" européen. Les PIC commandés dans les secteurs de l'électricité et du gaz ont eu un impact plus important sur les petits marchés et les marchés périphériques ; ils ont donc contribué à l'intégration du marché de l'énergie dans les deux secteurs.

Les avantages du règlement l'emportent sur les coûts. Le règlement apporte une valeur ajoutée européenne, car les résultats n'auraient pas pu être atteints par une action au niveau des États membres. Les possibilités d'améliorer l'efficacité du règlement sont limitées, mais l'étude a identifié des options potentielles pour réduire la charge administrative pour les promoteurs de projets dans le cadre du processus de demande de PIC et en termes d'exigences de suivi.

Bien que le règlement ait été généralement efficace et efficient, avec une valeur ajoutée évidente de l'intervention de l'UE, il est nécessaire de le réviser pour le mettre en conformité avec l'objectif de neutralité climatique.

Le contexte du "Green Deal" européen exige que les aspects de durabilité soient considérés comme prioritaires dans le règlement RTE-E. L'accent du règlement doit être mis sur l'intégration des systèmes énergétiques. Cela nécessite une plus grande flexibilité du système et du volume de stockage, l'intégration d'une part plus importante de combustibles à faible teneur en carbone (y compris l'hydrogène) et la numérisation. Il est nécessaire de donner la priorité aux investissements dans les infrastructures électriques, parallèlement aux investissements dans les infrastructures pour les combustibles à faible teneur en carbone et synthétiques (par exemple, le biogaz, le biométhane et l'hydrogène à faible teneur en carbone) pour les secteurs où une électrification complète n'est pas possible. Certains acteurs (par exemple, les ONG) sont d'avis que les projets pétroliers et gaziers ne devraient pas être éligibles au label PIC à l'avenir. Bien que le gaz puisse encore jouer un rôle important dans la transition vers un système énergétique plus décarbonisé pour certains États membres, notre modélisation montre que l'infrastructure du réseau européen (y compris les projets PIC pour lesquels une décision d'investissement a été prise) est déjà adéquate pour répondre à la demande. Les acteurs du secteur ont mentionné de nombreux projets qui devraient entrer dans le champ d'application du règlement RTE-E et encouragent la révision du règlement afin d'intégrer ces technologies émergentes dans le système de PIC en introduisant de nouveaux domaines thématiques ou en modifiant les critères restrictifs actuels (par exemple, étendre le réseau intelligent aux projets gaziers et basse tension, y compris les domaines thématiques sur l'éolien offshore hybride, les infrastructures d'hydrogène et les gaz propres). Les régulateurs, en revanche, soutiennent que le règlement RTE-E devrait continuer à se concentrer sur les projets à grande échelle ayant un impact transfrontalier.

Recommandations

Les recommandations suivantes pour la révision du règlement sont basées sur les problèmes constatés.

Recommandations sur le champ d'application du règlement et le processus de sélection des PIC

Il est nécessaire de modifier le champ d'application du règlement, notamment les critères de sélection et le processus de sélection des PIC, afin d'aligner le règlement RTE-E sur les nouveaux objectifs climatiques.

Les axes prioritaires et les zones thématiques pourraient devoir être mis à jour en vue des défis futurs relatifs à l'infrastructure du réseau. Ces défis peuvent être traités par de nouveaux types de projets. Cette révision pourrait envisager d'ajouter, de modifier ou de supprimer des axes prioritaires et des zones thématiques. Compte tenu de l'incertitude quant au développement des technologies émergentes, il pourrait être nécessaire d'avoir une certaine flexibilité dans la définition des corridors prioritaires et des zones thématiques, c'est-à-dire des définitions plus ouvertes ou des révisions périodiques.

Les critères de sélection doivent être adaptés pour garantir que les projets soient également conformes aux objectifs climatiques. Une contribution positive à la durabilité ("la durabilité d'abord") devrait être une condition préalable à tous les projets. Comme pour les infrastructures gazières, des feuilles de route de durabilité peuvent être utilisées pour s'assurer qu'elles peuvent être remises en état pour le transport d'hydrogène ou d'autres gaz décarbonisés.

L'inclusion du principe d'efficacité énergétique en premier (PEEP) devrait être explicitement envisagée dans le règlement RTE-E. L'efficacité énergétique pourrait être explicitement incluse parmi les critères spécifiques de l'article 4 et/ou des annexes II et IV afin de garantir le déploiement des infrastructures de conversion, de transport et de distribution d'énergie les plus efficaces. Une autre solution pour tenir compte du PEEP, et conformément à l'article 51, paragraphe 3, de la directive sur l'électricité, pourrait consister à faire en sorte que les projets d'infrastructure de réseau soient évalués en fonction de l'efficacité énergétique / des solutions de réponse à la demande comme alternatives à l'expansion du réseau.

Le critère transfrontalier pourrait être redéfini pour élargir le concept d'impact transfrontalier, dans le but de faciliter le déploiement d'infrastructures décentralisées dans les différents États membres. Une définition potentielle de l'"impact transfrontalier" est un impact positif quantifiable sur les objectifs du RTE-E. Si cette définition était utilisée, davantage de projets répondraient au critère transfrontalier, ce qui pourrait rendre le nombre d'PIC ingérable. Pour cette raison, nous recommandons de fixer des seuils d'impact qui ne peuvent être atteints que par des projets relativement importants.

Les critères de sélection spécifiques pour les réseaux intelligents de l'annexe IV.1.e, et notamment le seuil de 10 kV, pourraient entraver le déploiement complet des projets de réseaux intelligents. Ces critères devront éventuellement être reconsidérés si des projets à des niveaux de tension inférieurs sont considérés comme nécessaires pour la réalisation des objectifs du RTE-E.

Compte tenu du conflit potentiel entre les rôles de l'REGRT-E et de l'REGRT-G (les REGRT) - en tant que promoteurs de projets et développeurs des scénarios et de la méthodologie d'analyse coûts-bénéfices (ACB) par rapport à laquelle les projets sont évalués - et étant donné la perception partagée par les parties prenantes que les REGRT ont des rôles prédominants qui ne sont pas considérés comme totalement indépendants, certaines mesures d'atténuation doivent être prises pour garantir la confiance de toutes les acteurs dans le processus de sélection des PIC. Deux approches différentes peuvent être adoptées : (1) renforcer la participation des parties prenantes à toutes les étapes pertinentes du processus de sélection des PIC, en particulier l'élaboration des scénarios et la révision de la méthodologie des ACB ; ou (2) envisager de donner à l'ACRE ou à une autre entité indépendante le pouvoir d'approuver et de modifier les scénarios et les lignes directrices de la méthodologie des ACB. Un inconvénient de la première approche est qu'il existe toujours un risque (perçu) que les REGRT n'agissent pas dans le meilleur intérêt de toutes les parties prenantes. Toutefois, il est reconnu que les REGRT possèdent l'expertise requise et que leurs membres participent également à l'élaboration des plans de développement nationaux dans les États membres. Quelle que soit l'approche adoptée, le processus de sélection des PIC doit continuer à être transparent et fondé sur une solide méthodologie d'analyse coûts-bénéfices.

Recommandation sur la répartition transfrontalière des coûts

Les répartitions transfrontalières des coûts sont bénéfiques dans certains cas, mais moins efficaces dans d'autres. L'inefficacité du processus de la répartition transfrontalière des coûts peut se traduire par des projets qui ne sont pas réalisés en raison d'un manque de financement ou de l'utilisation "inutile" de fonds communautaires, alors que des projets pourraient également être financés par les tarifs des États membres. En raison de l'inefficacité de la répartition transfrontalière des coûts, les

promoteurs de projets, les ARN et l'ACRE la considèrent comme une charge administrative avec, dans de nombreux cas, peu ou aucun avantage direct.

L'efficacité du processus de répartition transfrontalière des coûts peut être améliorée en incluant des lignes directrices plus strictes dans le règlement RTE-E sur les mesures à prendre dans le processus. L'objectif de ces lignes directrices serait de garantir une approche harmonisée pour l'examen de tous les coûts et avantages afin d'identifier le déficit de financement pour lequel un financement européen pourrait être nécessaire. Les lignes directrices devraient, au minimum, faire référence à la méthodologie ACB, aux données d'entrée à utiliser, à l'interprétation des résultats de l'ACB et à la répartition des coûts d'investissement (il devrait être clair si et quand le financement européen peut être assumé). Si les bénéfices d'un projet dans d'autres États membres sont inférieurs à un certain seuil (et que les possibilités de répartition des coûts par-delà les frontières sont limitées), le processus de l'ACB devrait être aussi bref et efficace que possible.

Recommandations sur la procédure d'autorisation

Les promoteurs de projets décrivent des expériences variées en matière de processus d'autorisation, qui sont essentiellement influencées par la mise en œuvre nationale des règles d'autorisation du règlement RTE-E. Cela concerne la législation nationale en matière d'octroi de permis ainsi que les dispositions du règlement RTE-E relatives à la création de guichets uniques pour l'octroi de permis. Compte tenu de ces contextes nationaux divergents et de ces règles qui dépassent le champ d'application du règlement RTE-E, il semble y avoir une marge limitée pour une action communautaire supplémentaire visant à réduire la durée des procédures d'octroi des autorisations. Toutefois, il semble possible de développer des mécanismes pour améliorer la performance européenne, d'autant plus que les projets transfrontaliers sont au centre du règlement. Comme les configurations et les contextes des projets diffèrent pour chaque PIC, les expériences acquises dans d'autres États membres peuvent être utiles aux autorités nationales, tant au niveau général concernant l'organisation des responsabilités et des obligations qu'au niveau des projets spécifiques concernant les implications sur le processus d'autorisation.

Il est donc recommandé que le règlement RTE-E améliore le suivi de la mise en œuvre des régimes d'autorisation dans les États membres et mette au point de nouvelles mesures d'incitation et des orientations à l'intention des autorités nationales sur la manière de rationaliser et de raccourcir les durées de délivrance des permis. Cela peut être réalisé en promouvant des plateformes de partage des meilleures pratiques entre les ANC en vue de raccourcir les procédures d'autorisation dans les pays qui n'ont pas encore pu le faire.

Recommandations visant à réduire les coûts administratifs de certaines dispositions

Les trois recommandations suivantes visent principalement à réduire la charge administrative pour les promoteurs de projets.

Réapplication de la liste de PCI

Les promoteurs de projets considèrent qu'il est trop contraignant que tous les projets passent par la procédure de candidature complète pour chaque liste PIC. Le processus de renouvellement crée également une incertitude pour les projets.

La justification de l'évaluation de tous les projets (y compris les PIC existants) pour chaque nouvelle liste de PIC réside dans le fait que tous les projets peuvent être évalués sur une base égale et que les changements de circonstances (du marché) peuvent être pris en compte. Nous recommandons de réduire la charge de la nouvelle demande pour tous les projets et toutes les catégories d'infrastructures en utilisant autant que possible les données des demandes précédentes et les résultats du suivi.

Les coûts de suivi

Les contrôles des coûts ont été le plus souvent mentionnés comme une charge administrative par les promoteurs de projets. Les coûts de suivi peuvent être réduits en diminuant la fréquence des rapports, en réduisant la portée du suivi ou en rendant la soumission des données plus facile et plus intuitive. Nous recommandons d'examiner en permanence si les exigences en matière de données sont toujours adaptées à l'objectif visé et de rechercher les possibilités de faciliter le processus de soumission. Un contrôle bisannuel (une fois par liste de PIC) au lieu d'un contrôle annuel réduirait la charge administrative, mais entraînerait également une perte de transparence.

Incitations réglementaires

Les dispositions relatives aux incitations réglementaires sont rarement utilisées. Pour cette raison, nous recommandons de ne pas inclure les incitations réglementaires sous leur forme actuelle dans une version révisée du règlement. Toutefois, les avantages de la suppression de ces dispositions sont

limités, car la charge administrative pour les promoteurs de projets et les ARN est faible. Certains acteurs, en particulier les promoteurs de projets, pensent que les incitations réglementaires pourraient être efficaces pour des projets spécifiques. Si les dispositions relatives aux incitations réglementaires font partie d'une version révisée du règlement, nous recommandons qu'elles soient plus prescriptives quant au moment (par exemple pour des catégories d'infrastructures spécifiques telles que les réseaux d'électricité en mer ou si le cadre réglementaire d'un État membre décourage à attribuer des coûts à d'autres États membres ou à utiliser le financement du MIE) et à la manière dont elles doivent être utilisées.

ZUSAMMENFASSUNG

Einleitung zu Verordnung (EU) Nr. 347/2013 und zum Umfang der Evaluierung

Die Energieinfrastruktur ist von entscheidender Bedeutung für die ununterbrochene Verfügbarkeit von Energie zu einem Preis, der für die Verbraucher erschwinglich ist, und sie trägt auch zu den umfassenderen Sozial- und Klimazielen der EU bei. Die Entwicklung von großvolumiger Energieinfrastruktur ist komplex, insbesondere bei grenzüberschreitenden Netzwerken. Die Verordnung (EU) Nr. 347/2013 zu Leitlinien für die transeuropäisches Energieinfrastruktur (im Folgenden als „TEN-E-Verordnung" bezeichnet) ist Teil eines umfassenderen Rechtsrahmens zur Beseitigung einer Reihe von Hindernissen für die Umsetzung von europäischer Energieinfrastruktur und integrierten Energienetzen.

Zum Zeitpunkt des Inkrafttretens der Verordnung im Bereich Gas standen Bedenken hinsichtlich der Versorgungssicherheit im Vordergrund. Bei Elektrizität war (bereits) die Integration erneuerbarer Energiequellen in den Markt das Hauptanliegen. Daher waren Investitionen in die Infrastruktur erforderlich, um die Marktintegration zu fördern und Versorgungssicherheit aufrechtzuerhalten. Die folgenden Haupthindernisse sollten durch die Verordnung angegangen werden:

- hohe Zeiterfordernis für die Erlangung von Baugenehmigungen, was die rechtzeitige Umsetzung von Energieinfrastrukturvorhaben behindern kann, sowie Widerstand der betroffenen Bevölkerung;
- regulatorische Herausforderungen beim Aufbau grenzüberschreitender Vorhaben; und
- mangelnde wirtschaftliche Realisierbarkeit einiger Energieinfrastrukturprojekte, einschließlich begrenzter Finanzierungskapazitäten der Übertragungsnetzbetreiber (TSO) und Schwierigkeiten bei Investitionen in die Energieinfrastruktur bei der Gewinnung neuer Investoren wie Pensionsfonds und Versicherungsunternehmen.

Die Ziele der Verordnung sind:

- die Gewährleistung des Funktionierens des Energiebinnenmarkts und das Versorgungssicherheit in der Union;
- die Förderung der Entwicklung neuer und erneuerbarer Energieformen, Energieeffizienz und Energieeinsparungen; und
- die Förderung der Verbindung von Energienetzen.

Mit der TEN-E-Verordnung wurde ein Verfahren für die Auswahl von Vorhaben von gemeinsamen Interesse (PCI) festgelegt. Die neueste „PCI-Liste" (die vierte) enthält 149 PCIs. PCIs sind nach Sektoren kategorisiert. Die meisten Listeneinträge sind Strom-PCIs (100 Vorhaben), gefolgt von Gas-PCIs (32), Öl-PCIs (6), intelligente Netze PCIs (6) und Kohlendioxid (CO2) -PCIs (5). Die TEN-E-Verordnung enthält eine Reihe von Bestimmungen, darunter:

- Bestimmungen über (Prioritätsstatus in) Genehmigungsverfahren und Beteiligung der Öffentlichkeit;
- Bestimmungen zur Überwachung der Vorhabendurchführung;
- Bestimmungen zur grenzüberschreitenden Aufteilung der Vorhabenkosten (CBCA) und zu regulatorischen Anreizen; und
- Bestimmungen über die Förderfähigkeit der Connecting Europe Facility (CEF).

Im Dezember 2019 veröffentlichte die Europäische Kommission die Mitteilung der Europäischen Kommission COM (2019) 640 ([3]) (im Folgenden „European Green Deal") mit dem Ziel, das Ziel der Erreichung der Klimaneutralität bis 2050 in das vorgeschlagene europäische Klimagesetz aufzunehmen. Der European Green Deal verweist ausdrücklich auf die Notwendigkeit einer Überprüfung der TEN-E-Verordnung, um die Kohärenz mit den Zielen der Klimaneutralität

([3]) European Commission (2019), The European Green Deal, https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf.

sicherzustellen. Im Mai 2020 veröffentlichte die Kommission eine erste Folgenabschätzung einer Überarbeitung der TEN-E-Verordnung, um den politischen Rahmen an den neuen politischen Kontext anzupassen. Infolgedessen hat die Kommission beschlossen, eine „Back-to-Back" Evaluierung und -Überarbeitung vorzunehmen. Die Studie enthält daher eine retrospektive Bewertung mit formativen Elementen, um zu beurteilen, inwieweit die derzeitige Verordnung zweckmäßig und für die Zukunft relevant ist.

Evaluierungsmethodik

Die Studie entspricht den Richtlinien der Kommission für bessere Rechtsetzung und bewertet daher die TEN-E-Verordnung anhand von fünf zentralen Bewertungskriterien: Wirksamkeit; Effizienz; Relevanz; Kohärenz; und den Nutzen für die EU. Der **Ansatz** für die Studie folgte den typischen vier Bewertungsphasen: Strukturierung (Bewertungsmatrix, Interventionslogik, Beginn); Beobachten (Datenerfassung); Analyse; und Beurteilung und Bericht.

The **Methodik** enthält:

- Recherche - umfangreiche Recherche, die Daten zu zurück- und zukunftsgerichteten Elemente liefert;
- Interviews – 82 halbstrukturierte Interviews mit Vertretern von Vorhabenträgern, Übertragungsnetzbetreibern (ÜNB), nationalen Regulierungsbehörden (NRA), zuständigen nationalen Behörden (NCA), Branchenverbänden, Nichtregierungsorganisationen (NGO), der Agentur für die Zusammenarbeit der Energieregulierungsbehörden (ACER), dem Europäische Netz der Übertragungsnetzbetreiber für Elektrizität (ENTSO-E), dem Europäische Netzwerk der Übertragungsnetzbetreiber für Gas (ENTSOG) und der Europäische Kommission;
- eine gezielte Umfrage - eine Online-Umfrage zum Sammeln zusätzlicher Informationen mit 112 Antworten;
- Fallstudien - sechs Fallstudien spezifischer PCIs;
- Webinare - Im Juni 2020 wurden vier Webinare mit verschiedenen Interessengruppen organisiert, die aufgefordert wurden, ihre Ansichten zur Bewertung und Überarbeitung der Verordnung auszutauschen.
- Modellierung - Der Nettonutzen von Gas- und Strom-PCIs wurden mit von REKK entwickelten Modellen bewertet.
- Öffentliche Konsultation - 103 Rückmeldungen wurden durch die öffentliche Konsultation gewonnen und weitere 169 E-Mails gingen über die Mailbox ein.

Hauptschlussfolgerungen

In Bezug auf die Gesamtziele hat die TEN-E-Verordnung die Marktintegration und Wettbewerbsfähigkeit wirksam verbessert, wie aus den Erkenntnissen zu Interkonnektionszielen sowie Energiepreisen und ihrer Konvergenz in der gesamten EU hervorgeht. Versorgungssicherheit hat sich ebenfalls verbessert wozu PCIs in Strom und Gas zusammen mit Marktbedingungen und anderen Vorschriften (z. B. Vorschriften zur Versorgungssicherheit und Netzcodes) beitrugen. In Bezug auf Gas, hat sich die Widerstandsfähigkeit von Infrastruktur und Versorgung seit 2013 erheblich verbessert, da fast alle Mitgliedstaaten die N-1-Regel einhalten, sodass die Nachfrage auch bei Ausfall der Infrastruktur gedeckt werden kann.

Der Fokus auf grenzüberschreitende Vorhaben, die die Vernetzung verbessern, hat einen wirksamen Beitrag zu diesen Zielen geleistet. In dieser Hinsicht wird die Organisation der PCI-Auswahl in regionalen Gruppen unter der Koordination der Kommission als wichtiger Faktor angesehen, ebenso wie der Ansatz der Kostenverteilung zwischen den Mitgliedstaaten, um Projekte mit grenzüberschreitendem Nutzen zu ermöglichen. Die von der CEF geleistete Finanzierungsunterstützung trug ebenfalls dazu bei. Hauptsächlich geschah dies durch die Unterstützung von Elektrizitätsprojekten, aber auch durch die gezielte Unterstützung von Gasverbindungsleitungen in mittel- und osteuropäischen Mitgliedstaaten, die dazu beitrugen, die Energieisolierung zu beenden und die Abhängigkeit von dominanten Importeuren erfolgreich zu verringern.

Die Auswirkungen der Verordnung auf Energie- und Klimaziele, Energieeffizienz und Reduzierung der Treibhausgasemissionen sind weniger bedeutend, was hauptsächlich die Interventionsgründe der TEN-E-Verordnung zum Zeitpunkt ihrer Einführung widerspiegelt. PCIs für die Interkonnektion von Elektrizität sind Schlüsselelemente für die Integration erneuerbarer Energiequellen in den europäischen Markt. Der Beitrag von Gasprojekten zur Nachhaltigkeit ist weniger klar und schwer zu bewerten, da es derzeit keine solide Bewertungsmethode gibt. Aufgrund des Fehlens einer

robusten Methodik hat das Nachhaltigkeitskriterium für die Auswahl von Gas-PCIs eine weniger wichtige Rolle gespielt als die Kriterien für die anderen drei Gesamtziele Marktintegration, Wettbewerbsfähigkeit und Versorgungssicherheit. Das Nachhaltigkeitskriterium war daher für die Verfolgung der Energie- und Klimaziele 2020 nicht immer wirksam.

Die Genehmigungsverfahren haben sich seit Inkrafttreten der TEN-E-Verordnung verkürzt, aber die Wirksamkeit der Genehmigungsverfahren hängt stark von der nationalen Umsetzung ab. Bestimmungen zur grenzüberschreitenden Kostenverteilung (CBCA) sind in einigen Fällen vorteilhaft, in anderen jedoch weniger wirksam. Während die Stakeholder im Allgemeinen die Idee der Aufteilung der Kosten in Bezug auf den Nutzen zwischen den Mitgliedstaaten unterstützen, verringern die Einzelheiten dieses Mechanismus (wie Zeitplan und Datenanforderungen) sowie die Komplexität seine Attraktivität. CBCA Prozesse werden häufig ausgelöst, um Zugang zu CEF-Mitteln zu erhalten, und werden regelmäßig ohne grenzüberschreitende Kosten abgeschlossen. Regulatorische Anreize werden selten angewendet.

Die Modellierung in dieser Studie zeigt, dass die Vorteile von abgeschlossenen Gas-PCIs sehr positiv sind. Abgeschlossene Gas-PCIs haben die Marktintegration und die Versorgungssicherheit für die EU erheblich verbessert. Die Ergebnisse untermauern auch, dass in Zukunft nur begrenzte Investitionen in das Gasnetz getätigt werden sollten. Der Nettonutzen von Strom-PCIs steigt in Szenarien mit einem höheren CO2-Preis, was wiederum zeigt, dass diese Projekte im Rahmen des Europäischen Green Deal Vorteile haben. Abgeschlossene PCIs sowohl für Strom als auch für Gas hatten einen höheren Einfluss auf die Peripherie und kleinere Märkte. Daher trugen sie in beiden Sektoren zur Integration des Energiemarktes bei.

Die Vorteile der Verordnung überwiegen die Kosten. Die Verordnung bringt einen Mehrwert für die EU, da die Ergebnisse nicht durch Maßnahmen auf Ebene der Mitgliedstaaten erzielt werden könnten. Die Möglichkeiten zur Verbesserung der Effizienz der Verordnung sind begrenzt, aber die Studie hat potenzielle Optionen zur Verringerung des Verwaltungsaufwands für Vorhabensträger des PCI-Antragsverfahrens und hinsichtlich der Überwachungsanforderungen ermittelt.

Obwohl die Verordnung im Allgemeinen wirksam und effizient war und einen deutlichen Mehrwert der EU-Intervention bietet, muss die Verordnung überarbeitet werden, um sie mit dem Ziel der Klimaneutralität in Einklang zu bringen.

Der Kontext des European Green Deal erfordert die Priorisierung von Nachhaltigkeitsaspekten in der TEN-E Verordnung. Der Schwerpunkt der Verordnung muss auf die Integration von Energiesystemen verlagert werden. Dies erfordert mehr Systemflexibilität und -speicherung, die Integration eines höheren Anteils kohlenstoffarmer Kraftstoffe (einschließlich Wasserstoff) und die Digitalisierung. Investitionen in die Strominfrastruktur müssen priorisiert werden, zusammen mit Investitionen in die Infrastruktur für kohlenstoffarme und synthetische Brennstoffe (z. B. Biogas, Biomethan und kohlenstoffarmer Wasserstoff) für diejenigen Sektoren, in denen eine vollständige Elektrifizierung nicht möglich ist. Einige Interessengruppen (z. B. NGOs) sind der Meinung, dass Öl- und Gasprojekte künftig nicht mehr für das PCI-Label in Frage kommen sollten. Obwohl Gas für einige Mitgliedstaaten eine wichtige Rolle beim Übergang zu einem stärker dekarbonisierten Energiesystem spielen könnte, unsere Modellierung zeigt, dass die europäische Netzwerkinfrastruktur (einschließlich der PCI-Projekte, für die eine Investitionsentscheidung getroffen wurde) bereits ausreicht, um die Nachfrage zu bedienen.. Die Interessengruppen haben zahlreiche Projekte erwähnt, die in den Rahmen der TEN-E-Verordnung fallen sollten und fordern die Überarbeitung der Verordnung, um diese neuen Technologien in das PCI-System aufzunehmen, indem neue Themenbereiche eingeführt oder derzeitige restriktive Kriterien geändert werden (z. B. Ausweitung des Smart Grid auf Gas und Niederspannungsprojekte, Ausweisung thematischer Bereiche für Hybrid-Offshore-Wind, Wasserstoffinfrastrukturen und saubere Gase). Im Gegensatz dazu argumentieren die Regulierungsbehörden, dass sich die TEN-E-Verordnung weiterhin auf Großprojekte mit grenzüberschreitenden Auswirkungen konzentrieren sollte.

Empfehlungen

Die folgenden Empfehlungen für die Überarbeitung der Verordnung basieren auf den festgestellten Problemen.

Empfehlungen zu Themenbereichen der Verordnung und zum PCI-Auswahlverfahren

Änderungen der Themenbereiche der Verordnung, einschließlich der Auswahlkriterien und des PCI-Auswahlverfahrens, sind erforderlich, um die TEN-E-Verordnung an die neuen Klimaziele anzupassen.

Priorisierte Korridore und Themenbereiche müssen möglicherweise angesichts künftiger Herausforderungen für die Netzwerkinfrastruktur aktualisiert werden. Diese Herausforderungen können durch neue Vorhabentypen angegangen werden. Diese Überarbeitung kann das Hinzufügen, Ändern oder Aufgeben von Prioritätskorridoren und Themenbereichen in Betracht ziehen. Angesichts der Unsicherheit über die Entwicklung neuer Technologien könnte es erforderlich sein, die Definition der vorrangigen Korridore und Themenbereiche flexibel zu gestalten, z.B durch offenere Definitionen oder regelmäßige Überarbeitungen.

Die Auswahlkriterien müssen angepasst werden, um sicherzustellen, dass die Projekte auch den Klimazielen entsprechen. Ein positiver Beitrag zur Nachhaltigkeit („Nachhaltigkeit zuerst") sollte Voraussetzung für alle Projekte sein. Bei Gasinfrastrukturen können Nachhaltigkeitsfahrpläne verwendet werden, um sicherzustellen, dass sie für den Transport von Wasserstoff oder anderen dekarbonisierten Gasen renoviert werden können.

Die Aufnahme des Prinzips „Energieeffizienz zuerst" (EEFP) sollte in der TEN-E Verordnung ausdrücklich berücksichtigt werden. Die Energieeffizienz könnte ausdrücklich in die spezifischen Kriterien in Artikel 4 und / oder den Anhängen II und IV aufgenommen werden, um sicherzustellen, dass die effizienteste Umwandlung, Übertragung und Verteilung von Energieinfrastrukturen erfolgt. Eine andere Alternative zur Berücksichtigung des EEFP und in Übereinstimmung mit Artikel 51.3 der Elekrizitätsbinnenmarktrichtlinie könnte darin bestehen, durchzusetzen, dass Netzinfrastrukturprojekte anhand von Lösungen in Energieeffizienz oder Nachfrageanpassung als Alternativen zur Systemerweiterung bewertet werden.

Das grenzüberschreitende Kriterium könnte neu definiert werden, um das Konzept der grenzüberschreitenden Auswirkungen zu erweitern und den Einsatz dezentraler Infrastruktur in einzelnen Mitgliedstaaten zu erleichtern. Eine mögliche Definition der „grenzüberschreitenden Auswirkungen" ist eine quantifizierbare positive Auswirkung auf die TEN-E Ziele. Wenn diese Definition verwendet würde, würden mehr Vorhaben das grenzüberschreitende Kriterium erfüllen, was die Anzahl der PCIs unüberschaubar machen könnte. Aus diesem Grund empfehlen wir, Untergrenzen festzulegen, die nur von relativ großen Vorhaben erreicht werden können.

Die spezifischen Auswahlkriterien für Smart Grids aus Anhang IV.1.e und insbesondere der 10-kV-Schwellenwert könnten die vollständige Umsetzung von Smart-Grid-Projekten behindern. Diese Kriterien müssen möglicherweise überdacht werden, wenn Projekte mit niedrigeren Spannungspegeln als notwendig für die Erfüllung der TEN-E Ziele angesehen werden.

Angesichts möglicher Konflikte in den Rollen von ENTSO-E und ENTSOG (ENTSOs) müssen Änderungsmaßnahmen ergriffen werden, um das Vertrauen aller Beteiligten in den PCI-Auswahlprozess sicherzustellen, da ENTSOs als Vorhabenträger sowie Entwickler der Szenarien und der Kosten-Nutzen-Analyse, anhand derer Projekte bewertet werden auftreten – und außerdem angesichts der gemeinsamen Wahrnehmung von Stakeholdern, dass ENTSOs eine vorherrschende, nicht vollständig unabhängige Rolle haben. Es können zwei verschiedene Ansätze verfolgt werden: (1) Verbesserung der Einbeziehung aller Stakeholder in alle relevanten Schritte des PCI-Auswahlprozesses, insbesondere in die Szenario Entwicklung und die Überarbeitung der Methodik der Kosten-Nutzen-Analys; oder (2) zu erwägen, ACER oder einer anderen unabhängigen Organisation die Befugnis zu erteilen, Szenarien und Richtlinien für die CBA-Methodik zu genehmigen und zu ändern. Ein Nachteil des ersten Ansatzes besteht darin, dass immer noch das (wahrgenommene) Risiko besteht, dass ENTSOs nicht im besten Interesse aller Beteiligten handeln. Es wird jedoch anerkannt, dass die ENTSOs über das erforderliche Fachwissen verfügen und ihre Mitglieder auch an der Entwicklung nationaler Entwicklungspläne in den Mitgliedstaaten beteiligt sind. Unabhängig vom gewählten Ansatz sollte der PCI-Auswahlprozess weiterhin transparent sein und auf einer soliden Kosten-Nutzen-Methodik basieren.

Empfehlung zur grenzüberschreitenden Aufteilung der Vorhabenkosten (CBCA)

CBCAs sind in einigen Fällen vorteilhaft, in anderen jedoch weniger wirksam. Die Ineffektivität des CBCA-Prozesses kann zu Projekten führen, die nicht realisiert werden aufgrund von fehlender Finanzmittel bei „unnötiger" Verwendung von EU-Mitteln, wenn Vorhaben auch aus Netzentgelten in den Mitgliedstaaten finanziert werden könnten. Aufgrund der Ineffektivität von CBCA betrachten Vorhabenträger, NRAs und ACER dies als Verwaltungsaufwand mit in vielen Fällen geringem oder keinem direkten Nutzen.

Die Wirksamkeit des CBCA-Prozesses kann verbessert werden, indem strengere Richtlinien über die im Prozess zu ergreifenden Schritte in die TEN-E Verordnung aufgenommen werden. Ziel der Leitlinien wäre es, einen harmonisierten Ansatz für die Berücksichtigung aller Kosten und Nutzen zu gewährleisten, um die Finanzierungslücke zu ermitteln, für die möglicherweise europäische Mittel erforderlich sind. Die Leitlinien sollten sich zumindest auf die Kosten-Nutzen Analyse-Methodik, die notwendigen Eingabedaten, die Interpretation der Kosten-Nutzen-Ergebnisse und die Aufteilung der Investitionskosten beziehen (es sollte klar sein, ob und wann eine EU-Finanzierung angenommen werden kann). Wenn der Nutzen eines Vorhabens in anderen Mitgliedstaaten unter einem bestimmten Schwellenwert liegt (und es nur begrenzte Möglichkeiten gibt, Kosten grenzüberschreitend zu verteilen), sollte der CBCA-Prozess so kurz und effizient wie möglich sein.

Empfehlungen zum Genehmigungsverfahren

Vorhabenträger beschreiben unterschiedliche Erfahrungen mit dem Genehmigungsverfahren, die im Wesentlichen von der nationalen Umsetzung der Genehmigungsregeln der TEN-E-Verordnung geprägt sind. Dies betrifft die nationalen Genehmigungsgesetze sowie die Bestimmungen der TEN-E-Verordnung über die Schaffung von One-Stop-Shops für die Erteilung von Genehmigungen. Angesichts derart unterschiedlicher nationaler Rahmen und Regeln, die über den Anwendungsbereich der TEN-E Verordnung hinausgehen, scheint es nur begrenzten Spielraum für zusätzliche EU-Maßnahmen zur Verkürzung der Dauer von Genehmigungsverfahren zu geben. Es scheint jedoch Potenzial für die Entwicklung von Mechanismen zur Verbesserung der Effektivität der europäischen Regeln zu geben, insbesondere da grenzüberschreitende Projekte im Mittelpunkt der Verordnung stehen. Da Projektaufbau und -umstand für jedes PCI unterschiedlich sind, können die in anderen Mitgliedstaaten gesammelten Erfahrungen für die nationalen Behörden bei der Gestaltung der Genehmigungsverfahren von Wert sein, sowohl auf allgemeiner Ebene hinsichtlich der Organisation von Rechten und Pflichten als auch auf der Ebene spezifischer Projekte.

Daher wird empfohlen, dass die TEN-E-Verordnung die Überwachung der Umsetzung von Genehmigungssystemen in den Mitgliedstaaten verbessert und den nationalen Behörden weitere Anreize und Leitlinien für die Erreichung einer optimierten und verkürzten Genehmigungsdauer bietet. Dies kann erreicht werden, indem Plattformen für den Austausch bewährter Verfahren zwischen zuständige nationale Behörden gefördert werden, um die Genehmigungsverfahren in Ländern zu verkürzen, die dies noch nicht konnten.

Empfehlungen zur Reduzierung der Verwaltungskosten bestimmter Bestimmungen

Die folgenden drei Empfehlungen zielen hauptsächlich darauf ab, den Verwaltungsaufwand für die Vorhabenträger zu verringern.

Wiederbewerbung für PCI Liste

Projektträger halten es für zu aufwändig, dass alle Projekte für jede PCI-Liste den vollständigen Bewerbungsprozess durchlaufen müssen da der Erneuerungsprozess unter anderem Unsicherheit für die Projekte schafft.

Der Grund für die Bewertung aller Projekte (einschließlich bestehender PCIs) für jede neue PCI-Liste besteht darin, dass alle Projekte gleich bewertet werden können und Änderungen der (Markt-) Umstände berücksichtigt werden können. Wir empfehlen, den Aufwand für die erneute Bewerbung für alle Projekte und Infrastrukturkategorien zu verringern, indem sie wo immer möglich Daten aus früheren Bewerbungen und den Ergebnissen des Überwachungsprozesses verwenden können.

Überwachungskosten

Die Überwachungskosten wurden von den Vorhabenträger am häufigsten als belastender Aufwand genannt. Die Überwachungskosten können gesenkt werden, indem die Häufigkeit der Berichterstattung verringert, der Umfang der Überwachung eingeschränkt, oder die Übermittlung von Daten einfacher und benutzerfreundlicher gestaltet wird. Wir empfehlen, kontinuierlich zu überprüfen, ob die Datenanforderungen noch zweckmäßig sind, und nach Möglichkeiten zu suchen, um den Einreichungsprozess zu vereinfachen. Eine zweijährliche Überwachung (einmal pro PCI-Liste) anstelle einer jährlichen Überwachung würde den Verwaltungsaufwand verringern, aber auch zu einem Verlust an Transparenz führen.

Regulatorische Anreize

Regulatorische Anreize werden selten angewendet. Aus diesem Grund empfehlen wir, die regulatorischen Anreize in ihrer aktuellen Form nicht in eine überarbeitete Fassung der Verordnung aufzunehmen. Die Vorteile der Streichung dieser Bestimmungen sind jedoch begrenzt, da der Verwaltungsaufwand für Projektträger und nationale Regulierungsbehörde gering ist. Einige Interessengruppen, insbesondere Vorhabenträger, sind der Ansicht, dass regulatorische Anreize für bestimmte Vorhaben wirksam sein könnten. Wenn Bestimmungen zu regulatorischen Anreizen Teil einer überarbeiteten Fassung der Verordnung sind, empfehlen wir, dass genauer festgelegt wird, wann (z. B. für bestimmte Infrastrukturkategorien wie Offshore-Stromnetze oder wenn der regulatorische Rahmen in einem Mitgliedstaat ein Hürde darstellt Kosten mit andere Mitgliedstaaten zu teilen oder CEF-Mittel zu verwenden) und wie diese zu verwenden sind.

1 INTRODUCTION, PURPOSE AND SCOPE OF THE STUDY

1.1 Evaluation and revision of Regulation (EU) No 347/2013 in a new policy context

A common EU energy policy has evolved around the objective to ensure uninterrupted physical availability of energy products and services on the market at a price which is affordable for all consumers while also contributing to the EU's wider social and climate goals. Energy infrastructure is crucial for meeting these objectives. Regulation (EU) No 347/2013 on guidelines for a Trans-European Networks for Energy (TEN-E; hereinafter referred to as the 'TEN-E Regulation') is part of a larger regulatory framework adopted to tackle barriers to the development of energy networks.

Prior to the Regulation coming into force, in the field of gas, concerns about security of supply (SOS) were setting the agenda (see the Regulation concerning measures to safeguard security of gas supply ([4]), the Security of Supply Strategy and ENTSOs' reports on system resilience). For electricity, the integration of renewable sources into the market was (already) the main concern. Investments in electricity infrastructure were also needed to foster market integration and maintain SOS.

Since the implementation of the TEN-E Regulation, a new policy context has emerged, facilitated through the Paris Agreement on climate change, the Clean Energy for All Europeans package and the communication of the European Commission COM(2019) 640 (the European Green Deal). There is increased urgency to reduce climate change and integrate renewables into the energy grids. This requires additional physical energy infrastructure and digital solutions. Therefore, it is pertinent to ensure that the TEN-E Regulation is fit for purpose to meet the EU's climate neutrality goals.

With the TEN-E Regulation, the Commission laid down rules for the timely development and interoperability of energy networks in the EU and the European Economic Area. The provisions of the TEN-E Regulation are based on the 2011 impact assessment, published by the Commission on 19 October 2011, related to Decision No 1364/2006/EC establishing the first guidelines for trans-European energy infrastructure ([5]). The 2011 impact assessment outlined the key problems remaining at the time relating to energy infrastructure investments. The length and ineffectiveness of permit-granting procedures for energy projects, the inefficient administrative procedures and the asymmetries between benefits and costs were identified as burdens for the policy objectives.

The Regulation sets out a new method for the planning of trans-European infrastructure. It defines broad infrastructure **priority corridors** ([6]) and **priority thematic areas** ([7]) as well as building on strengths of regional cooperation to identify and implement the necessary projects. The TEN-E Regulation sets out guidelines for streamlining the permitting processes for major energy infrastructure projects that contribute to European energy networks, referred to as projects of common interest (PCIs) ([8]). The TEN-E Regulation lays down criteria for the identification of PCIs ([9]) and criteria for projects falling within specific energy infrastructure categories in order to improve the selection of projects to meet regional needs as well as to increase cooperation and transparency towards the public and wider stakeholder community. The TEN-E Regulation also establishes that PCIs are necessary to take forward EU energy networks policy and should be given the most rapid consideration that is legally possible in the permitting process. Furthermore PCIs can benefit from accelerated permitting, improved regulatory conditions and cost allocation,

(4) Regulation (EU) No 994/2010.
(5) European Commission (2011), Commission Staff Working Paper: Impact assessment, Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC. Retrieved from: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:1233:FIN:EN:PDF.
(6) The nine corridors identified are the Northern sea offshore grid, NSI West Electricity, NSI East Electricity, BEMIP Electricity, NSI West Gas, NSI East Gas, BEMIP Gas, Southern Gas and OSC.
(7) The priority thematic areas are development of smart grids, electricity highways and a cross-border carbon dioxide network.
(8) These infrastructure projects are selected by the decision-making body (DMB) that consists of the decision-making powers in the 12 regional groups. The decision-making powers in the groups are restricted to Member States and the Commission. A regional group is composed of representatives from the Member States, the transmission systems operators (TSOs), the Commission, the Agency for the Cooperation of Energy Regulators (ACER) and the European Network of Transmission Systems Operators (ENTSO).
(9) See Article 4 Regulation (EU) No 347/2013.

eligibility for financial support from the Connecting Europe Facility (CEF) and increased transparency. The provisions are further detailed in Chapter 3 of this report.

In March 2019, as part of the partial political agreement between the European Parliament and the Council on the CEF for the period 2021-2027, the co-legislators agreed that the Commission shall evaluate the effectiveness and policy coherence of the TEN-E Regulation and submit an evaluation to the European Parliament and to the Council by 31 December 2020. Our consortium, made up of lead partner Ecorys, consortium partner Ramboll and subcontractors REKK and Shepherd and Wedderburn, has been commissioned by the European Commission (Directorate-General for Energy, hereafter DG ENER) to provide support to this evaluation.

Since the implementation of the TEN-E Regulation, the policy context has shifted, as the emphasis on climate objectives has increased. In December 2019, just before the start of the evaluation, the European Commission published the **European Green Deal** and proposed to include the objective of climate neutrality by 2050 in the European Climate Law ([10]). The European Green Deal explicitly refers to the need for a review of the TEN-E Regulation to ensure consistency with climate neutrality objectives (see Box 1). In May 2020, the Commission published an inception impact assessment / roadmap of a revision of the TEN-E Regulation to align the policy framework with the new policy context.

As a result, the Commission has decided to undertake a 'back-to-back' evaluation and impact assessment. The study, therefore, will contain a retrospective evaluation and a formative element. The **retrospective evaluation** looks at the extent to which the TEN-E Regulation has achieved its stated objectives, including factors that helped or hindered their achievement. Specifically, it assesses the effectiveness of the Regulation compared to a baseline (i.e. the situation without the Regulation) to determine whether or not it has had a significant impact and added value. In relation to the **formative element**, on the basis of the outcomes and results achieved to date and an assessment of the extent to which the Regulation will remain fit for purpose and relevant in the future, the study will put forward recommendations for improving the current situation.

Box 1: TEN-E Regulation in the Communication on the European Green Deal

'The transition to climate neutrality also requires smart infrastructure. Increased cross-border and regional cooperation will help achieve the benefits of the clean energy transition at affordable prices. The regulatory framework for energy infrastructure, including the TEN-E Regulation, will need to be reviewed to ensure consistency with the climate neutrality objective. This framework should foster the deployment of innovative technologies and infrastructure, such as smart grids, hydrogen networks or carbon capture, storage and utilisation, energy storage, also enabling sector integration. Some existing infrastructure and assets will require upgrading to remain fit for purpose and climate resilient.'

1.2 Study purpose

One of the key objectives of the study is to gather evidence to assess how the TEN-E Regulation as a specific intervention has performed so far. Thus, it will support the Commission in evaluating:

- how and why the current TEN-E Regulation has worked well or not so well, and which factors have helped or hampered the achievement of its objectives; and
- the impact of the Regulation, particularly in terms of progress towards achieving its objectives.

The other key objective is to assess the extent to which the Regulation will remain fit for purpose and relevant in the future. The study will put forward recommendations for improving the current situation.

(10) European Commission (2020), Proposal for a Regulation of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 (European Climate Law). Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588581905912&uri=CELEX:52020PC0080.

The study covers the period 2013-2019 (as far as data are available for 2019). It does not specifically cover the EU's funding through the CEF, although it looks at the synergies and complementarities with the CEF.

The study complies with the Commission's Better Regulation Guidelines and associated Toolbox ([11]) and, therefore, assesses the TEN-E Regulation against five core evaluation criteria: effectiveness, efficiency, relevance, coherence and EU added value.

1.3 Scope of the study

According to the Terms of Reference (ToR), the study consists of the following tasks:

- Task 1: development of a methodology and drafting of a detailed work plan;
- Task 2: data collection and review of relevant evidence;
- Task 3: stakeholder consultation;
- Task 4: data assessment and provision of evidence-based answers to the evaluation questions; and
- Task 5: reporting.

Under Task 1, a general evaluation framework was developed. The methodology employed includes an intervention logic and an evaluation matrix to guide the evaluation process and define the manner in which the evaluation questions are to be answered, as well as highlighting how additional evaluation questions are integrated into the analysis. This is presented in a detailed work plan. Task 2 concerns collection of data relevant to the implementation of the TEN-E Regulation and other data required to answer the evaluation questions. Task 3 elaborates on the stakeholder consultation strategy that includes activities for Task 2, including the targeted survey and interviews as well as the online public consultation (OPC) and four webinars. Task 4 is to provide evidence-based and, to the extent possible, quantitative answers to the evaluation questions by using the methodology presented in Task 1 and through employing expert judgment. In Task 5, a (draft) interim report and a (draft) final report are provided to DG ENER, detailing our findings and conclusions based on the analysis in the preceding tasks. Further details of our approach are included in Annex I as well as in the inception report.

In view of achieving the objectives set out in the European Green Deal, a number of priorities were identified by DG ENER. In particular, the evaluation question matrix (EQM) was revised to accommodate the change in scope of the project. Evaluation questions were merged under all criteria to avoid unnecessary repetition; however, we ensured that the questions were not 'lost', but rather reformulated to ensure that the information would be captured elsewhere. The questions under relevance and coherence were revised to reflect the current policy context (i.e. the European Green Deal). The indicators, data sources, data collection and data analysis approaches were revised and made more specific (see the revised EQM in Annex I).

([11]) European Commission (2017), Better Regulation Guidelines. Retrieved from: https://ec.europa.eu/info/sites/info/files/better-regulation-guidelines.pdf.

1.4 Overview of deliverables

Deliverable	Description of deliverable	Time frame for deliverable (from the signing of the contract)
Draft inception note	Detailed work programme and planning of the study	0.5 months
Inception note	Revised draft inception note	1.5 months
Draft interim report	Preliminary findings and summary report of the OPC	5 months
Interim report	Revised draft interim report	6 months
Draft final report	Conclusions and exploratory findings	7 months
Final report	Finalised draft final report with the synopsis report of all consultation activities attached	9 months

1.5 Structure of the final report

After an inception and scoping phase in January and February 2020, the project team commenced data collection via desk research and consultation activities. We also carried out six case studies and energy market modelling for both gas and electricity.

The rest of the report is structured as follows:

- Chapter 2 provides an overview of our methodological approach in this evaluation;
- Chapter 3 introduces the TEN-E Regulation and summarises how the Regulation has been implemented in qualitative and quantitative terms;
- Chapter 4 presents the assessment of effectiveness, efficiency, relevance, coherence and EU added value, based on the evidence established by desk research, data analysis, stakeholder consultation, case studies and modelling;
- Chapter 5 provides the conclusions, presented by evaluation criterion, as well as our preliminary recommendations.

Annexes provide additional information on the EQM, case study reports, modelling methodology and results, procedural information and synopsis report as well as describing the methods and tools deployed during analysis.

2 OUR METHODOLOGICAL APPROACH

2.1 Overall approach

The overall approach includes the following five main tasks:

- Task 1: Development of a methodology and drafting of a detailed work plan;
- Task 2: Data collection and review of relevant evidence;
- Task 3: Stakeholder consultation;
- Task 4: Data assessment and evidence-based answers to the evaluation questions;
- Task 5: Reporting.

In Figure 2.1, we show the overall approach to the study. It follows the typical four evaluation stages. During the structuring phase, we establish the overall evaluation framework. The data collection (observing) phase comes next, followed by the data analysis phase. Reporting, as the last phase, relies on the analysis of the data collected and presents the conclusions and recommendations of the study.

Figure 2.1 Overall approach

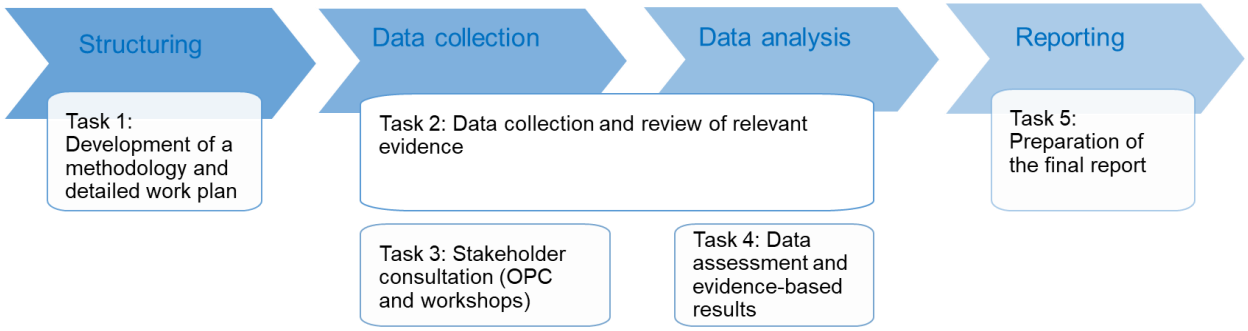
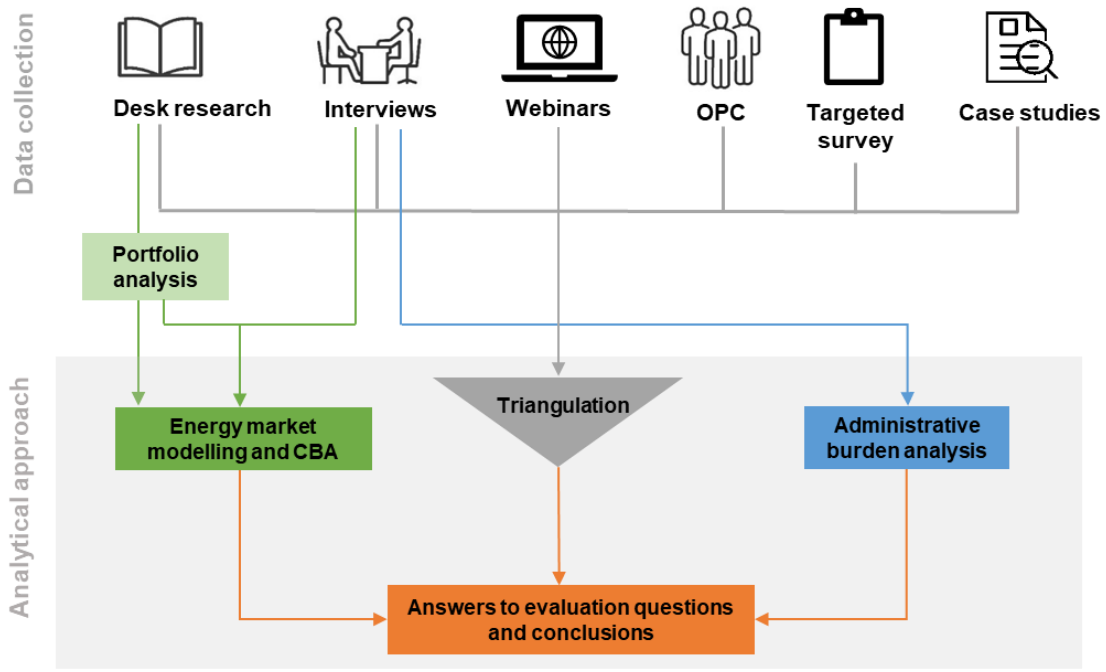


Figure 2.2 outlines the proposed tools for the data collection and data analysis phases. The data collection plan for the study encompasses desk research, a targeted survey, interviews with different types of stakeholder, six PCI case studies (Task 2), an OPC and four webinars (Task 3). The analytical activities include portfolio analysis focusing on a sample of projects, energy market modelling and cost–benefit analysis (CBA) as well as administrative burden analysis performed in order to address the costs of the Regulation. The analytical activities will be elaborated on in Task 4. All evidence is triangulated in order to produce robust assessment of all evaluation criteria and questions (Task 4).

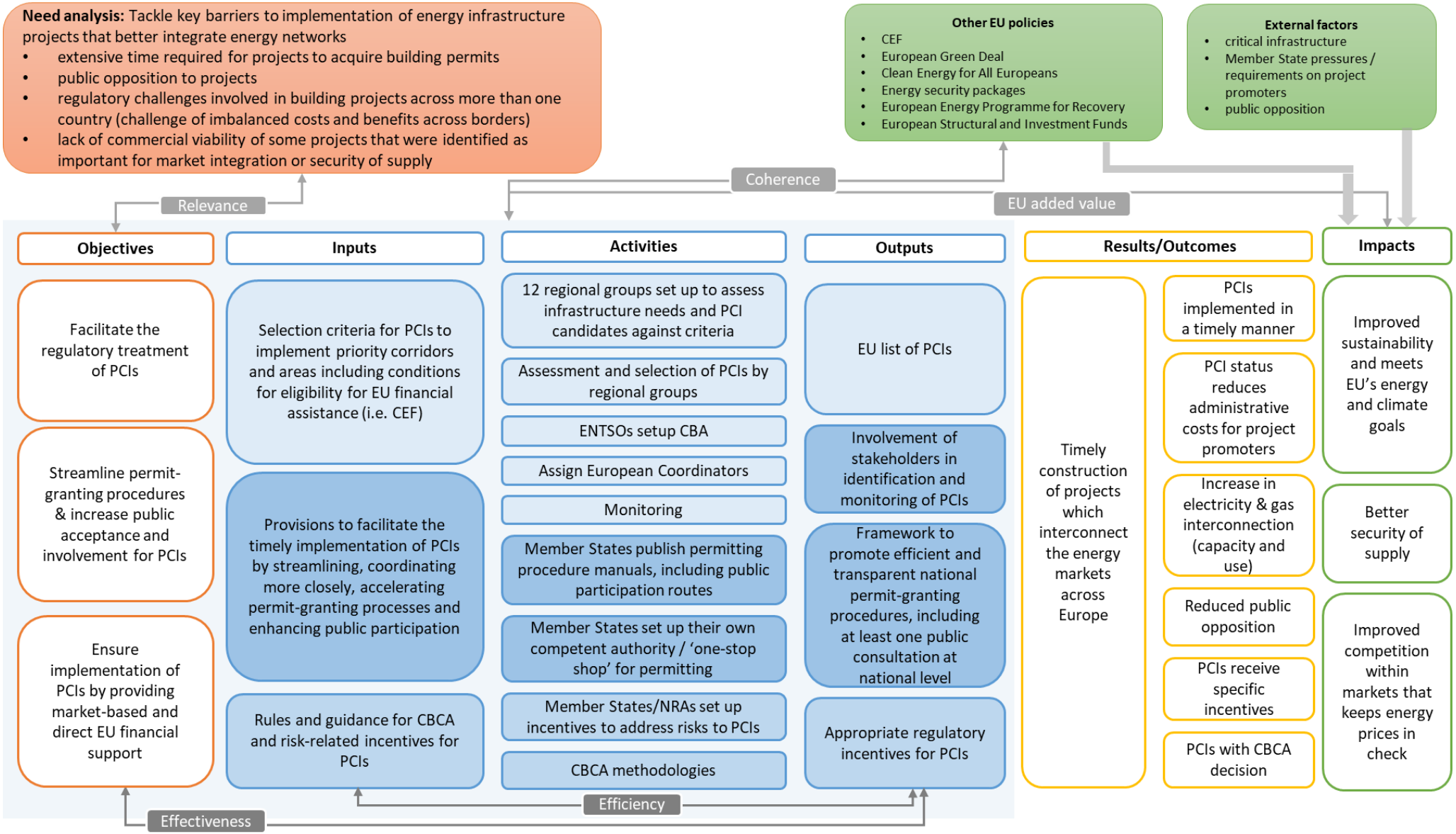
Figure 2.2 Proposed methodology for data collection and analysis



2.2 Intervention logic

The intervention logic links the objectives and the input and activities to the outputs, results and impacts. It also includes external factors relevant to this Regulation. With the adoption of the European Green Deal by the Commission, there is a need to ensure that TEN-E is consistent with the climate neutrality objective. As such, the European Green Deal is included as one of the major EU policies that guides the evaluation and revision of the TEN-E Regulation. Figure 2.3 outlines the intervention logic and the following section describes the various elements.

Figure 2.3 Intervention logic



Source: Own elaboration.

The TEN-E Regulation is part of a larger regulatory framework adopted to tackle challenges in the energy market while contributing to the EU's wider goals of smart, sustainable and inclusive growth. The goals of the Regulation are:

- to ensure the functioning of the internal energy market and SOS in the EU;
- to promote the development of new and renewable forms of energy, energy efficiency and energy savings; and
- to promote the interconnection of energy networks.

To achieve its objectives, the TEN-E Regulation identifies priority corridors and thematic areas of trans-European energy infrastructure and provides guidelines for the selection of PCIs. Therefore, the specific objectives of the Regulation are:

- identification of PCIs necessary to implement priority corridors and areas falling under the energy infrastructure categories in electricity, gas, oil and carbon dioxide (CO2) set out in Annex II of the Regulation;
- facilitation of the timely implementation of PCIs by streamlining, coordinating closely, accelerating permit-granting processes and enhancing public participation;
- provision of rules and guidance for the cross-border allocation of costs and risk-related incentives for PCIs; and
- determination of the conditions for eligibility of PCIs for EU financial assistance.

The Regulation is based on Article 171 of the Treaty on the Functioning of the European Union. According to Article 171(1), 'the Union shall establish a series of guidelines covering the objectives, priorities and broad lines of measures envisaged in the sphere of trans-European networks; these guidelines shall identify projects of common interest'.

To meet these objectives, the Regulation lays down rules for the timely development and interoperability of trans-European energy networks, by providing the following inputs:

- The **identification of PCIs** necessary to implement priority corridors and areas ([12]) falling under the energy infrastructure categories in electricity, gas, oil, smart grid and CO2 ([13]) (Chapter II of the Regulation). Specifically, the Regulation:
  - sets out the criteria which PCIs should meet;
  - ensures the adoption every 2 years by the Commission of a Union list of the proposed PCIs; and
  - ensures that a plan is in place to implement the PCI as well as procedures to monitor progress of the project.

- Provisions to facilitate the timely implementation of PCIs by streamlining, closely coordinating, accelerating permit-granting processes and enhancing public participation (Chapter III). The Regulation:
  - assigns the highest national priority status to the PCIs and requires that they are included in national network development plans;
  - requires Member States to designate a national competent authority (NCA) responsible for facilitating and coordinating the permit-granting process for PCIs;
  - requires that the competent authority publishes a manual of procedures for the permit-granting process applicable to PCIs;
  - requires the project promoter to draw up and submit a concept for public participation to the competent authority and to ensure the necessary public consultation is conducted; and
  - sets out a maximum time limit of 3.5 years for the pre-application and permit-granting procedures combined.

- Rules and guidance for the cross-border allocation of costs and risk-related incentives for PCIs. The Regulation:
  - requires Member States and national regulatory authorities (NRAs) to set up incentives to address risks to PCIs;

([12]) The priority corridors and areas are defined in Annex I of Regulation (EU) No 347/2013.
([13]) As defined in Annex II of Regulation (EU) No 347/2013.

- establishes the use of cost-benefit methodologies for PCIs for an energy system-wide analysis in line with the principles laid out in Annex V of the Regulation and consistent with the rules and indicators set out in Annex IV; and
- ensures that PCIs benefit from CBCA decisions, which assist the sharing of project costs among countries in line with their expected benefits.

The **outputs** of the Regulation are, therefore, closely linked to each set of inputs described above (and the related activities). The outputs are:

- establishment of relevant cross-border projects within priority corridors and areas and energy infrastructure categories;
- a framework to promote efficient and transparent national permit-granting procedures;
- appropriate regulatory incentives for PCIs and long-term signals to meet EU priorities; and
- involvement of stakeholders in identification and monitoring of PCIs.

The overall outcome is the **timely construction of projects**, which interconnect the energy markets across Europe. More specifically:

- PCIs receive permits more rapidly, ensuring they are implemented in a timely manner;
- PCI status reduces administrative costs for the project promoters;
- there is an increase in electricity and gas interconnection (capacity and use);
- there is increased public participation;
- PCIs receive specific incentives; and
- PCIs could receive a CBCA decision.

In the long term, the Regulation was designed to contribute to smart, sustainable and inclusive growth and brings benefits in terms of competitiveness and economic, social and territorial cohesion by:

- improving sustainability and meeting the EU's energy and climate goals;
- achieving better SOS; and
- improving competition within markets, which keeps energy prices in check.

2.2.1 Permit-granting procedures in Member States

The 2011 impact assessment accompanying the TEN-E Regulation proposal provided a baseline for the permit-granting procedures in the various Member States. Lengthy and ineffective permit-granting procedures as well as public opposition were among the main reasons for delays in implementing energy infrastructure projects. The delays in permitting procedures caused projects to be implemented within 10 years, and this delay could be even longer for projects which faced public opposition. The impact assessment identified that the administrative process of permit granting was complex and fragmented, mainly as procedures varied per Member State as well as between regions within Member States, and due to the many authorities indirectly involved whose opinion is required in the process. Furthermore, there was a lack of upfront planning and coordination in Member States, which has particularly severe consequences for cross-border projects. Most Member States either did not have time limits in place or these were not respected and applied in practice. There was a lack of clear documentation of standards as guidance for promoters in their applications; thus, the applications were often of poor quality and resulted in lengthy request-response cycles between promoters and authorities.

Due to the long, complex and fragmented permitting procedures, scheduled investments were lagging behind performed investments, with 30 % of all projects (in particular, 35 cross-border projects) expected to be completed in or after 2020. With total investment needs in electricity of EUR 100 billion, the impact assessment estimated that up to EUR 50 billion worth of projects could face delay beyond 2020. Figure 2.4 is taken from the 2011 impact assessment ([14]) and illustrates

([14]) European Commission (2011), Commission Staff Working Paper: Impact assessment, Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC. Retrieved from: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:1233:FIN:EN:PDF.

key aspects arising from the permit-granting procedures in Member States. It summarises for each Member State the duration of permit granting-procedures, the number of permits required, the number of authorities responsible at national level and the existence of fast-track schemes. Overall, 13 Member States had time limits; 5 Member States had one responsible authority, while 15 Member States had more than one responsible authority; 10 Member States had fast-track schemes; and the duration of the procedures ranged from 2 to 10 years with an average of about 4 years.

Figure 2.4 Permit-granting procedures in Member States (Annex 7 of Impact Assessment)

Country	AT	BE	BG	CZ	DE	DK	EE	EL	ES	FI	FR	HU
Duration and delays												
time limits for statutory process	Y	N	na	Y	partly	N	na	Y	partially	N	N	Y
real average duration	3 years*	4 years	na	4 years	8 years	10 years	na	5 years	3* years	6 years	5.5 years*	2 years*
Authorities and permits												
number of permits	>1	5	na	3	1	2-3	na	1	>3	3	3	3
responsible authorities	>1	na	na	na	>2	2-3	na	1	>10	8-10	1-2	3-10
Fast-track procedure existing	Y	N	na	N	Y	N	na	Y	Y	N	N	N

Country	IE	IT	LT	LV	NL	PL	PT	RO	SE	SK	SI	UK
Duration and delays												
time limits for statutory process	Y	Y	N	partially	partially	partially	partially	N	N	N	N	Y
real average duration	4 years	5 years	4 years*	3 years*	1.5 years*	4 years*	1.5 years*	3.5 years	9.5 years	4 years*	7.5 years	4 years
Authorities and permits												
number of permits	1	1	3	3	1	>3	2	>4	2	4	4	1
responsible authorities	1	1	several	>5	1	>3	>1	25	>2	>2	4	1
Fast-track procedure existing	Y	Y	N	N	Y	Y	N	Y	N	N	N	Y

*pre-application efforts to be added (average 2 years)

SUMMARY:	Time limits (partially or entire procedure)	13 MS
	1 responsible authority at national level	5 MS
	Fast track schemes	10 MS

Source: Annex 7 in the impact assessment of the TEN-E Regulation (SEC (2011) 1233 Final).

The baseline described for permit-granting processes was used in the effectiveness analysis (including implementation questions) to analyse whether the situation has improved. The duration of the permit-granting processes of PCIs was scrutinised and qualitative information from the stakeholder interviews was analysed.

2.3 Objectives and description of the evaluation baseline

The evaluation baseline captures the point of comparison for the evaluation, i.e. had the 2013 TEN-E Regulation not been introduced (a business-as-usual scenario). The baseline serves to answer the evaluation questions (primarily in relation to effectiveness and efficiency) as well as being used in the modelling, which also feeds in to the answering of evaluation questions.

The baseline for this evaluation is based largely on the baseline scenario in the 2011 impact assessment of the TEN-E Regulation. The baseline consists of four components:

1. permit-granting procedures in Member States;
2. financing;
3. administrative cost estimates; and
4. infrastructure assessment.

The aspects of this evaluation that rely on the 2011 impact assessment baseline are the analysis of permit-granting procedures in Member States, financing, and administrative cost estimates (described in Sections 2.3.1 to 2.3.3). The projections in the 2011 impact assessment reflect expectations on market and technological developments in 2010/2011. Since then, the market landscape has changed and thus a new modelling baseline was established for the infrastructure assessment. The modelling baseline is used in the infrastructure assessment.

2.3.1 *Financing*

The 2011 impact assessment details that energy infrastructure projects are primarily financed by corporate financing through TSOs' own capital and loans from commercial banks or international financial institutions. They rarely use project finance where the long-term financing is based on the projected cash flows of the project rather than the balance sheets of the project sponsor. This system functioned well under a stable regulatory environment, but it did not work well for cross-border projects. Financing these cross-border projects was challenging due to three main factors: limited financing capacities of TSOs, difficulties for energy infrastructure investments in attracting new institutional investors and lack of adapted funding instruments and sufficient envelopes.

For projects that face difficulties with financing but provide high economic, social or environmental benefit, public funding would be justified to trigger investment. The 2011 impact assessment found that the existing public support is insufficient both in its form and the available funds. Under business as usual, the TEN-E approach to financing would have continued to focus the EU funding on studies rather than financial support for works with no reiteration of the European Energy Programme for Recovery. Projects of European significance would continue to receive EU grants for feasibility and front-end engineering and design studies. The 2011 impact assessment indicates that only EUR 55 million of the available funds of EUR 155 million would be for works expenses. In addition, the 2011 impact assessment indicates that the EU-allowed co-financing rates for works would be insufficient to boost implementation of important projects which aim at increasing SOS. Co-financing rates of 50 % or more would be necessary to unblock certain projects, while in the past, the TEN-E co-financing rate was capped at 10 % of the construction costs. Thus, only investment with sufficiently high direct and short-term benefit for the investors would be realised, which would be insufficient to meet the investments needed. Given the likely future evolution of (repayable) loans by institutions such as the European Investment Bank as well as the level of external equity investment, the 2011 impact assessment estimated that funding needs could not be satisfied, as far less than EUR 2 billion of (non-research) grants would be available for the period 2013-2020 under business as usual.

The financing baseline is used in analysis of the extent to which the Regulation has tackled the problems related to financing of energy infrastructure projects.

2.3.2 *Administrative cost assessment*

The 2011 impact assessment presented an administrative cost assessment in which cost figures under various policy options were analysed. The EU Standard Cost Model was applied, and the total administrative cost associated with 150 PCIs to be implemented between 2014-2020 was estimated at EUR 137.1 million under business as usual, with almost 84 % of the costs coming from the costs to promoters associated with activities necessary to secure permits. Table 2.1 provides an overview of the number of full time equivalents (FTEs) that are needed for the permitting procedures per project for project promoters and the NCAs.

Table 2.1 Full-time equivalents needed for permitting procedures per project

	FTEs required per project
Project promoter	14.9
National authority	2.9

Source: 2011 Impact Assessment.

Conducting a similar Standard Cost Model assessment is not within the scope of this project, but an assessment of administrative costs is nevertheless relevant and necessary to provide answers to evaluation questions regarding the efficiency of the Regulation. Therefore, we carried out a qualitative assessment of administrative costs instead through a targeted survey and interviews, while quantitative results are provided as much as possible in the form of FTE estimates. The efficiency evaluation questions compare the administrative cost estimates baseline to the administrative cost estimates gathered through stakeholder consultation.

2.3.3 *Infrastructure assessment*

The 2011 impact assessment outlined the expected investment levels and gaps for various types of project under business as usual, with nationally focused regulation, lack of cost allocation solutions and insufficient risk-related incentives. The investment levels in Table 2.2 constituted the baseline for the impact assessment.

In the evaluation, modelling was used to assess the costs and benefits of electricity and gas PCIs. Benefits were assessed by comparing social economic welfare with and without the commissioned PCIs, and these benefits were compared to the annualised capital expenditure (CAPEX) and operating expenditure (OPEX) cost of these projects.

The modelling estimated the monetised benefit of PCIs in terms of socio-economic welfare change, which derives from price and flow changes. Since 2013 the market landscape has changed, which means that there may be a difference between expectations about costs and benefits of PCIs in 2013 and costs and benefits based on actual market circumstances. With modelling, it is possible to estimate costs and benefits of PCIs in aspects of the changed market landscape (e.g. the construction of the Turkstream pipeline, the stop of the South Stream pipeline and the delay of Nord Stream 2; the impact of US shale gas and oil on energy prices; and availability of liquefied natural gas (LNG) for the EU market).

The modelling scenarios are summarised as follows:

- **The baseline (without Regulation) scenario was defined as an infrastructure set-up**:
  - for 2020 as the infrastructure today: latest capacity map of ENTSOs + final investment decision (FID) projects of Ten-Year Network Development Plan (TYNDP) 2018 that were planned to be commissioned by 2020 + those that were commissioned in 2019-2020 but are not part of the TYNDP (e.g. Turkish Stream 1), excluding all PCIs that were commissioned up to 1 January 2020 with the exception of those that already had an FID in 2013;
  - for 2030: as the infrastructure for 2020 + FID projects of the TYNPD 2018 to be commissioned between 2020 and 2030 + the projects under construction that are not part of the TYNDP (e.g. Nord Stream 2, Turkish Stream 2).
- **The 'TEN-E' scenario was compared to the baseline scenario. This was defined as a market situation assuming the infrastructure of the baseline scenario plus**:
  - for 2020: the commissioned PCIs up to now;
  - for 2030: the 2020 set-up + the PCIs with an FID.
- **A 'TEN-E PCI' scenario was also analysed: a market situation which assumes that all the projects on the 4th PCI list are implemented**.

Table 2.2 Overview of investment levels in the 2011 impact assessment

	Investment levels
Electricity interconnectors	The expectation was that only 25 out of the 58 needed interconnectors would be completed by 2020, leaving about 30 projects (EUR 16 billion) at risk.
Offshore grids	TSOs continued to prefer radial solutions to connect new individual wind farms, affecting roughly EUR 10 billion out of a total investment of EUR 30 billion foreseen up to 2020. Offshore grids would be prevented from starting to develop into a meshed network before 2020, inter alia increasing long-term costs and preventing market integration at a European level.
Electricity storage and smart grids	Demand in electricity was expected to increase steadily to 5 % by 2020 and up to 8 % by 2030, creating a corresponding need for investment in 'expensive peak load and back-up generation assets'.
Gas networks	The investment needs of gas networks in the period 2011-2020 amounted to EUR 89 billion, with EUR 67.8 billion not yet having received a final investment decision even though the projects are very important to enhancing the security of gas supply. (Significantly) more than EUR 10 billion worth of projects were at risk.
CO2 transportation	Most of the potential EUR 2.5 billion investment needed over the period 2010-2020 would not be delivered under business as usual.
Total	The existing framework would be insufficient to ensure the delivery of the needed investment of approximately EUR 200 billion.

Source: 2011 Impact Assessment.

2.4 Evaluation question matrix

Drawing on evidence and rigorous analysis, answers are provided to the evaluation questions to assess the five main evaluation criteria: effectiveness, efficiency, relevance, coherence and EU added value. Our understanding of each of these evaluation criteria within the context of Regulation Ten-E is presented below.

The ToR provides a set of evaluation questions as well as possible detailed questions on the effectiveness of the main provisions under TEN-E Regulation. These detailed questions are very specific to the implementation of the legislation, thus they cross-cut the evaluation questions. We have thus opted to include them in the EQM in a distinct section called 'detailed questions on the effectiveness of the main provisions', that covers questions that are more descriptive and provide an understanding of functioning/implementation and set the scene. The questions have a strong focus on how the 'activities' (see the intervention logic) perform and how they contribute to the objectives and outputs. For this reason, almost all detailed questions on the effectiveness of the main provisions help in answering the main evaluation questions regarding the effectiveness of the Regulation. As such, the detailed questions are not answered separately, but rather integrated to provide input into the main evaluation questions under effectiveness questions. The assessment of the effectiveness of instruments can be used to assess other evaluation criteria, in particular EU added value and coherence.

Based on these evaluation questions, the EQM was developed (see Annex I). This matrix guides the evaluation process and defines the way the evaluation questions are to be answered. The matrix outlines our interpretation of the evaluation questions by proposing indicators based on the intervention logic.

The evaluation matrix includes a table for each of the evaluation questions. The table breaks down the questions into various sub-questions and includes the following information for each evaluation question:

- assessment criteria;
- indicators to be used;
- data sources;
- data collection methods;
- data analysis approaches; and
- ability to answer the evaluation question and limitations.

As mentioned in Section 1.3, in view of the objectives set out in the European Green Deal, the EQM was revised to accommodate the change in scope of the project. Evaluation questions were combined and streamlined under all criteria to avoid unnecessary repetition; however, we ensured that the revised questions were reformulated and that the information required for the original evaluation questions in the ToR would be captured elsewhere. The questions under relevance and coherence were revised to reflect the current policy context. The indicators, data sources, data collection and data analysis approaches were revised and made more specific to this context (see Annex I).

2.4.1 Effectiveness

The evaluation criterion for effectiveness assess the extent to which the intended outcomes generated by the activities of the TEN-E Regulation correspond with the objectives, i.e. how successful it has been in achieving or progressing towards the achievement of its objectives.

The questions for effectiveness outlined in the ToR are as follows:

1. To what extent have the Regulation's main provisions addressed the needs identified in the impact assessment accompanying the Commission proposal in 2011?
2. How effective has the regulatory approach of the TEN-E Regulation been both in terms of scope and main provisions in contributing to the goals of market integration, SOS, competitiveness and the climate and energy targets for 2020?
3. What unintended or unexpected positive and negative effects, if any, have been produced by the TEN-E Regulation? (e.g. in terms of human health, use of resources and natural ecosystems)?

The TEN-E Regulation was designed to help overcome some of the key barriers to the development of European-wide energy infrastructure, mainly related to getting the required permits to build the infrastructure, lack of public acceptance, lack of incentives and systems to capture the EU-level benefits of cross-border energy transmissions projects and difficulties in accessing finance to construct the projects. By encouraging more integrated networks, the TEN-E Regulation aims to encourage a more competitive and sustainable energy market with improved SOS.

The key questions asked to assess the effectiveness of the Regulation, therefore, concern the extent to which it has achieved its general, specific and operational objectives, and the factors that

influenced this. If objectives (general, specific, operational) have not been achieved or progress is not on track, an assessment is presented of the extent to which progress has fallen short of the targets and what factors have influenced this.

Our approach to the assessment of effectiveness in this evaluation, therefore, reflects the principles of both theory-based evaluation and counter-factual evaluation. It aims to both confirm the effects of the Regulation (compared to the baseline scenario, in absence of the Regulation) and provide insight into the causal pathways between the inputs and effects. This assessment relied on documentary evidence and energy market modelling as well as stakeholder consultations on the degree to which the intended outcomes and impacts have been met.

2.4.2 Efficiency

The evaluation criterion of efficiency considers the extent to which the resources (inputs) used to produce the outputs are used as efficiently as possible (with lowest possible resources/costs).

The efficiency questions to be considered for this study are as follows:

1. To what extent are the costs resulting from the implementation of the TEN-E Regulation proportionate to the benefits that have been achieved? What are the major sources of inefficiencies?
2. To what extent do the different types of costs resulting from the implementation of the TEN-E Regulation vary based on the approach taken to implement the legislation (while achieving the same results)? Which approach was most efficient?

Efficiency is a measure of the relationship between the results of an intervention and the resources invested in attaining these results. In the case of the TEN-E Regulation, this means examining the costs and benefits for NRAs, NCAs and project promoters with regard to the implementation of the Regulation. Costs and benefits of implementing the Regulation's provisions were measured against one another to assess the degree to which the costs are proportionate to the benefits, and whether outcomes could have been achieved through different means or at lower costs.

Thus, our assessment of the efficiency of the TEN-E Regulation primarily focused on a quantitative assessment of costs associated with its implementation. Benefits were quantified where possible, but relied partly on a set of qualitative descriptors collected from NRAs and project promoters. The inputs to this task came primarily from stakeholder consultations (e.g. a targeted questionnaire to collect cost data and interviews with project promoters). The evidence was produced via an administrative cost analysis.

2.4.3 Relevance

The evaluation criterion of relevance assesses the extent to which the objectives of the TEN-E Regulation appropriately respond to the needs of its intended target group and internal stakeholders.

The questions on relevance are the following:

1. To what extent do the objectives of the TEN-E Regulation still respond to the needs of the EU in relation to energy infrastructure?
2. To what extent are the 12 priority corridors still relevant? Do they address current and arising challenges for TEN-E networks (e.g. sector coupling, hydrogen)?
3. To what extent are the provisions of the TEN-E Regulation able to respond to new or emerging issues, such as the energy and climate targets for 2030, the EU long-term decarbonisation commitment towards carbon neutrality, the EEFP and EU readiness for the digital age?

Our assessment of relevance took into account how the needs of consumers, energy producers, PCI promoters and other relevant stakeholders have changed over time (also with regards to policy developments and external influencing factors) and the degree to which these are adequately covered by the TEN-E Regulation as it currently stands. Under this criterion, we also assessed the ongoing relevance of the 12 priority corridors in light of current and future challenges for TEN-E networks, as required by the ToR and the shift toward an emphasis on climate objectives.

The starting point of our assessment of relevance was the needs identified in the impact assessments preceding the TEN-E Regulation, the objectives of the Regulation itself, recent studies that may highlight additional needs and influencing factors and stakeholder consultations to assess the degree to which stakeholders believe their needs are adequately met.

2.4.4 Coherence

Coherence is about the extent to which the objectives and the implementation of the activities are non-contradictory (internal coherence) and do not contradict other activities with similar objectives (external coherence).

The questions on coherence are as follows:

1. Are the measures set out within the TEN-E Regulation mutually reinforcing or are there any overlaps, inconsistencies or incoherencies (when read in isolation)?
2. How does the legislation interact with other EU/national/international initiatives (e.g. actions in the field of environment, single market, climate action) which have similar objectives?
3. How well does the legislation fit with and complement other EU policies (e.g. Regional Policy, Research and Innovation, Environment) but also other elements of EU energy policy (e.g. internal market design, the renewable energy framework, the EEFP, the EU's energy and climate targets for 2030, the EU's long-term decarbonisation commitment, the European Green Deal)?

In this evaluation, we considered whether there are any internal inconsistencies in the Regulation itself as well as the degree to which it is coherent with other (EU) initiatives with similar objectives and its situation in the wider EU energy policy field.

Considering the technicalities involved in assessing the coherence of complex legislative documents, we involved a legal expert to ensure there are no contradictions or inconsistencies within the Regulation and none between the TEN-E Regulation and related EU legislation in the field of energy policy and other (inter)national obligations of the Member States. This primarily concerned documentary evidence and, to some degree, stakeholder consultations, which helped identify relevant legislation that we might not have considered otherwise.

2.4.5 EU added value

The final evaluation criterion of EU added value concerns the extent to which it can reasonably be argued that changes are the result of the EU intervention, over and above what could reasonably have been expected from national actions. Thus, it considers whether and to what extent the TEN-E Regulation is justified based on its impacts and achievements.

The questions to be answered are as follows:

1. What has been the EU added value of the TEN-E Regulation (e.g. regional cooperation)? Would the same results have been achieved with legislation at national and/or regional level only?
2. To what extent do the issues addressed by the TEN-E Regulation continue to require action at EU level?

Thus, the EU added value of the TEN-E Regulation was measured on the basis of two interrelated aspects: the extent to which it is justified in terms of the results it brought about compared to what could have been achieved by Member States themselves; and the extent to which the issues addressed by the Regulation still require EU intervention (in other words, what the consequence of stopping the EU intervention would be).

The starting point for the assessment of the EU added value of the TEN-E Regulation was its effectiveness and efficiency, with an emphasis on identifying the mechanisms used to generate added value and assessing the magnitude of their results. As such, a large part of answering these two questions was based on a cross-cutting assessment of the findings from other evaluation criteria; but this was supplemented by data from stakeholder consultations regarding the rationale and justification of the intervention at EU level.

2.5 Methods used

To provide relevant evidence on the implementation of the TEN-E Regulation, a number of methods were employed to collect primary and secondary data. The data collection and analysis included desk research, portfolio analysis, case study analysis, modelling and expert and stakeholder consultations.

2.5.1 Desk research

The first step in answering most of the evaluation questions is to gather relevant information and findings from the literature. The desk research provided background information and context to the study as well as evidence crucial for triangulation of data. In line with the objectives of the study we implemented an extensive desk research providing insight on backward- and forward-looking elements.

Data from the desk research was mapped (in an Excel sheet) against the evaluation questions and the detailed questions on the effectiveness of the main provisions using the Rapid Evidence Assessment (REA) approach. REA allowed us to review a higher number of documents compared to a classic literature review; this was done through targeted research using pre-determined search criteria and scanning of the relevant sources.

Based on the REA approach, a review protocol was developed and applied by the desk researchers. The identified literature underwent an initial review to appraise the relevance of each source for all the evaluation criteria. Subsequently, a second and thoroughly focused review took place to extract findings in relation to the specific evaluation questions.

In order to ensure high accuracy and consistency, the desk research was conducted by a small team within the consortium, maintaining regular feedback loops. The resulting database of sources mapped against evaluation questions was shared with the entire team.

2.5.2 Portfolio analysis

The portfolio analysis took into account the progress made for each PCI and facilitated the application of a sampling strategy for subsequent data collection activities as well as providing input into the formulation of indicators for answering the evaluation questions. The main purpose of the portfolio analysis is to facilitate the assessment of the outputs and outcomes of the TEN-E Regulations. Referring back to the intervention logic (Figure 2.3), the outputs of the Regulation include the setting-up of a PCI list corresponding to gaps in the priority corridors of the TEN-E Regulation, while the outcomes are defined as the timely and successful implementation of the PCIs.

The portfolio analysis takes as its starting point the 2013, 2015, 2017 and 2019 PCI lists and the technical information listed for each project (definition; details of location, promoter(s), type/technology employed, implementation status and date of commissioning) ([15]). More recent project-level data collected through our desk research were integrated in order to form a comprehensive, up-to-date database. The populated database was used to obtain an overview of a number of indicators related to the implementation of PCIs and to identify evidence of trends and gaps therein.

The portfolio analysis focused on the key indicators regarding PCI implementation progress (outcomes) and their contribution to the attainment of the specific objectives of the Regulation (results).

2.5.3 Stakeholder consultation

To enrich and complement the secondary data collection, a stakeholder consultation strategy was developed. The aim was to collect views, experiences and concrete examples from stakeholders to illustrate particular opportunities, challenges and impacts resulting from the implementation of the TEN-E Regulation with a view to filling any potential information/data gaps and facilitating the analysis of the different evaluation criteria. The scope of the consultation strategy is encapsulated in the evaluation questions related to the individual evaluation criteria (see the EQM in Annex I).

The consultation strategy combined several consultation tools that generated the information and evidence necessary to provide well-reasoned responses to the evaluation questions. Specifically, the following methods were employed:

- OPC;
- a targeted online survey;
- in-depth interviews; and
- webinars.

([15]) European Commission (2018), Technical information on Projects of Common Interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/technical_document_3rd_list_with_subheadings.pdf.

Each method and tool employed is briefly introduced in the following sections. A more detailed description of the consultation activities, the stakeholders engaged and the results are provided in the Synopsis report in Annex V of this report.

Online Public Consultation

The objective of the OPC in the context of this study was to consult all interested stakeholders to provide input for the evaluation. The OPC was carried out via the Commission's online survey management system.

The questionnaire was addressed to citizens and organisations (e.g. NGOs, local government, local communities, companies and industry associations) with no specialist knowledge of the TEN-E Regulation. It was made clear that a targeted survey was available for stakeholders with specialist knowledge of the TEN-E Regulation (see below), but also that professionals could answer both questionnaires. The OPC was accessible to a broader audience, used more general language and referred to issues of broader interest compared to the targeted survey; for example, the OPC covered infrastructure categories and the related priority energy infrastructure corridors and priority thematic areas, project selection criteria and participation in the PCI process and the implementation of these projects on the ground.

The OPC included the following elements (see Annex VI):

- introduction – introducing Regulation (EU) No 347/2013 and its context as well as setting out the purposes of the questionnaire;
- identification questions;
- Part I – questions focusing on the criteria of relevance and EU added value and exploring the changing context of the Regulation; and
- Part II – questions focusing on public participation and transparency of PCIs.

Targeted online survey

The aim of the targeted survey was to collect primary data, mainly on the effectiveness of the TEN-E Regulation but also covering questions related to its relevance, external coherence and EU added value. As it aimed to collect data from practitioners and experts in the field of energy infrastructure, it was targeted at project promoters, public authorities (NRAs, NCAs, regional and local governments), other actors in the energy system (e.g. distribution system operators (DSOs), energy suppliers, developers of technological solutions), civil society (e.g. local communities, NGOs), wider industry representatives and academics or researchers. The Commission sent invitations to take part along with the invitation for the public consultation and interviews.

The survey also served to identify stakeholders to take part in in-depth interviews, which allowed for follow up on survey responses where interviews were completed in time.

The survey questions covered all evaluation criteria, including detailed questions on implementation. It generated quantitative as well as qualitative data that were used to answer the evaluation questions presented in Chapter 1. An overview of the (types of) responses received is included in the Synopsis report in Annex V.

Interviews

Eighty-two in-depth interviews were conducted and the data analysed and incorporated into the answers to evaluation questions in the final report.

In-depth interviews are one of the main methods for collecting information used in the evaluation. The interviews provided evaluators with the opportunity to obtain detailed information and evidence from key stakeholders. The information gathered through interviews complements the assessments provided in the targeted online survey and the OPC. While the survey and OPC are great tools to assess *what* stakeholders think, interviews provide an opportunity to assess *why* they think those things. Where possible based on the time frame, preliminary evidence from the targeted survey was used to refine the interview guide.

This component of the stakeholder consultation strategy comprised of 112 hour-long interviews with key stakeholders. The stakeholders targeted were largely the same as those targeted for the online survey (as already noted, the Commission sent out a single invitation email for both, as the

interviews served as a follow-up data collection tool). A few additional stakeholders (EU institutions, ENTSOs) were contacted separately for interview.

Due to a lack of interest in participating from certain groups (notably NRAs, NCAs), the planned sample of interviewees had to be adapted. This was done in agreement with DG ENER, and where this led to any bias in the results, this has been duly taken into consideration. Interviewee numbers are shown in Table 2.3 according to stakeholder category.

Table 2.3 Interviews by stakeholder type

Stakeholder	Number of interviews conducted
EU institutions	6
European regulators (Agency for the Cooperation of Energy Regulators; ACER)	1
ENTSOs	2
NRA	4
NCA	5
Transmission System Operators	20
Project promoter (non-TSO) ([16])	6
Distribution System Operators	5
Civil society	12
Research, academia	2
Industry association	13
Business	5
Other	1
Total	**82**

The interview guide was flexible to allow interviewees to respond to the topics they wanted to contribute most to, also building on their responses to the targeted online survey (where applicable). As such, not all stakeholders interviewed provided data for all questions included in the interview guide.

Webinars

In line with the inception report and the consultation strategy, the methodology for the study envisaged two one-day workshops (one in April and one in August). However, due to the Covid-19 crisis, in consultation with DG ENER, it was agreed that the first workshop should be transformed into a series of four webinars. These were held in the first 2 weeks of June 2020. Despite this change, the objective – to gather information and evidence for the evaluation – was the same.

The project team supported the preparation of the concept, invitation and roadmap for the webinars. During the webinars, we provided technical support to the moderators, panellists and participants. The topics and dates of webinars are presented in Table 2.4.

Table 2.4 Topics and dates of four webinars

Webinar topic	Date
TEN-E infrastructure categories to ensure consistency with the climate neutrality objectives of the European Green Deal and digitalisation priorities	2 June 2020
Selection procedure and criteria for PCIs	4 June 2020
Cross-border allocation of costs and incentives and criteria for the CEF financial assistance	9 June 2020
Implementing PCIs: Monitoring progress, streamlining permitting procedures and involving of stakeholders and local communities	11 June 2020

([16]) Including energy producers, DSOs.

The webinars took place via the WebEx platform, and the registration process was managed through the EU Survey platform. The discussions that took place during the webinars were summarised in webinar reports, which were distributed to DG ENER and the evaluation team so that the results could be used to answer the respective evaluation questions. More information on the webinars is provided in the synopsis report in Annex V.

2.5.4 Case studies

The purpose of the case studies is to illustrate the assessment and conclusions drawn, by means of a deep dive into six PCIs. The selection of the case studies was balanced in terms of geography, sector (electricity, smart grids, gas, CO2) and implementation phase. For geographical balance, we selected projects covering various priority corridors. For sectoral balance, we selected electricity, gas and CO2 PCIs for analysis, while at the same time we also covered diverse technologies (e.g. interconnectors, an LNG terminal and a smart grid project). For balance of implementation phase, we covered both finalised and non-finalised projects. As assessment was retrospective and evidence based, we selected projects that had been completed so that we could compare the planned and achieved results. In addition, we selected ongoing and delayed projects so that we could assess the major barriers preventing the completion of PCIs on time despite the presence of the Regulation.

Based on these criteria, the six selected case studies included:

- the internal line between Brunsbüttel/Wilster and Groβgartach/Bergrheinfeld-West (Germany) to increase capacity at northern and southern borders (currently known as Suedlink) (PCI 2.10);
- the interconnection between Kilingi-Nõmme (Estonia) and Riga CHP2 substation (Latvia), part of the cluster known as the 3rd Interconnection between Estonia and Latvia (PCI 4.2.1);
- the gas pipeline from Greece to Italy via Albania and the Adriatic Sea (currently known as the Trans-Adriatic Pipeline (TAP)) (PCI 7.1.3);
- the Poland-Lithuania interconnection (currently known as GIPL) (PCI 8.5);
- Again, Connected Networks (ACON) Smart Grid (Czechia, Slovakia) (PCI 10.4); and
- CO2 TransPorts (Porthos) (PCI 12.3).

A detailed case study template was prepared in collaboration with the Commission to ensure that each case study approaches the research questions using similar structures (see Annex VI).

2.5.5 Modelling

The most challenging part of evaluating the infrastructure developments triggered by the TEN-E Regulation was the measuring of benefits, as many benefit categories can only be measured using modelling (e.g. socio-economic welfare derived from the higher trading opportunities allowed by the new infrastructure). The main purpose of the modelling carried out for this study was to monetise the realised and potential benefits (in term of socio-economic welfare change) of the PCIs. In addition, based on modelling outcomes, several indicators were calculated in order to illustrate the effect of the TEN-E Regulation on market integration, competition, CO2 emissions and RES integration.

The individual CBAs carried out for the various projects were not necessarily harmonised, which meant that the data could only be aggregated and assessed with caution. Evaluating PCIs as a whole group (but separately for the electricity and natural gas sectors) would allow more robust benefit estimates that could be aggregated and assessed at the EU level.

Infrastructure baselines (the state of infrastructure development without the TEN-E Regulation) must be designed carefully so as not to overestimate the benefits of the Regulation, as some of the projects would have been realised even without the Regulation. To arrive at realistic baselines, we relied on Primes EUCO3232.5 scenarios, the ENTSOs' capacity data for 2019, the 2020 TYNDP and additional information provided by Commission services. The input data and the data from the analysed projects were harmonised with the Joint Research Centre (JRC) modelling.

In order to provide quantitative answers to the evaluation questions, we used REKK's European Electricity Market Model (EEMM) and European Gas Market Model (EGMM).

The EEMM is a partial equilibrium microeconomic model. It assumes fully liberalised and perfectly competitive electricity markets. Forty-four markets were modelled, including almost all members of ENTSO-E ([17]). Although production and trade are constrained by the available installed capacity of power plants and net transfer capacity (NTC) of cross-border transmission lines, in the model, one country is one node (with a few exceptions – e.g. we modelled two markets in Denmark and in Ukraine), so no internal congestion is assumed. Power flows are ensured by more than 100 interconnectors between countries.

The model included more than 3 000 power plant units operated with 12 different fuels. Each plant had a specific marginal cost of production, which was constant at the unit level. Generation capacity was constrained at the level of available capacity as well. Consumers were represented in an aggregated way by different price-sensitive demand curves for each modelled market, approximated by a downward sloping linear function. The model has an hourly time step, modelling 90 representative hours with respect to load, covering all four seasons and all daily variations in electricity demand.

The model maximised welfare in the 44 countries covered (using the sum of producer and consumer surpluses). As an output it provided the equilibrium (wholesale) electricity prices for each market, the trade on each interconnector and the production and CO2 emissions of each power plant unit.

The EGMM is a competitive, dynamic, multi-market equilibrium model that simulated the operation of the wholesale natural gas market across the whole of Europe. It included a supply-demand representation of European countries, including gas storage and transportation linkages. Large external markets, including Russia, Turkey, Libya, Algeria and other LNG exporters, were represented exogenously with market prices, long-term supply contracts and physical connections to Europe.

The time frame of the model covered 12 consecutive months, starting in April. Market participants had perfect foresight over this period. Dynamic connections between months were introduced via the operation of gas storages and take-or-play constraints of long-term contracts.

Given the input data, the model calculated a dynamic, competitive market equilibrium for the modelled countries, where all arbitrage opportunities across time and space were exhausted to the extent that storage facilities, transportation, infrastructure and contractual conditions permitted. As a result, the competitive equilibrium yielded an efficient, welfare-maximising outcome.

Using these tools, the benefits of the already commissioned PCIs and the projects on the 4th PCI list were monetised for 2020 and 2030, compared to infrastructure baselines. More detailed information on the methodology and the results of the modelling are provided in Annex III.

2.6 Limitations and mitigating measures

In the process of data collection and analysis, the research team identified several key challenges and limitations for the evaluation. These are described in Table 2.5 along with the impacts they may have had on the evaluation.

Table 2.5 Issues in and limitations of the evaluation and the current report

Issue or limitation	Impact	Mitigation measures taken
Limited information available via desk research	Low	The available information was logged against the evaluation matrix at an early stage of the project. Therefore, the gaps were identified early on and missing topics were included in the questionnaires for the targeted survey and the OPC. Further gaps were identified after assessing the results of the survey and the OPC, and these were addressed as part of the interview process.
Fragmented quantitative	Medium	Desk research revealed that quantitative information on PCIs is fragmented or difficult to access. Specifically,

([17]) Cyprus and Malta were not included in the EEMM.

Issue or limitation	Impact	Mitigation measures taken
information on specific PCI technical data		combining monitoring data with CEF funding and historical PCI data is problematic due to inconsistencies in formats and lack of centralised accessibility. This is why special attention was paid to this information when drafting the questionnaires for the OPC and the targeted survey.
Inconsistent availability of meaningful cost estimates to answer the evaluation questions on efficiency	Medium	The questionnaires for the targeted survey and the OPC were designed to address this issue and include questions on the estimates of FTEs and cost drivers for cost items which are considered 'high' or 'too high' according to stakeholders. Further information was requested in the interviews. In addition, we triangulated the results between different types of stakeholder.
Divergence from planned sampling strategy for interviews	Low	The differences in stakeholder types between the planned sample and the achieved sample were addressed in the qualitative analysis with the selection of interviewees from particular stakeholder categories.
Data on permitting schemes is possibly outdated, and current information is dispersed and difficult to access	Medium	The latest study on permitting schemes adopted in Member States is from 2016 and, therefore, not fully up to date. We searched for descriptions of permitting schemes in the 'manuals of procedures' mandated by the Regulation, but these were titled inconsistently in manuals from different Member States. Language barriers also represented a challenge. Moreover, the 2016 study showed that manuals of procedures are not always sufficiently clear. To obtain more clarity, we reached out to NCAs to ask for additional information on the schemes currently in place.
Data quality issues with project monitoring data	Low	Project monitoring data from ACER were used in analysis of the portfolio of electricity and gas projects. Several data quality issues were identified, and as a result not all data could be used (data quality improved in recent years). In the report, monitoring data are only used when we have sufficient confidence in the completeness of the data.
Fragmented quantitative information on specific PCI technical data	Medium	Desk research revealed that quantitative information on PCIs is fragmented or somewhat difficult to access. Specifically, combining monitoring data with data on CEF funding and historical PCI data was problematic due to inconsistencies in formats and lack of centralised accessibility. To overcome this difficulty, we used the available and consistent data and filtered out inconsistencies as part of data cleaning. Additionally, we used insights from stakeholder interviews to fill gaps. In very few cases, we complemented these data with ACER monitoring data.
Lack of cost estimates to answer all the evaluation questions on efficiency	Medium	Conducting a Standard Cost Model assessment to analyse administrative costs was not within the scope of this project, but an assessment of administrative costs was nevertheless necessary to provide answers to the evaluation questions regarding the efficiency of the Regulation. Therefore, we used quantitative results as far as possible and, in addition, carried out a qualitative assessment of administrative costs.
Not all benefits can be quantified through modelling	Low	In the modelling, socio-economic benefits were quantified but estimates did not reflect all benefits. This was addressed by explaining socio-economic benefits in Annex III.

3 TEN-E AND THE STATE OF PLAY IN ITS CURRENT IMPLEMENTATION

This chapter provides an introduction to the TEN-E Regulation and summarises how the Regulation has been implemented in qualitative and quantitative terms. The section provides an overview and descriptive information about the TEN-E Regulation, further analysed in Chapter 4. Section 3.1 details why the TEN-E Regulation was established and outlines the objectives of the Regulation. Section 3.2 summarises how the Regulation was implemented, including the PCI process, permit-granting and public participation, regulatory treatment and financing.

3.1 Rationale for the establishment of the TEN-E Regulation

The TEN-E Regulation was designed to address a number of barriers to the implementation of the energy infrastructure and integrated energy networks. Specifically, the 2010 and 2011 impact assessments accompanying the Commission proposal ([18]) mentioned the following main obstacles:

- extensive time required for projects to acquire building permits, and opposition of the affected population, which can impede the timely implementation of energy infrastructure projects. Specific issues include:
  - complex and fragmented permit-granting processes;
  - lack of upfront planning and coordination;
  - lack of time limits on permitting decisions; and
  - unclear documentation standards and lack of quality information.
- regulatory challenges involved in building cross-border projects, including:
  - lack of coordination and appropriate and transparent rules for cost allocation for cross-border investment;
  - asymmetric distribution of costs and benefits among beneficiaries;
  - externalities not properly reflected by existing market signals or the existing regulatory system; and
  - lack of appropriate regulatory incentives and long-term signals to meet EU priorities.
- lack of commercial viability of some energy infrastructure projects, including limited financing capacities of TSOs, difficulties for energy infrastructure investments in attracting new investors (such as pension funds and insurance companies) and lack of adapted funding instruments available to promote PCI.

To tackle these obstacles, the TEN-E Regulation was adopted as part of a larger regulatory framework. The Regulation lays down rules to achieve a number of objectives ([19]):

- to ensure the functioning of the internal energy market and SOS in the EU;
- to promote the development of new and renewable forms of energy, energy efficiency and energy savings; and
- to promote the interconnection of energy networks.

([18]) European Commission (2011), Commission Staff Working Paper: Impact assessment, Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC. Retrieved from: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:1233:FIN:EN:PDF.
European Commission (2010), Commission staff working document impact assessment Accompanying document to the communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions Energy infrastructure priorities for 2020 and beyond - A Blueprint for an integrated European energy network. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010SC1395&from=EN.

([19]) Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 201 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) N0 713//2009, (EC) No 714/2009 and (EC) No 715/2009.

3.2 Summary of the main provisions of the TEN-E Regulation and their implementation

This section summarises how the Regulation was implemented and covers specifically the following aspects: the PCI process; permit granting and public participation; regulatory treatment; and financing. It describes the main provisions of Regulation as well as the roles of stakeholders who are involved in different parts of the process. Furthermore, indicators of implementation status (such as duration of permit granting), initial insights and descriptive statistics are also included. Here we provide a basis for the deeper analysis of the evaluation questions and implementation questions in Chapter 4.

3.2.1 PCIs

The TEN-E Regulation distinguishes and targets specific projects that are identified as PCIs from an internal energy market perspective. This section sets out the governance of the Regulation, how the selection process is designed, what makes a project a PCI and how the implementation and monitoring takes place. Table 3.1 provides an overview of articles within the Regulation specifying this information.

Table 3.1 Articles within the TEN-E Regulation specifying PCI process, governance and monitoring

Article	Scope of the article
Article 3	• Establishment of 12 regional groups; • Selection process of PCIs.
Article 4	Assessment or eligibility criteria for PCIs
Article 5	Implementation and monitoring requirements
Article 11	CBA

PCI governance: Regional groups and high level groups

Various stakeholders and stakeholder groups are involved in the selection and implementation of the PCIs, at both national and European levels. The cooperation of and coordination among the involved stakeholders is facilitated by regional groups, established by Article 3. The membership of each group is based on a priority corridor or thematic area and their respective geographical coverage. A total of 12 corridors/areas with 12 respective regional groups, each with their own functional framework, have been set up. The regional groups include representatives from NCAs, the European Commission, TSOs, project promoters, NRAs and ACER; however, the final decision-making powers are restricted to Member States and the Commission (the DMB). The groups are responsible for the assessment of candidate projects proposed by the project promoters, but also for monitoring the execution of PCIs and for making recommendations to facilitate their implementation. Table 3.2 shows the regional groups (or priority corridors and areas) for each infrastructure sector.

Table 3.2 Regional groups

Sector	Regional group / priority corridor or thematic area	Composed of representatives of:
Electricity	North Seas Offshore Grid (NSOG)	NCAs, NRAs and TSOs as well as the Commission, ACER and ENTSO-E
	North-South electricity interconnections in Western Europe (NSI West Electricity)	
	North-South electricity interconnections in Central Eastern and South Eastern Europe (NSI East Electricity)	
	Baltic Energy Market Interconnection Plan (BEMIP) Electricity	
Gas	Southern Gas Corridor (SGC)	NCAs, NRAs and TSOs as well as the Commission, ACER and ENTSOG
	North-South gas interconnections in Western Europe (NSI West Gas)	
	North-South gas interconnections in Central Eastern and South Eastern Europe (NSI East Gas)	
	BEMIP Gas	
Oil	Oil supply connections in Central Eastern Europe (OSC)	NCAs and relevant project promoters
CO2	Cross-border CO2 networks thematic group	NCAs and relevant project promoters
Smart grids	Smart grid priority thematic group	NCAs, NRAs, TSOs and DSOs as well as the

Sector	Regional group / priority corridor or thematic area	Composed of representatives of:
		Commission and European Distribution System Operators
Electricity highways	Electricity highways priority thematic group	NCAs, NRAs and TSOs as well as the Commission, ACER and ENTSO-E

Sources: European Commission (2020a), Technical information on Projects of Common Interest (https://ec.europa.eu/energy/sites/ener/files/technical_document_4th_pci_list.pdf) and Regulation (EU) No 347/2013, Annex III.

Member States can establish 'high level groups' aiming to pursue a specific long-term strategy. The organisation of and interaction within high level groups takes place independently and is, in contrast to regional groups, not established by the Regulation. High level groups contribute to the PCI development process by fostering high-level (international) political commitment and supporting the reaching of consensus on regional action plans ([20]). Each group promotes a specific goal regarding EU energy network integration. There are currently four different high level groups ([21]):

- **North Seas Energy Cooperation** – linking the North Seas region;
- **Interconnections for South-West Europe** – integrating the Iberian Peninsula energy markets with the rest of Europe;
- **Central and South Eastern Europe Energy connectivity** – accelerating the integration of gas and electricity markets in the Central and South Eastern region;
- **BEMIP** – aiming to end energy isolation in the Baltic region and foster their integration by, inter alia, synchronisation with continental European network.

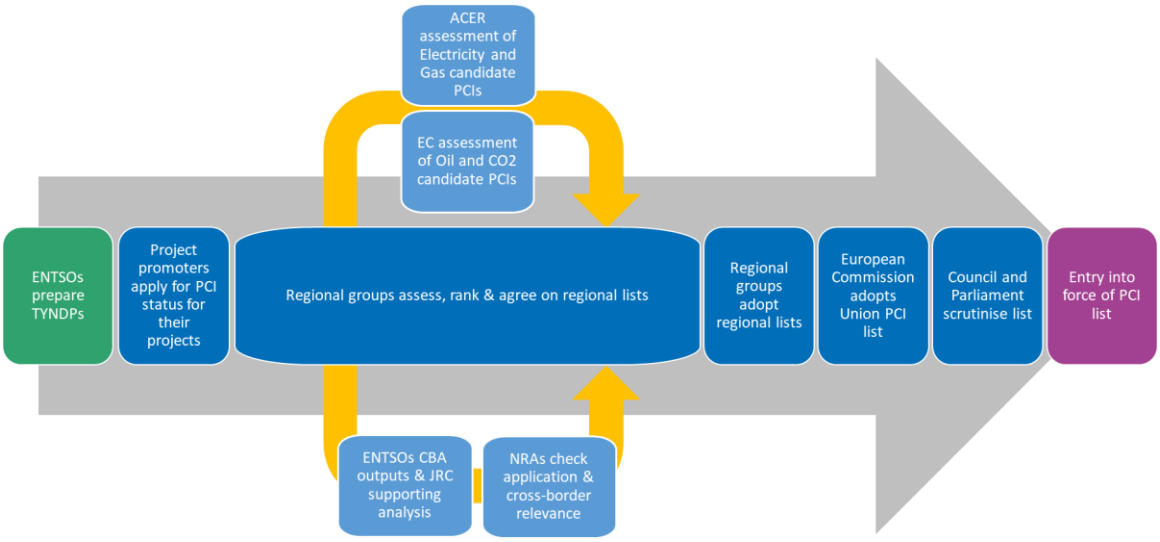
PCI selection process

Article 3 of the TEN-E Regulation defines the process for PCI selection. The PCI selection process is based on the national development plans (NDPs) and TYNDP (which take an EU-centric approach) prepared by the ENTSOs. Furthermore, the PCI process involves consultation with multiple stakeholders within the regional groups and via public consultation to ensure broad consensus of the list adopted by the European Commission. Figure 3.1 illustrates the PCI selection process and the roles of the various stakeholders in this process.

([20]) Regional action plans are made by regional groups to identify and formalise the regional actions needed. The regional action plans specify the corresponding Member State(s), responsible entities, preconditions, done/ongoing activities and immediate actions needed. An example can be found at: https://ec.europa.eu/energy/sites/ener/files/documents/cesec_electricity_action_plan_updated.pdf.

([21]) https://ec.europa.eu/energy/topics/infrastructure/high-level-groups_en.

Figure 3.1 PCI selection process



Source: Own development, adapted from Trinomics et al (2018) ([22]), Norton Rose Fulbright (2014), European Commission presentation 'Implementing the projects of common interest' (2016) and Regulation (EU) No 347/2013, Articles 3 and 4.

A new list of PCIs is established every 2 years. Promoters of projects that are potentially eligible for PCI status can submit an application to the corresponding regional groups. The regional groups assess the applications regarding their compliance with and relevance to the specific PCI selection criteria as defined under Article 4 of the Regulation. Through this assessment, the PCI candidates are ranked by the DMBs of the regional groups. This results in a regional list of proposed PCIs. The regional group should aim at having a 'manageable total number of PCIs' (Regulation (EU) No 347/2013, Article 3). When a group draws up its regional list, the Member States are required to approve projects related to their territory.

Regional groups determine the assessment methodologies by which the projects will be ranked, based on the aggregated contribution to the PCI criteria. In addition, ACER is responsible for assessing compliance with the PCI criteria and the European added value for electricity and gas projects specifically. The respective ENTSOs carry out a CBA. The Commission is solely responsible for assessment of the candidate oil supply connections and cross-border CO2 network projects. Both ACER and the Commission present the mentioned assessments to the relevant groups to be included in the PCI assessments.

After the DMBs of the regional groups have adopted their own lists of proposed PCIs, all regional lists are combined into an EU-wide PCI list. The EU-wide PCI list is adopted by the Commission via a delegated act procedure. Afterwards, the delegated act is submitted to the European Parliament and Council for a non-objection period, during which they can approve or reject the list as a whole. If neither party rejects the list within 2 months, it enters into force. PCIs included on the list are additionally required to become an integral part of relevant regional investment plans and the relevant NDPs. The PCI status of all listed projects will then last for 2 years, until a new list enters into force.

([22]) Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

PCI criteria

The criteria for PCIs are outlined in Article 4 of the Regulation. To become eligible for PCI status, a candidate project is required, at the least, to meet the following general criteria:

- the project is considered necessary for at least one of the infrastructure priority corridors and thematic areas;
- the potential benefits of the project outweigh its cost, including in the longer term; and
- the project significantly involves EU Member States, indicated by:
  - involving at least two Member States by directly crossing the border of two or more Member States;
  - being located in one Member State and having a significant cross-border impact; and
  - crossing the border of at least one Member State and a European Economic Area country.

In addition to the general criteria, there are specific criteria applied to PCIs falling within certain energy infrastructure categories. During assessment, the candidate project is valued on all specific criteria. Table 3.3 shows the specific PCI criteria for different energy infrastructure categories.

Table 3.3 Specific PCI criteria per infrastructure category

Energy infrastructure category	Specific criteria
Electricity	Market integration
	Sustainability
	SOS
Gas	Market integration
	SOS
	Competition
	Sustainability
Smart grids	Integration and involvement of network users with regard to supply and demand
	Efficiency and interoperability in day-to-day network operation
	Network security, system control and quality of supply
	Optimised planning of future cost-efficient network investments
	Market functioning and customer services
	Involvement of users in the management of their energy usage
Oil	SOS
	Efficient and sustainable use of resources
	Interoperability
CO2	Avoidance of CO2 emissions while maintaining security of energy supply
	Increasing resilience and security of CO2 transport
	Efficient use of resources and minimising environmental burden and risks

Source: Regulation (EU) No 347/2013 Article 4.

When assessing projects, each regional group is required to consider the urgency of each proposed project to meet the EU energy policy targets of market integration, the number of Member States affected by each project (whilst ensuring equal opportunities for projects involving peripheral Member States), the contribution of each project to territorial cohesion and the complementarity of the project with regard to other candidate projects.

Energy system-wide CBA and network planning

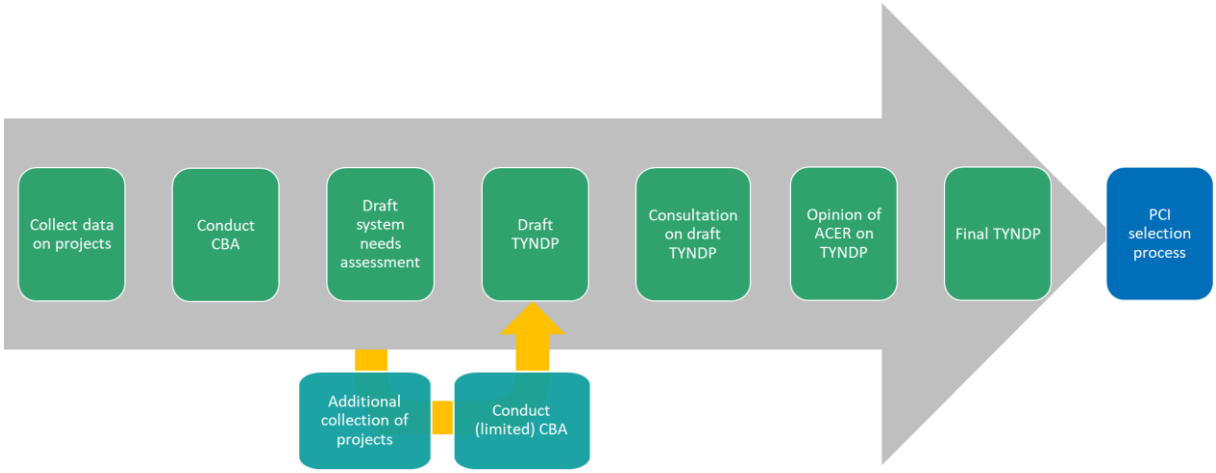
Article 11 of the Regulation sets out the methodology for a system-wide CBA methodology. This methodology together with network planning is closely tied to the framework of the NDPs and the TYNDP. The Regulation specifically requires that ENTSO-E and ENTSOG draft a CBA methodology to assess the projects included in the TYNDP (which are prepared every 2 years) for electricity and gas projects, respectively. Furthermore, the Regulation stipulates that the ENTSOs should jointly

submit an interlinked electricity and gas market and network model to be used in the context of the CBA ([23]).

According to the Regulation, gas and electricity transmission and storage projects shall be part of the TYNDP if a project is to be eligible for inclusion in the PCI list. It is not automatic that a project included in the TYNDP is a part of the PCI list. If a project wants to have PCI status, it has to apply for it following the PCI selection process. In other words, the PCIs are required to be included in TYNDPs for gas and electricity transmission and storage PCIs.

The preparation process for the TYNDP and PCI list is summarised in Figure 3.2. The ENTSOs develop a number of scenarios, which test infrastructural needs and projects. Afterwards, the system needs are investigated to see where system assets could bring (additional) benefits throughout Europe in the long term. In addition, information on projects is gathered to perform a CBA with the goal of identifying how these projects contribute to fulfilling the system needs. This feeds into a basis for infrastructure investment planning used to determine the funding for electricity and gas infrastructure PCIs. The scenarios and system need investigation are conducted every 2 years, resulting in an adjusted TYNDP. The latest available scenarios report and project-specific CBA analysis were finalised in 2020 during the implementation of this study. Box 1 and Box 2 summarise the current cross-border capacity for electricity and gas, respectively.

Figure 3.2 TYNDP and PCI list preparation process



Source: Own development, adapted from Guidance for Applicants – transmission and storage project promoters ([24]).

Box 1. Utilisation of cross-border transmission capacity: Electricity

The adoption of the Clean Energy for All Europeans package ([25]) (Clean Energy Package, CEP) legislation in June 2019 has specified specific performance metrics for electricity capacity

([23]) ENTSO-E and ENTSOG published their first set of guidelines in 2015 and updated their guidelines in 2018. 2nd ENTSO-E Guidelines for Cost Benefit Analysis of Grid Development Projects (2018) https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/tyndp-documents/Cost%20Benefit%20Analysis/2018-10-11-tyndp-cba-20.pdf; ENTSOG press release https://www.entsog.eu/sites/default/files/2018-11/PR0170-18_181023_Press_Release%20ENTSOG%20publishes%20the%20Adapted%202nd%20Cost-Benefit%20Analysis%20Methodology%20for%20gas%20infrastructure%20projects%20%28002%29_1.pdf .

([24]) ENTSO-E (2019), GUIDANCE FOR APPLICANTS TRANSMISSION AND STORAGE PROJECT PROMOTERS. Retrieved from: https://eepublicdownloads.blob.core.windows.net/public-cdn-container/tyndp-documents/190918_TYNDP2020_Guidance_for_promoters.pdf.

([25]) The Commission's Clean Energy for All Europeans legislative proposal covered energy efficiency, RES generation, design of the electricity market, security of electricity supply and governance rules for the

utilisation. For example, in view of the persistently low levels of electricity capacity, the CEP requires a minimum level of capacity to be made available for cross-zonal trade: 70 % of the maximum admissible active power flow of critical network elements considering contingencies must be made available for cross-zonal trade. Consequently, ACER also adapted its methodology to track the amount of cross-zonal capacity available for trade and to compare it to the minimum target set in the CEP rather than assessing legal compliance of TSOs actions.

The latest electricity Market Monitoring Reports (MMRs) by ACER and the Council of European Energy Regulators (CEER) ([26]) show a high level of efficiency in the usage of available cross-border capacity in the day-ahead time frame, reaching 87 % in 2018. On most of the direct current (DC) bidding-zone borders, the margin available for cross-zonal trade (MACZT) satisfies the 70 % target. However, on some DC and on all alternating current bidding-zone borders, the cross-zonal capacity made available for trading remained significantly below the 70 % mark ([27]), suggesting significant room for improvement.

In the available monitoring data, exchanges with non-EU countries were not considered although these impacts the overall MACZT. However, overall the desired utilisation rates are not satisfied. ACER and CEER state in their two latest MMRs that the low cross-zonal capacities made available for trade are assumed to be the result of congestions not being properly addressed by the current bidding zone configuration in Europe. In 2018, congestion frequently continued to relate to intra-zonal critical network elements rather than to interconnectors. In order to achieve the targets, the capacity made available for cross-zonal trade should be significantly increased.

Box 2. Utilisation of cross-border transmission capacity: Gas

ACER reported that the utilisation of gas interconnectors should be further improved, although qualitative observations may suggest otherwise. In 2018 almost, all Member States had access to three different gas sources, and most had sufficient residual supply capacities to be independent of their largest supplier. But concentration of gas supplies increased in many Member States, causing contractual congestion (capacity hoarding) ([26]).

At the EU level, an increased situation of overcapacity in the gas networks can be observed. The average physical utilisation was 72 % in 2016, and this share decreased to 66 % in 2018 ([27]). On contractual congestion, the latest numbers published by ACER ([28]) show that significantly more interconnection points (IPs) were labelled as congested in 2018 than in 2017 (31 compared to 17), although the total number of IPs remained similar. Secondary capacity trades were concluded for only 5 out of 31 congested IPs. For more effective use of gas interconnection capacities, specific policy measures can provide the necessary support.

Physical congestion, indicated by actual interruptions of physical capacity, occurred at a relatively low (4) number with varying frequencies. This means that from a physical congestion perspective, there is limited need for additional physical interconnection capacity.

The TYNDP-related approach and the involvement of the ENTSOs do not apply to CO2 network, smart grid or oil PCIs. The guidelines for gas project CBAs are most often used for oil projects as a reference. Similarly, the guidelines for electricity project CBAs are applied to electricity highways. For smart grids, an updated methodology was published by the JRC in 2017. This provides a checklist to verify project compliance with the general criteria set out by the Regulation, a CBA to argue the economic viability of the project and a methodology for analysis based on key

Energy Union. Relevant material along with the adopted directives and legislation is available at: https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-alleuropeans.

([26]) ACER (2019f), Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2018. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202018%20-%20Electricity%20Wholesale%20Markets%20Volume.pdf.

([27]) ACER (2019f), Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2018. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202018%20-%20Electricity%20Wholesale%20Markets%20Volume.pdf.

([28]) ACER (2019), Annual Report on Contractual Congestion at Interconnection Points. 6th edition – Period covered: 2018.

performance indicators (KPIs) for the evaluation of non-monetary impacts. For carbon dioxide networks there is no fixed standard for CBA methodology.

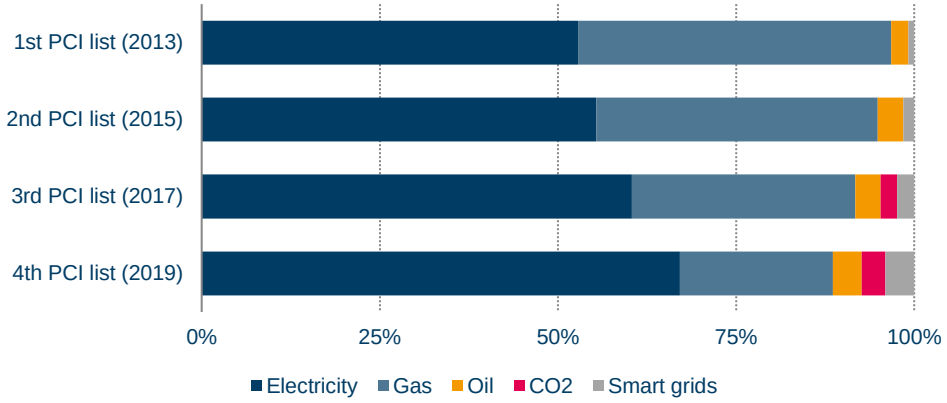
Adopted EU lists of PCIs

The 1st list of PCIs was adopted in October 2013 by the European Commission. It contained 248 projects. The 2nd, 3rd and 4th PCI lists contained 195, 173 and 149 projects, respectively. Excluding PCIs that appeared in several lists, the lists comprise 437 unique projects. Table 3.4 shows an overview of the PCI lists including the date of adoption and number of PCIs per infrastructure category. Figure 3.3 shows the distribution of PCIs by infrastructure category. The number of PCIs in the gas sector has declined over the years. Additionally, the relative distributions indicate an increased representation of electricity, CO2 and smart grid PCIs. The number of oil PCIs remained similar in each list.

Table 3.4 Overview of PCI lists, including date of adoption and number of PCIs by infrastructure category

	Date of adoption	Total PCIs	Electricity PCIs	Gas PCIs	Oil PCIs	CO2 PCIs	Smart grid PCIs
1st PCI list	October 2013	248	131	109	6	0	2
2nd PCI list	November 2015	195	108	77	7	0	3
3rd PCI list	November 2017	173	102	53	6	4	4
4th PCI list	October 2019	149	100	32	6	5	6

Figure 3.3 Relative distribution of PCIs by infrastructure category



Among Member States, Poland is represented most frequently in the 4th list with 18 PCIs listed, followed by the United Kingdom ([29]) and Lithuania with, respectively, 16 and 15 PCIs, then Germany and Estonia, each with 12 PCIs. Electricity projects are hosted most frequently by the United Kingdom (14 PCIs) followed by Lithuania (12 PCIs), gas PCIs are hosted most frequently by Greece (6 PCIs), and Poland is the most dominant host for oil projects (3 PCIs).

The status of PCIs is also monitored annually by ACER and the regional groups. Article 5 of the Regulation sets out that a progress report must be submitted for each PCI to ACER by 31 March each year. ACER then presents a consolidated report to the regional groups by 30 June.

([29]) To provide consistency with the available datasets, the United Kingdom is considered as an EU Member State in the analysis.

Additionally, NCAs from associated Member States report to the regional group on delays in permit granting ([30]).

The latest consolidated report, published on 1 July 2019, covers the period from 1 February 2018 to 31 January 2019 ([31]). The consolidated report on the progress of electricity and gas projects ([32]) by ACER considers:

- fulfilment of the reporting obligations and quality of the reports;
- PCI progress evaluation, including comparison against the previous lists;
- information on usage of public financial support (e.g. CEF funding);
- duration of permit granting and issues regarding regulatory treatment;
- recommendations on how to overcome identified delays and difficulties; and
- an evaluation of consistency in the implementation of plans on EU network development.

The 2019 consolidated progress report by ACER states that some PCIs are still not included in the NDPs in one or several hosting states. Specifically, 14 PCIs were not included in any NDP. Eight PCIs were included in only some of the applicable NDPs, not all of them. On the contrary, 84 electricity PCIs were included in the relevant NDPs. The other 14 PCIs were not included in any NDP. The projects either not included in all NDPs or included in only some applicable NDPs comprise of 11 transmission, 8 storage and 3 smart grid PCIs, of which some were promoted by actors other than TSOs. Of the 52 gas PCIs, 16 were missing from NDPs of their host country; these were 14 transmission projects, 1 underground gas storage (UGS) and 1 LNG project. Section 4.2.2 analyses these figures further.

The report also found that despite advancement in the status of projects, the commissioning dates were shifted into the future for almost 50 % of the PCIs. In addition, the expected overall budget for electricity and gas PCIs remained more or less the same as the expected overall budget for the same projects in 2018. Furthermore, the assessment of the benefits of gas PCIs faced serious difficulties (based on the fact that data was reported for only six gas PCIs). Finally, ACER observed that the interest of promoters in using the array of regulatory tools in the Regulation was relatively low.

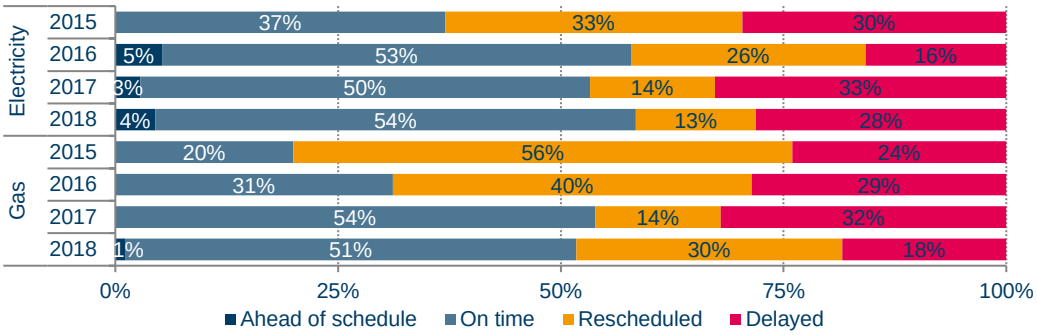
Figure 3.4 shows the progress of PCI implementation from 2015 to 2018. The share of PCIs reported as 'ahead of schedule' and 'on time' increased, while the share of PCIs reported as 'rescheduled' decreased. There is no observed difference in the share of PCIs that were 'delayed'.

([30]) Project promoter, ACER and NCA deadlines are stated in, respectively, Article 5(4), Article 5(5) and Article 5(6) of the Regulation.

([31]) ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest – 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

([32]) No similar (public) reports are identified for oil and CO2 projects. Smart grid projects are captured in the report under 'electricity' projects.

Figure 3.4 PCI progress compared to initial planning, by monitoring exercise



Source: Underlying data of ACER monitoring reports. For both electricity and gas PCIs no sufficiently, complete data are available on relative implementation progress for 2019.

3.2.2 Permit granting and public participation

An important aim of the Regulation is to streamline the permit-granting process while ensuring sufficient public participation. This section sets out what it means when a PCI is granted a 'priority status' and what guidelines are set out by the Regulation on the permit-granting process and on transparency and public participation. Table 3.5 provides an overview of articles within the Regulation specifying this information.

Table 3.5 Articles within the TEN-E Regulation that cover permit granting and public participation

Article	Scope of the article
Article 7	Priority status of the PCIs
Article 8	Permit-granting process
Article 9	Requirements regarding transparency and public participation
Article 10	Two stages of the permit-granting procedure

Priority status

The Regulation formalises a 'priority status' for a project once it is on the PCI list. Article 7 of the Regulation sets out that PCIs are allocated the status of the highest national significance possible in the relevant Member States and that they are to be treated as such in permit-granting processes. Project promoters and all authorities concerned are guided by this, ensuring the most rapid treatment legally possible of application files related to the PCIs.

Furthermore, Article 7 of the Regulation sets out the specific requirement for Member States to assess potential measures to streamline environmental assessment procedures when treating projects with priority status. In 2013 the Commission issued non-binding guidance to support Member States in defining adequate measures to streamline environmental assessment procedures for energy infrastructure PCIs ([33]). Within 9 and 24 months from the date of issue, Member States have taken the relevant non-legislative and legislative measures.

Permit-granting process

The TEN-Regulation defines and sets out a variety of activities to streamline the permit-granting process. Member States are required to designate a single NCA to be responsible for facilitating and coordinating the permit-granting process for PCIs according to Article 8 of the Regulation. In other words, Member States set up a 'one-stop shop'. All Member States established this by 16

([33]) European Commission (2013), Streamlining environmental assessment procedures for energy infrastructure Projects of Common Interest (PCIs). Environment & Energy. Retrieved from: https://ec.europa.eu/environment/eia/pdf/PCI_guidance.pdf.

November 2013 at the latest ([34]). The established NCA is the sole point of contact for the project promoter in the process leading to a comprehensive decision for a given PCI and coordinates the submission of all relevant documents and information. Member States may organise the NCA and the corresponding process of issuing the comprehensive decisions according to one of the three schemes provided:

1. integrated scheme: the comprehensive decision is issued by the NCA and is the sole legally binding decision resulting from the statutory permit-granting procedure;
2. coordinated scheme: the comprehensive decision comprises multiple individual legally binding decisions issued by several authorities concerned, which are coordinated by the NCA; or
3. collaborative scheme: the comprehensive decision is coordinated by the NCA, which, in consultation with other authorities concerned, establishes a reasonable time limit on a case-by-case basis. Within this limit, the required individual decisions on permitting must be issued.

Table 3.6 Overview of schemes adopted

	Integrated	Coordinated	Collaborative
AT	X		X
BE			X
BG		X	
CY			X
CZ			X
DE			X
DK			X
EE			X
EL		X	
ES		X	
FI			X
FR		X	
HR			X
HU			X
IE			X
IT		X	
LT			X
LU			X
LV			X
MT	X		
NL		X	
PL			X
PT	X		
RO	X		
SE			X
SI	X		X
SK			X
UK			X

Source: The applied implementation schemes marked in green have been verified through a targeted inquiry sent to all Member State NCAs. Cells marked in blue represent missing responses, the listed schemes for which are derived from the analysis by Milieu et al. (2016).

The integrated, coordinated and collaborative schemes are implemented by 1, 11 and 15 Member States, respectively. Two Member States (Denmark and Greece) chose multiple schemes ([35]).

([34]) Milieu et al., (2016), Analysis of the manuals of procedures for the permit granting process applicable to projects of common interest prepared under Art. 9 Regulation (EU) No 347/2013. Retrieved from: https://op.europa.eu/nl/publication-detail/-/publication/4459f151-1028-11e6-ba9a-01aa75ed71a1.

([35]) Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

Further analysis of the correlation between the different schemes and times for permit granting is discussed in Section 4.2.1.

According to Article 10 of the Regulation, Member States are required to additionally implement a two-stage permitting process. This consists of a pre-application procedure and a statutory permit-granting procedure. It also sets time limits for each stage. The pre-application procedure should take place within 1 year and 6 months. The combined process should not take more than 3.5 years, but can be extended by a maximum of 9 months on a case-by-case basis.

ACER ([36]) reported that in 2019 the average duration of the permit-granting process was 4 years for electricity PCIs and 3.1 years for gas PCIs. Many electricity and most gas PCIs completed the permitting stage within the 3.5 years established in Article 10(2) of the Regulation. However, the time frame is not yet achieved by all PCIs. Some projects in both infrastructure categories still face long permitting times. For electricity PCIs, even the average duration of permit-granting procedures still exceeds the limit. Analysis of the duration of permit granting is discussed in depth in Section 4.2.1.

Transparency and public participation

The TEN-E Regulation sets out specific requirements on transparency and public participation in Article 9. The purpose of the requirements is to improve public engagement and to increase public acceptance of the implementation of PCIs. Project promoters, Member States, NCAs and other involved parties are required to comply with the requirements before submitting an application. As one of the central challenges to energy infrastructure projects in 2011 was opposition from affected citizens, the TEN-E Regulation introduced a requirement for additional public consultation during the permitting process to ensure early consultation of local communities and stakeholders and ultimately improve public acceptance of such projects. Article 9 specifies that:

- the Member State or NCA shall, where applicable, publish a manual of procedures for the permit-granting process applicable to PCIs;
- all parties involved in the permit-granting process shall follow the principles for public participation set out in Annex VI.3 of the Regulation;
- project promoters shall draw up a concept for public participation to the NCA within a period of 3 months of the start of the permit-granting process;
- at least one public consultation shall be carried out in each Member State before submission of the application of a project; and
- for each PCI, a website with relevant information (specified in Annex VI.6 of the Regulation) about the project, shall be regularly updated and sufficiently visible (linked to the Commission website) ([37]).

Belgium, France and Latvia are the only Member States that have adopted specific legislation related to the Regulation on permit granting and public participation. Regarding public participation specifically, a study by Milieu (2016) concluded that most Member States have not properly implemented the requirements of Article 9. Some of the issues are related to the lack of power and means of the previously mentioned one-stop-shop approach to ensure support for the promoter in its actions in relation to Article 9. Only four Member States have applied the obligation for project promoters to draw up public participation concepts, and only eight have held public participation procedures in addition to the one envisaged in the environmental impact assessment (EIA) ([38]).

([36]) ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

([37]) Links to specific PCI websites are included in the corresponding PCI fiches, which can be found through the PCI interactive map provided by the European Commission: https://ec.europa.eu/energy/infrastructure/transparency_platform/map-viewer/main.html.

([38]) Milieu et al. 2016. Analysis of the manuals of procedures for the permit granting process applicable to projects of common interest prepared under Art. 9 Regulation (EU) No 347/2013. Retrieved from: https://op.europa.eu/nl/publication-detail/-/publication/4459f151-1028-11e6-ba9a-01aa75ed71a1.

3.2.3 Regulatory treatment

The Regulation applies to the regulatory treatment of PCIs by setting out rules for establishing methodologies for CBA, guidelines on cost allocations and risk-related incentives. Table 3.7 provides an overview of articles within the Regulation specifying this information.

Table 3.7 Articles within the TEN-E Regulation covering PCI process, governance and monitoring

Article	Scope of the article
Article 12	CBCA framework
Article 13	Incentives for addressing the higher risks of PCIs

Cross-border cost allocation (CBCA)

When at least one country, affected by a PCI, estimates net negative impacts, it raises an important barrier for the project promoter(s) to invest in that PCI. The Regulation aims to eliminate this barrier and thereby facilitate investments. This is done by incorporating decisions by NRAs and by ACER on the allocation of the costs of such projects across borders if project promoters submit an investment request, including a request for CBCA ([39]).

Article 12 of the Regulation introduces the CBCA mechanism and specifies its features. It describes that the decisions are aimed only at certain PCIs, specifically excluding electricity storage, smart grid projects, oil and CO2 transport PCIs as well as projects with an exemption related to third-party access rules or tariff-related obligations. Projects are only eligible for a CBCA decision when they are 'sufficiently mature'. There is sufficient knowledge and certainty about the investment costs and their ranges, and maximum estimated costs should not exceed the minimum estimated investment costs by more than 20 %. To ensure that CBCA decisions are targeted only at projects with significant net positive impact, ACER recommends applying a significance threshold equal to 10 % of the sum of net positive impacts associated with all beneficiary countries. There is also reasonable knowledge of factors affecting benefits and their ranges, and permitting procedures have started in all hosting countries. CBCA decisions are taken by NRAs. However, if there is no agreement between NRAs within the specified 6-month period, ACER will take the decision instead.

Following the adoption of the 1st PCI list, ACER issued recommendations on CBCAs ([40]). Since then, a new recommendation ([39]) was adopted specifying that a CBCA decision that allocates costs across borders can be justified for a project where:

- the long-term benefits outweigh the costs at regional level;
- at least one additional non-hosting country will benefit from the infrastructure development;
- the costs outweigh the benefits in at least one hosting Member State or the costs of the infrastructure exceed the financial potentials of a hosting Member State.

Preparing a CBCA decision involves five consecutive steps:

1. socio-economic benefits of Member States impacted by the projects are calculated;
2. costs are calculated for each individual Member State;
3. net benefits of each concerned Member State are calculated, identifying one or multiple possible net-cost bearers and net beneficiaries;
4. by applying the net benefits and expected revenues, the total financial cross-border compensation is calculated;

([39]) ACER (2015) Recommendation No 5/2015 on Good Practices for the Treatment of the Investment Requests, including Cross Border Cost Allocation Requests, for Electricity and Gas Projects of Common Interest of 18 December 2015, available at https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Recommendations/ACER%20Recommendation%2005-2015.pdf.

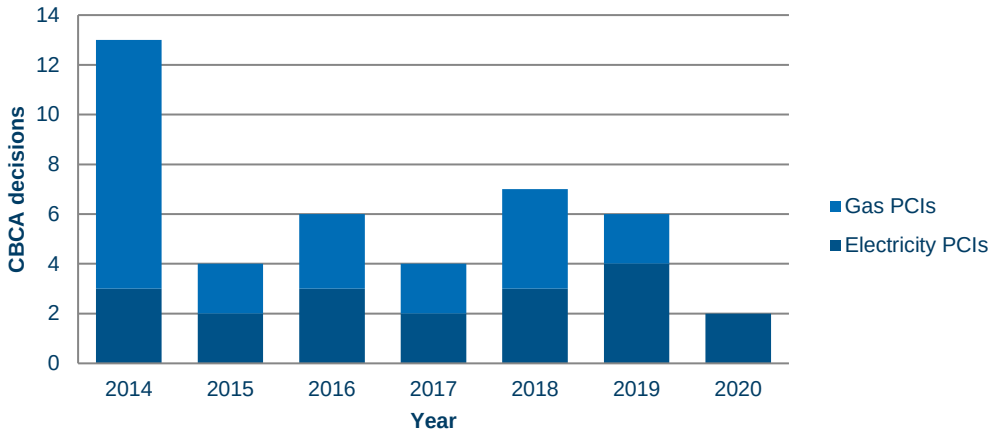
([40]) ACER (2013) Recommendation No 07/2013 regarding the Cross-Border Cost Allocation Requests Submitted in the Framework of the First Union List of Electricity and Gas Projects of Common Interest of 25 September 2013, available at: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Recommendations/ACER%20Recommendation%2007-2013.pdf.

5. the 10 % significance threshold and the territorial principle are applied to calculate cross-border compensations to be paid by each of the concerned Member States.

While the methodology for taking CBCA, decisions varies and is subject to the interpretations of relevant NRAs, the aim in all cases should be for countries to which a project provides a net positive compensation to compensate net negative impacts in relevant Member States. In cases where it is found that no non-hosting country is impacted by the project, the 'territorial principle' could be applied. This means that costs are allocated proportionally to hosting countries where the project is located; in other words, each country pays for the part of the project on its territory.

ACER's latest overview of CBCA decisions ([41]) shows that 37 investment requests resulted in a decision on cost allocation up until July 2019. Between August 2019 and March 2020, five requests were granted a decision ([42]). Altogether, there are currently 42 CBCA decisions concluded until August 2020. From these decisions, only two have been adopted by ACER (2014 and 2015) ([43]).

Figure 3.5 CBCA decisions by infrastructure category, 2014-2020



Source: Own elaboration, adapted from ACER's 2019 list of CBCA decisions and complemented by more recent findings through data provided by DG ENER on the 4th PCI list.

Most CBCA decisions concern gas projects: from 2014 to 2020, 23 decisions have been concluded for gas projects as opposed to 19 for electricity. Figure 3.5 shows the CBCA decisions per sector for each year. Of the decisions for gas projects, most were taken in 2014 (10 decisions). In each of the years after 2014, there has been a more equal share of decisions among electricity and gas PCIs. Most CBCA decisions concern BEMIP and NSI East Gas (15 and 12 PCIs, respectively). For 76 % of all the projects with a CBCA decision, the overall project costs were fully allocated. For the remaining 24 % of projects, with partial allocations, it is assumed that the remaining costs will be covered by grants. Among the 42 concluded CBCA decisions, 26 concern PCIs listed in the 4th PCI list (out of a total of 149 on that list).

Specific regulatory incentives

The TEN-E Regulation uses investment incentive provisions to provide additional support for PCIs with increased risks. Article 13 in the Regulation states that appropriate incentives shall be granted by the associated NRA(s), and may therefore vary per regulatory framework, if two conditions are met. The first condition is that a project promoter experiences higher risks for the construction,

([41]) ACER (2019b), Overview of Cross-Border Cost Allocation Decisions – LAST UPDATE: 1 July 2019.
([42]) This information is based on the internal project status data provided by DG ENER in March 2020, which contains only the 4th PCI list. Decisions were granted as follows: one for PCI cluster 1.7 (Cluster France-United Kingdom interconnections – electricity); one for cluster 3.27 (Interconnection between Sicily and Tunisia – electricity); two for cluster 4.8 (Integration and synchronisation of the Baltic States' electricity system – electricity); and one for cluster 6.8 (Cluster of infrastructure development and enhancement enabling the Balkan Gas Hub – gas).
([43]) Article 12(6) of Regulation (EU) No 347/2013 states that if NRAs have not reached an agreement after 6 months (or upon request), ACER will take the decision.

development, maintenance or operation of a PCI than for comparable projects. The second condition is that the net positive impact of that project is confirmed by a CBA.

Article 13 of the Regulation specifically applies to project-specific risk-based incentives. Non-project or non-risk-related incentives are not within scope of the Regulation and should be requested from NRAs. The investment incentive provisions are applicable only for 'regulated' electricity and gas transmission projects, not for storage, smart grid, oil and CO2 PCIs. The NRAs can decide on the combination of regulatory measures, monetary reward / penalty schemes, etc.

Outside the scope of Article 13, under specific circumstances, NRAs may provide a full or partial exemption for projects which are based on third-party access. PCIs who are granted exemptions are no longer eligible for investment incentive provisions under Article 13.

The Regulation obliges ACER to provide best practices and recommendations for adequate measures as well as providing the European Commission with the option to issue guidelines if necessary. Accordingly, ACER published a Recommendation on incentives for PCIs and on a common methodology for risk evaluation ([44]). ACER publishes information on the use of incentives for PCIs in its annual consolidated monitoring reports and in its summary report on project specific risk-based incentives ([45]). The latest available report, dated September 2018, addresses all PCIs up to the 3rd PCI list (2017), and only non-cancelled transmission PCIs are included in the assessment, as ACER does not report on cancelled transmission PCIs in their assessments. None of the PCIs in the 3rd PCI list have applied for project-specific risk-based incentives pursuant to Article 13.

3.2.4 Financing

The TEN-E Regulation is based on a three-step logic:

1. As a principle, infrastructure should be paid for through congestion rents. If costs are covered through congestion rents, a project can be considered sufficiently commercially viable and therefore no further provisions are applicable;
2. If a network operator is not able to recover the costs of the network through congestion rents, the Regulation establishes the principle that it should be paid for by network users through tariffs for network access. The CBCA provision allows for a (re)allocation of project costs across borders to Members States, where the project has a net positive impact;
3. Finally, if reallocation of costs through CBCA is still not sufficient and a project remains commercially non-viable, PCIs can, under certain conditions, apply for EU financial assistance in the form of grants for studies and grants for works.

According to Article 19 of the TEN-E Regulation, there are two objectives that have priority with respect to the allocation of congestion income:

- guaranteeing the actual availability of the allocated capacity, including firmness compensation; or
- maintaining or increasing cross-zonal capacities through optimisation of the usage of existing interconnectors by means of coordinated remedial action, where applicable, or covering costs resulting from network investments that are relevant to reduce interconnector congestion.

Only if these objectives have been fulfilled may congestion income be used to lower network tariffs. Article 12 of the TEN-E Regulation states that the same principles used for congestion rents have to be taken into account in the cross-border allocation of PCI costs. The use of revenues in

([44]) ACER (2014), Recommendation No 03/2014 on incentives for Projects of Common Interest and on a common methodology for risk evaluation. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Recommendations/ACER%20Recommendation%2003-2014.pdf.

([45]) ACER (2018), Summary report on project-specific risk-based incentives. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER-summary-report-on-project-specific-risk-based-incentives_2018.pdf.

accordance with the above is subject to a methodology proposed by TSOs and approved by ACER. TSOs have to submit the proposed methodology to ACER by 5 July 2020.

The share of congestion revenue effectively spent on maintaining or increasing interconnection capacity increased between 2011 and 2015 (from 18 % to 40 %) ([46]). However, consolidated data for 2016-2019 was not available during the implementation of this study. More spending of congestion revenue is in line with the 'three-step logic' in the TEN-E Regulation, according to which the market should have the priority to invest. However, based on the available data, it is not possible to conclude whether congestion income is used in all projects where that was possible.

Eligibility of projects for EU financial assistance

Article 14 of the Regulation specifies the specific conditions that must apply for PCIs to be eligible for financial assistance. All PCIs, with the exception of oil PCIs, are eligible for EU financial assistance in the form of grants for studies. Smart grid and CO2 network PCIs are additionally eligible for grants for works if the relevant project promoters can clearly demonstrate the significant positive externalities resulting from the PCIs and their lack of commercial viability according to the business plans. Electricity and gas PCIs, except for hydro-pumped electricity storage projects, are also eligible for grants for works if they fulfil all of the specific criteria:

- the project-specific CBA provides evidence of the existence of significant positive externalities, such as SOS, solidarity or innovation;
- the project has received a CBCA decision or, for PCIs for which a CBCA decision is not applicable, there is evidence of the PCI intending to provide services across borders, to bring technological innovation and, regarding storage projects specifically, to ensure the safety of cross-border grid operation; and
- the project is commercially not viable according to the business plan and other assessments carried out. The decision on incentives and its justification referred to in Article 13 (risk-related incentives) are taken into account when assessing the project's commercial viability;
- EU financial assistance is specifically intended to intervene in cases where benefits/externalities are not remunerated by the market and there is significant evidence indicating that the project is not commercially viable. The viability of a project is underlined by all relevant assessments required for, at the least, both the PCI and CBCA application procedures. A project can only be seen as 'commercially not viable' when a complete set of costs and benefits has been accounted for, among which congestion rents, specific incentives and exemptions, and other sources of funding and grants are also included.

Article 15 of the Regulation sets out that the specific PCI criteria, as set out in Article 4 (and previously elaborated in section 4.2 (PCI criteria) also fulfil the role of objectives for the purpose of establishing award criteria for financial assistance. The financial assistance on the TEN-E Regulation are facilitated via a call for proposals by the CEF.

Financial incentives via the CEF

PCIs complying with all specific criteria as mentioned in the previous sections, proving both substantial merits of the project and an evidential need for additional funding to reach commercial viability, are granted funding through the CEF.

The CEF is a co-funding mechanism designed to support the development of cross-border infrastructure, introduced by the European Commission's growth package for integrated European infrastructure. The mechanism aims at providing support where market conditions do not compensate for the full benefits (including externalities) of a project.

The CEF's total budget for 2014-2020 was initially EUR 33.2 billion, but this was later reduced to EUR 30.4 billion due to the implementation of the European Fund for Strategic Investments. EUR 5.35 billion of the CEF budget is earmarked for energy projects (EUR 4.6 billion to be allocated

([46]) Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

through grants managed by the Innovation and Networks Executive Agency (INEA) ([47]), EUR 24 billion for transport ([48]) and EUR 1 billion for telecommunications ([49]).

The CEF aims to act as a catalyst and to leverage funding from private and public investors by giving infrastructure projects credibility and lowering their risk profiles. In particular, the CEF provides financial support to PCIs with positive externalities that cannot be financed completely by the market ([50]). CEF actions in energy are funded through regular calls for proposals. Until May 2020, the Commission allocated EU co-funding to 139 actions, for a total amount of EUR 3.7 billion, contributing to the implementation of 95 PCIs (see Table 3.8) ([51]).

ACER's overview of CBCA decisions reports 37 CBCA decisions for PCIs between 2014 and July 2019: 78 % of electricity CBCAs considered the allocation of CEF grants for the project(s), while only 17 % of gas CBCA decisions foresaw grants to the projects ([52]).

Table 3.8 Realised CEF funding for energy PCIs (EUR million)

		Electricity	Gas	Smart grids	CO2	Total
Studies	Actions	54	50	1	3	108
	Funding	284	181	1	9.7	476
Works	Actions	13	15	3	0	31
	Funding	1 800	1 300	133	n/a	3 300
Total	**Actions**	**67**	**65**	**4**	**3**	**139**
	Funding	**2 100**	**1 500**	**134**	**10**	**3 744**

Source: INEA (2020a). Connecting Europe Facility Energy. Supported Actions – May 2020.

([47]) European Commission website on CEF Energy; https://ec.europa.eu/inea/en/connecting-europe-facility/cef-energy, last accessed in July 2020.
([48]) European Commission website on CEF Transport: https://ec.europa.eu/inea/connecting-europe-facility/cef-transport, last accessed in July 2020.
([49]) European Commission website on CEF Telecom: https://ec.europa.eu/inea/connecting-europe-facility/cef-telecom, last accessed in July 2020.
([50]) European Commission (2011a, October 19), Press release: Connecting Europe Facility: Commission adopts plan for EUR 50 billion boost to European networks. Retrieved from: https://ec.europa.eu/commission/presscorner/detail/en/IP_11_1200.
([51]) INEA (2020a). Connecting Europe Facility Energy. Supported Actions – May 2020. Retrieved from: https://ec.europa.eu/inea/sites/inea/files/cefpub/cef_energy_supporting-actions_2020-web.pdf.
([52]) ACER (2019b), Overview of Cross-Border Cost Allocation Decisions – LAST UPDATE: 1 July 2019.

4 REPLIES TO THE EVALUATION QUESTIONS

4.1 Introduction

This chapter contains the findings of the evaluation questions on the effectiveness (Section 4.2), efficiency (Section 4.3), relevance (Section 4.4), coherence (Section 4.5) and EU added value (Section 4.6) of the Regulation.

4.2 Effectiveness

4.2.1 Evaluation question 1

To what extent have the Regulation's main provisions addressed the needs identified in the impact assessment accompanying the Commission proposal in 2011?

Sub-questions:

1.1 To what extent has the Regulation tackled the lengthy and ineffective permit-granting procedures?

1.2. To what extent has the Regulation tackled problems related to the regulatory framework for energy infrastructure investments?

1.3 To what extent has the Regulation tackled the problems related to financing of energy infrastructure projects?

Conclusions

The duration of permit-granting procedures has shortened for PCIs compared to the pre-TEN-E situation. The average duration is 4 years for electricity and 3.1 years for gas PCIs compared to durations of more than 6 years in some Member States prior to the entry into force of the TEN-E Regulation. The introduction of a one-stop shop provides a good approach to reducing the complexity of the permitting process, but the effectiveness depends strongly on the national implementation and existing permitting requirements in the Member States. Therefore, an overall statement on the extent to which permitting duration has been reduced is not possible. This is supported by experiences of project promoters on permitting, which vary widely. The complex and unique nature of many PCIs makes a general time limit difficult to implement. Lengthy durations still occur but those are often caused by factors outside the direct scope of the TEN-E Regulation, such as environmental compliance and lawsuits.

Similar findings are made for the improvement of the regulatory framework. CBCA decisions are the main instrument to improve the regulatory conditions of cross-border projects. While the approach taken to share costs between Member States in relation to benefits is largely appraised, the details of the mechanism reduce its attractiveness, as explained below. The number of PCIs with a CBCA decision remains relatively low: as of March 2020, 42 CBCA decisions were issued among 437 unique PCIs. Until 2018 most decisions concerned gas projects, while after 2018 the balance shifted to electricity projects. This indicates that the desired effect is limited to a small number of projects only. In those cases, the contribution to the improvement of the regulatory framework is however well appraised. Therefore, CBCAs prove to be effective in some cases, while a question on the valuation of the mechanism remains, as it is a step to an application for CEF grants. Thus, issues in the details of the process for CBCAs persist, which are reflected in the low number of cost-sharing decisions, just as the use of other risk-based incentives so far is very low. However, the cases in which a CBCA has led to the sharing of costs show that the regulatory framework has been improved. Regulatory incentives have not played a substantial role to date.

The provisions to address the identified need to improve the financing of energy infrastructure are subsequently found to be largely effective. The access to CEF funds and the funding volume of EUR 3.8 billion until May 2020 provide security and enable the realisation of PCIs. Grants for studies have supported 108 actions and are found to ensure the security that is necessary to enable the early stages of a project. Moreover, grants for works help to realise the crucial projects that close links and remove bottlenecks at an affordable cost. This is confirmed by stakeholders who share the view that the financing mechanisms are beneficial and effective. Challenges in the financing of projects are not mentioned at all, which indicates in combination with the substantial funding volume and the number of PCIs supported that the issue of financing has been successfully addressed.

Analysis

This section presents the findings on the achievements of the TEN-E Regulation with respect to its specific objectives. These aim at addressing the needs identified in the impact assessment, being lengthy and ineffective permit-granting procedures, regulatory challenges for cross-border projects in energy infrastructure, and difficulties in financing such large infrastructure projects. First, the assessment of the achievements in permit granting and in the regulatory framework will be described in the general effectiveness of addressing the needs. Second, the impacts of these provisions will be evaluated in more detail. Third, the financing of energy infrastructure as a third need will be evaluated.

Permit granting

The duration of permit-granting processes in the Member States has overall shortened compared to the situation in 2013. Looking at the overall picture, the literature finds progress in shortening the duration of the permit-granting process compared to the national averages of up to 10 years described in the impact assessment. ACER ([53]) reports an average duration of 4 years for electricity PCIs and 3.1 years for gas PCIs. That signifies that many electricity and most gas PCIs complete the permitting stage within the 3.5 years established in Article 10 (2) of the Regulation. This data points to an improvement in the permitting conditions for PCIs as the duration of permit-granting procedures is on average shorter than in the situation before the entry into force of the TEN-E Regulation. The situation before the introduction of the TEN-E Regulation is presented in Chapter 3. While it is difficult to compare these numbers with the aggregate information available for PCIs since then, the average duration for the permitting process (including pre-application procedures) is shortened for both types of infrastructure projects and for all three schemes established in Article 8(3).

However, longer permitting durations are still observed, including PCIs needing up to 9 years before obtaining the permit according to ACER's latest progress report ([54]), which indicates a high difference in permit-granting duration between individual projects. Based on the same report, the duration of 29.8 % of electricity PCIs and 25.3 % of gas PCIs exceed a permitting duration (actual or expected) of 4 years.

The finding of differing permitting durations is strongly supported by the results of the stakeholder consultation. Project promoters describe varying experiences with the permitting process, which are essentially shaped by the national implementation of the permitting rules of the TEN-E Regulation. Respondents to the targeted survey present opposing views on the contribution of TEN-E on the shortening of the procedures. While 21 % agree with a positive impact of the TEN-E Regulation, 35 % disagree and a quarter of respondents have neutral views. The differences can be explained with the diverging experiences for specific projects and different conditions in the Member States.

Evidence for the former aspect is provided in explanatory statements to the targeted survey as well as in the in-depth interviews. Project characteristics have a substantial influence on the requirements of the permitting process. The nature of PCIs as large projects with cross-border impacts creates strong needs for impact assessment and complex planning documentation according to project promoters across the EU. In ACER data obtained from monitoring, 'studies' have caused delays for 15 PCIs, while the optimisation of the technical planning has delayed an additional 5 PCIs. Project promoters also stated that the requirements for supporting documentation are often set by national legislation and other EU legislation and are not alleviated by the permitting provisions of the TEN-E Regulation. Steps that fall into this category concern the environmental impact assessment and lawsuits against project routes.

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(53) ACER (2019a). Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

(54) ACER (2019a). Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

Looking at the specific provisions, the single responsible authority – also called one-stop shop – is welcomed by many project promoters but the effectiveness of this provision again depends on the national implementation as those stakeholders pointed out. Positive examples that project promoters illustrated in interviews refer to the reduced complexity of having a single point of contact in contrast to the many local authorities that had been responsible before the introduction of the TEN-E Regulation. Moreover, the interaction with authorities from other Member States improved in certain cases according to project promoters and NCAs. In contrast, several stakeholders indicated that the competencies are still distributed between multiple authorities and national law requires numerous permits from multiple authorities. One organisation working with several project promoters described the situation in an interview: according to this stakeholder, the relevant national legislation previously in place was crucial for the effectiveness of the one-stop shop approach. In cases where existing national competencies are compatible with a one-stop shop, the TEN-E Regulation provided clarity and was able to speed up processes. In other cases where a different system was in place, adding a one-stop shop created additional complexity and may even have caused longer permitting times. This assessment is aligned with the views presented by other project promoters in the targeted survey and interviews that describe national specifications as important factors for the length of the permit-granting process. Only a few NCAs indicated the duration of PCI permitting in the targeted survey but also emphasised the national framework as a key factor. Thus, the available data clearly indicates that the permitting process depends on the national permitting provisions to be fully effective in reducing complexity and shortening permitting processes.

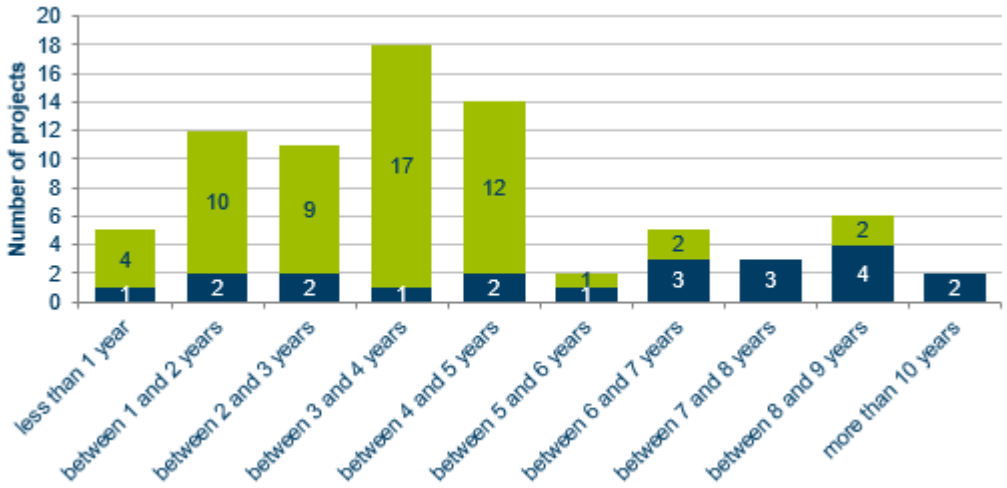
Detailed analysis of the duration of permit granting and reasons for delays

The duration of permit-granting processes for PCIs has decreased since the implementation of the TEN-E Regulation. More concretely, the previous evaluation of the Regulation ([55]) reported a reduction in the duration of permit-granting procedures for PCIs when comparing data from 2016 with the pre-2013 situation. In 2016, permitting for electricity PCIs was found to take 3.5 years on average, whereas gas PCIs took 3.2 years. As mentioned above, both numbers represented a significant reduction compared to the situation before the TEN-E Regulation.

As presented in Section 3.2.2, recent ACER data from the 2019 consolidated progress report shows an average permit-granting duration for electricity PCIs of 4 years (actual or expected). This estimation is based on the information of 21 PCIs that applied for permits before November 2013 and 57 PCIs since then (Figure 4.1). Narrowing down the focus on the latter group, the average permit-granting duration is 3.8 years. This number is higher than the 3.5 years stipulated in Article 10 (2) of the Regulation and the data from 2016 but, as stated by ACER during one of the Webinars conducted as part of this study, this constitutes a significant difference compared to the situation before 2013. Nonetheless, about 40 % of electricity PCIs are still expected to take more than the legal requirement to complete the permit-granting procedure and it has taken 5 years or longer for some projects to complete the permit-granting process (Figure 4.1).

(55) Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

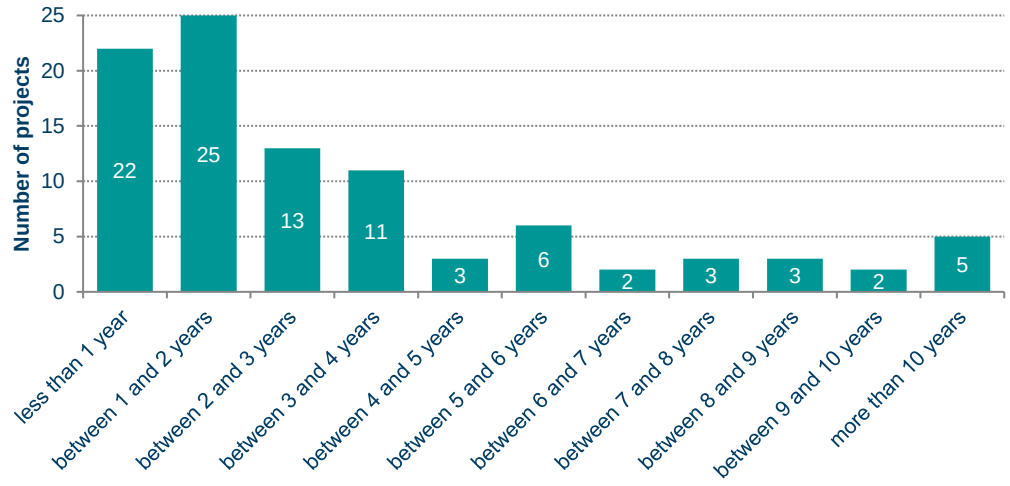
Figure 4.1 Duration of the permit-granting process for electricity PCIs



Source: adapted from ACER 2019 (Consolidated Progress Report).

For gas PCIs, the recent ACER data indicates an average duration of permitting of 3.1 years ([56]), which is below the timeline provided in Article 10 (2). Specifically, 60 out of the 95 projects have an expected duration of less than 3 years, whereas a few projects report a duration of more than 5 years. In the case of five gas PCIs, this took more than 10 years (Figure 4.2).

Figure 4.2 Duration of the expected permit-granting process for gas PCIs



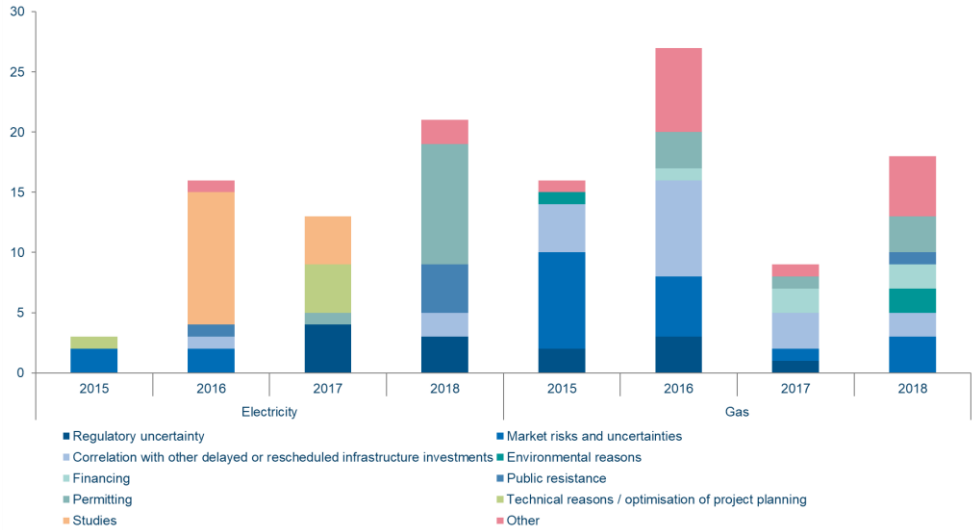
Source: Adapted from ACER 2019 (Consolidated Progress Report).

The permitting process constitutes one of the main causes for delays for both electricity and gas PCIs. For instance, 25 % of electricity PCIs were reported as delayed in the 2019 ACER report. Of these, 46 % encountered delays specifically during the permit-granting process. These numbers are similar to those provided in the 2018 report but slightly lower than those in the 2017 report, suggesting a slight improvement. For gas PCIs, the picture looks similar: 12 PCIs have been delayed (i.e. 28 % of gas PCIs), of which 7 (58 %) report the permitting stage as the cause. These results are similar to those reported in 2018. The portfolio analysis of the monitoring reports that

(56) ACER (2019a). Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest – 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

cover the period 2015-2018 (Figure 4.3) also shows that permitting has become a more prominent reason for delays in recent years for electricity PCIs.

Figure 4.3 Reasons for electricity and gas PCI delays



Source: Portfolio analysis.

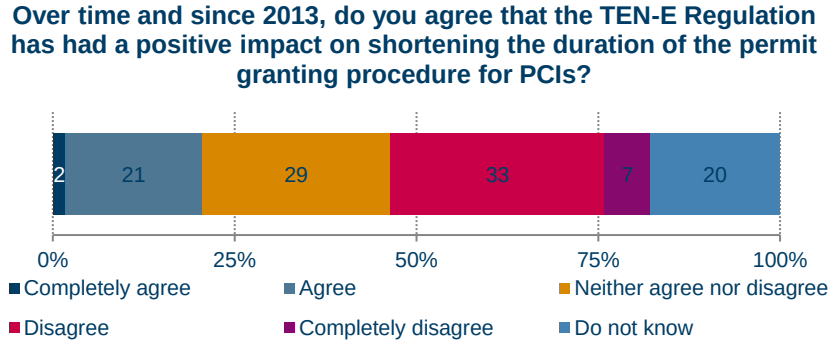
The 2019 ACER consolidated report on PCIs listed several reasons for delays in permitting. For electricity PCIs, the report describes five causes of delays during the permit-granting process:

- environmental problems;
- public opposition;
- changes in national legislation with an effect on permitting;
- requirements by the authorities for further studies;
- greater complexity of the procedure than expected.

According to the same report, gas PCIs also indicate issues with environmental or cultural heritage authorities as a key reason for delays.

The results from the targeted survey clarify the differences in permitting durations to some extent: they are largely project-specific and dependent on the context within the Member States concerned. When asked whether the TEN-E Regulation had a positive impact on shortening the duration of the permit-granting procedure for PCIs, 37 % of respondents indicated that it has not had a positive impact, although a significant proportion (21 %) agreed that it has. Representatives of all stakeholder groups were more likely to indicate that it has not had a positive impact – a similar number of representatives of both TSOs and NCAs agreed and disagreed with this statement, indicating a significant variation in the perceptions and experiences of stakeholders (Figure 4.4).

Figure 4.4 Positive impact of TEN-E on the duration of permit-granting procedures (n=112)



Source: Targeted survey.

The responses of TSO representatives indicated that, in their experience, the average permitting durations of PCIs and non-PCIs are similar, and that in some instances it actually took longer for PCIs to obtain permits than it did for non-PCIs. This illustrates that there are significant differences between the projects, which makes it challenging to reach a definitive conclusion. It is noteworthy that some stakeholders stated that the PCIs could differ significantly in terms of complexity and suggested that the duration of larger PCIs should be flexible to reflect that. Additionally, it was noted that smaller projects or projects with categorically lower environmental impact would benefit from a simplified permit-granting procedure once they have been granted a PCI status (e.g. by removing the pre-application requirement).

Some of the explanations provided by the respondents who stated that the Regulation has not had a positive impact on the duration of the permit-granting procedures included: increasing number of obligations related to the requirements of the environmental assessments and the complexities that arise from the differences between methodologies and practices of different Member States; administrative burden associated with the provisions; and pre-existing national provisions, which need to be respected in addition to the provisions of the Regulation. Similarly, public opposition and regulatory misalignment between Member States involved in a given PCI were also listed as issues that have an effect on the duration of the process. Additionally, the existence of a national legislation or mechanism similar to the one-stop shop that laid down the basis for an accelerating procedure independently of the TEN-E Regulation was also provided as a reason that may have reduced the impact of the Regulation.

According to TSOs, the factors that influence permit-granting duration the most are environmental impact assessment, followed by the statutory permit-granting procedure and the pre-application process. From the perspectives of NRAs and NCAs, the most time-consuming processes that impact the permit-granting duration are requests for provision of missing information to be submitted by the project promoters, followed by the statutory permit granting procedure, the public consultation, and the identification of the scope of material and level of detail of information to be submitted by project promoters.

The stakeholders who indicated that TEN-E has had a positive impact on the duration of the permit-granting procedures elaborated that this stemmed from the fact that the Regulation outlines a streamlined permitting process and obliges stakeholders to work towards an agreed-upon schedule and procedures. The respondents also provided examples of instances where the one-stop shop provision and the PCI status of the project had led to shortening of the permitting process (described in more detail below).

The interviews supported the evidence collected via the targeted surveys. The stakeholders displayed contrasting assessments of the effectiveness of the Regulation with some of them stating that it had provided clarity to the permit-granting process, while others perceived it as adding to its complexity. Specifically, some interviewees indicated that the provisions have not shortened the duration of the permit-granting procedure, estimating it to be the same as for some non-PCIs. Similarly, they noted that the national procedures and provisions specific to each Member State involved in a given PCI need to be followed and met in addition to the TEN-E provisions, which could take longer than the 3.5-year period indicated in Article 10(1). It was also added that it is challenging to shorten permitting duration as the requirements for environmental assessments become more stringent. Additionally, as indicated during one of the webinars conducted as part of this study, the involvement of a non-EU country makes permitting significantly more complex, which impacts the duration negatively.

Conversely, some interviewees were of the opinion that the Regulation has led to shortening of the duration of the process. It was noted that the extent to which the TEN-E provisions were effective varies on a case-by-case basis. The evidence pointed to several factors that play an important role, such as the sector and complexity of a PCI, the regulatory conditions and requirements within the involved Member States, as well as a regulatory misalignment between them, and the lack of political support. It was noted, for instance, that differences between smart grid PCIs and other types of PCIs make the application of the same provisions difficult. Furthermore, similar to the results from the targeted survey, public acceptance and NCA capacity were also listed as determining factors for the duration of the permitting process.

Effectiveness of permit-granting schemes

Section 3.2.2 described the three schemes for permitting stipulated in Article 8(3) that Member States can choose from when designating an NCA, the one-stop shop, responsible for facilitating and coordinating the permit-granting process for PCIs.

As presented in Section 3.2.2, the assessment conducted by Milieu in 2016 ([57]) found that the majority of Member States had adopted a collaborative scheme, followed by a coordinated scheme. Only one had put an integrated scheme in place, and two Member States had opted for multiple schemes (Table 3.6).

The 2016 ACER progress report ([58]) estimated the duration of permit granting per scheme, which is shown for electricity PCIs in Table 4.1. This report found that coordinated schemes had the shortest duration for permit granting, followed by a similar duration for integrated, collaborative and multiple schemes ([59]). The table also shows that coordinated schemes were compliant with the 3.5-year time limit, whereas the other types of schemes resulted in durations of the permitting stage slightly above the limit established in Article 10(2). No identification of the permitting duration per type of scheme has been done by ACER in the PCI reports since then.

Table 4.1 Distribution of permitting schemes for electricity PCIs and expected duration of permit granting depending on the scheme

Permitting scheme	Number of Member States applying the scheme (in 2016)	Number of PCIs (in 2016)	Average expected duration of permit granting (years, in 2016)
Integrated	1	4	3.8
Coordinated	9	24	2.8
Collaborative	15	47	3.6
Multiple schemes	2	21	3.7

Source: ACER 2016, Milieu 2016.

The targeted survey yielded a limited number of responses on this topic because the question was only targeted at NCAs and NRAs. Nonetheless, the NCA and NRA respondents were more likely to agree with the above assessment that the coordinated scheme had led to a reduction in the duration of permit-granting procedures, followed by the collaborative scheme and the integrated scheme ([60]).

Role of the one-stop shop

As mentioned previously, the intended role of the one-stop shop is to facilitate and coordinate the permit-granting process. The collected evidence suggests that while it is considered to be a welcome development, its effectiveness varies significantly depending on its implementation and the specific conditions within each Member State.

The results from the targeted survey indicate that relevant stakeholders are more likely to agree than to disagree that the one-stop shops have enhanced cooperation between Member States (an opinion that was particularly popular among TSOs and industry representatives) and increased the transparency of the permit-granting process. The latter opinion was shared by NCAs, while civil society representatives disagreed with it. While a larger number of TSOs agreed, some of them did

(57) Milieu et al., (2016), Analysis of the manuals of procedures for the permit granting process applicable to projects of common interest prepared under Art. 9 Regulation (EU) No 347/2013. Retrieved from: https://op.europa.eu/nl/publication-detail/-/publication/4459f151-1028-11e6-ba9a-01aa75ed71a1.

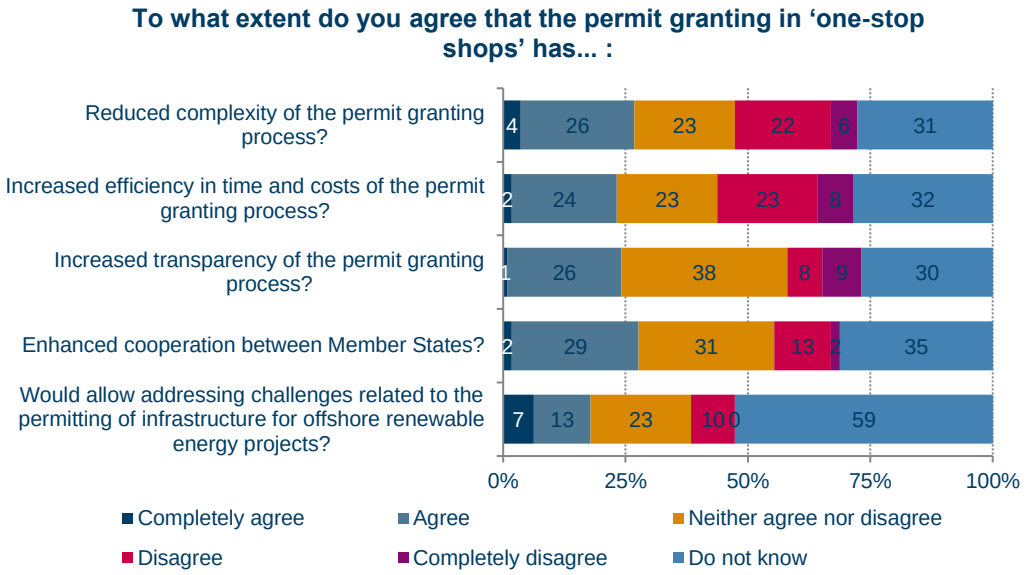
(58) ACER (2016). Consolidated report on the progress of electricity and gas projects of common interest for the year 2015. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20PROJECTS%20OF%20COMMON%20INTEREST%20for%20the%20year%202015.pdf.

(59) Sample size for integrated scheme is too small to provide a robust indication of the duration (ACER 2016).

(60) Three respondents completely agreed or agreed (coordinating scheme), two agreed (collaborative scheme), one agreed (integrated scheme).

not, which suggests that the experiences of working with the one-stop shops in the different Member States vary. As shown in Figure 4.5, a similar proportion of respondents agreed and disagreed with the statements that the one-stop shops have achieved their objective of reducing the complexity and increasing the efficiency of the permit-granting process. This evidence, along with the fact that there is an even split in the opinions of respondents within the key stakeholder groups, indicates that it is challenging to reach a definitive conclusion with respect to the effectiveness of the one-stop shops.

Figure 4.5 Impact of the one-stop shop (n=112)



Source: Targeted survey.

A number of reasons account for this. For instance, the capacities of NCAs, assigned the role of being a one-stop shop, differ significantly across Member States, which could have an impact on their efficiency. Similarly, some targeted survey respondents explained that the one-stop shop could present a significant administrative burden and it was reported that Member States that had previously established mechanisms that performed functions similar to those of the one-stop shop were able to adapt to this provision much more easily than others.

Another often-cited explanation for the differences in the perceived efficiency of the provisions pertains to the procedures and requirements already implemented in Member States. More concretely, an example provided by one respondent explained that the Polish NCA does not have the right to accelerate or simplify the permit-granting procedure. Additionally, an example brought forward during one of the webinars showed that in some Member States there are numerous national and regional authorities involved in the permit-granting process, which have conditions that need to be met individually. Therefore, despite the existence of a single authorisation mechanism, the process could still be quite complex and time-consuming as the PCI status does not exempt projects from national legislation. Moreover, several respondents also indicated that the one-stop shop has not been effectively implemented in all Member States yet.

Nonetheless, the respondents generally agreed that the one-stop shop provision constitutes a good approach and when implemented effectively it could play an important role in improving the efficiency of the permit-granting process. It was also mentioned that the provision could be further strengthened by the provision of guidance about the responsibilities and obligations of the NCAs in navigating the permit-granting process.

The results from the interviews support the evidence collected via the targeted surveys. Namely, a number of interviewees considered the introduction of a one-stop shop to be a useful development, which has streamlined the permit-granting process, reduced the number of stakeholders involved in the procedure and shortened its duration. However, it was reported that the single authorisation is not always effective in practice as PCIs need to comply with the national and regional provisions that pertain to permit application. This makes adhering to the deadlines set in the Regulation challenging. Furthermore, it was noted that some Member States do not have well-functioning one-stop shops. Conversely, some interviewees stated that mechanisms similar to the one-stop shop

had already been in place in their Member States prior to the Regulation and, thus, the provision was not perceived to have had an impact. In the case of Germany, which was already using the one-stop shop principle for all projects, the additional requirements introduced for PCIs were perceived to lead to an administrative burden.

Priority treatment by Member States for PCIs

As mentioned in Chapter 3, Article 7(2) of the Regulation stipulates that PCIs shall be given priority treatment to ensure that their permits are processed in a timely manner. The analysis done by Milieu ([61]) in 2016 found that while 16 Member States had introduced the option of a priority status for infrastructure planning, 11 Member States did not have such a status. Of the countries with priority status provisions, six Member States did not guarantee PCIs a national priority status. Additionally, the previous evaluation of the Regulation ([62]) reported that 35 % of all project promoters experience an accelerated project progress for their PCIs, whereas 65 % do not confirm an acceleration, indicating that the PCI status was not universally available. One study ([63]) also finds that multiple projects with priority status in one Member State could result in a reduction of the permitting speed of all projects because priority treatment resources need to be split between the projects. This suggests that in some instances, despite the availability of a priority status, PCIs may not be able to benefit from it due to capacity restraints.

The evidence collected from the interviews shows that some PCIs got priority treatment from NCAs as a result of their status. It was also noted that in some instances the PCI status made negotiations with NRAs easier. For instance, the PCI status of CO2 TransPorts (PCI 12.3), one of the PCIs examined as part of the case studies, ensured that the project was officially listed as a project of national interest that would be under the coordination of the Minister of Economic Affairs and Climate Policy of the Netherlands. In the case of the TAP (PCI 7.1.3), the involved NRAs and the European Commission and the Secretariat of the Energy Community demonstrated significant cooperation when introducing the main regulatory incentive. It provided an exemption from ownership unbundling and TPA rules, as per Article 36 of Directive 2009/73/EC concerning common rules for the internal market in natural gas. This made it possible for long-term ship or pay transmission contracts to be signed with the owners of the Shah Deniz gas field to ensure the bankability of the project. The collaboration started before the entry into force of the TEN-E Regulation, which indicates that priority had been given to the TAP project before obtaining a PCI status, but it remained a high priority and in compliance with Article 7(3) in the years since the implementation of the Regulation.

Conversely, other interviewees stated that the PCI label did not make a difference and that the projects in question were not treated any differently compared to non-PCIs. This once again demonstrated that the effectiveness of this provision varies on a case-by-case basis and it is largely dependent on the conditions within the Member States concerned. Namely, while the discussion during one of the webinars, conducted as part of the study, indicated that the idea behind the PCI status constitutes a good development, it was noted that it was sometimes challenging to translate into concrete benefits in practice due to existing national provisions. For example, it was stated that all relevant German projects are included in the Federal Requirement Plan Act (BBPIG), which must be implemented by law, thus granting them the highest possible priority status in Germany. While the German PCIs are included in the BBPIG, so are some non-PCIs, thus removing the differences between the two types of project. The discussion also indicated that the administrative requirements associated with obtaining the PCI status do not necessarily generate sufficient benefits to make obtaining it worthwhile, given the lack of certainty that the projects will receive priority treatment in practice.

([61]) Milieu et al., (2016), Analysis of the manuals of procedures for the permit granting process applicable to projects of common interest prepared under Art. 9 Regulation (EU) No 347/2013. Retrieved from: https://op.europa.eu/nl/publication-detail/-/publication/4459f151-1028-11e6-ba9a-01aa75ed71a1.

([62]) Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

([63]) Justice and Environment (2017), Energy Infrastructure Projects of Common Interest (PCI) – National Implementation of the EU Permitting Rules. Retrieved from: http://www.justiceandenvironment.org/fileadmin/user_upload/Publications/2017/TEN-E_Implementation_Study.pdf.

Environmental streamlining

As presented above in Section 3.2 and in line with Article 7(4), the Commission issued non-binding guidance for streamlining the environmental assessment procedures within Member States in 2013. Both the literature review and the targeted survey uncovered limited evidence about whether Member States have implemented adequate streamlining measures in line with the guidance. According to a study published in 2017 ([64]), none of five central and eastern European Member States in the sample had established measures for streamlining in accordance with the guidance. The analysis of the targeted survey showed that NCA and NRA representatives from Czechia, Denmark, Germany and Greece indicated that their Member States had streamlined environmental assessment procedures for PCIs, while the national authority stakeholders from Hungary and Portugal stated that this was not the case in their Member States. NCA and NRA representatives from all EU Member States were contacted individually to inquire whether the non-binding guidance was used. Of those who responded to the targeted inquiry, the representatives of Belgium, Czechia, Greece, Cyprus, Luxembourg, Malta, Austria and Poland indicated that it was.

Importance of PCI status for national network planning

As described in Chapter 3, the 2019 ACER yearly progress reports found that some PCIs are still not included in the NDPs in one or several hosting states. For electricity, 84 out of a total of 106 PCIs (79 %) are included in the NDPs, 8 PCIs (7.5 %) are only included in some of the applicable NDPs but not all, and 14 PCIs (13 %) are not included in any NDP.

ACER reports cite three reasons that not all PCIs are included in an NDP: some PCIs are not sufficiently advanced to be considered in the network planning; the NDP does not include projects promoted by actors other than TSOs (as is the case in France, Cyprus and Austria); and storage and distribution grid projects are not always included in NDPs (in Germany, Spain, France, Italy, Cyprus, the Netherlands and Austria). Thus, transmission PCIs are well integrated into national plans, whereas other types of electricity PCIs are in many instances not considered in national network planning.

Furthermore, 16 out of the 52 gas PCIs are not included in the NDPs of their host countries, of which 14 are transmission projects with one UGS and one LNG project, respectively. A key reason for non-inclusion in the NDPs is that the plans were established before the PCIs and that the projects would be included in the next NDPs. In other instances, an application for connection to the transmission system has not yet been requested, no NDP exists in the host countries, or a project is developed independently from national transmission systems.

Therefore, overall, PCIs are well represented in NDPs and if not, Member States have consistent reasons to exclude them. As described above, when assessing the effect of the priority status of PCIs, non-PCIs also share such status. This was also indicated by project promoters in interviews. Still, the importance of PCIs in the context of national network planning is high, even though this is not a unique feature of PCIs.

Public consultations and public acceptance

As mentioned in Section 3.2, in order to ensure transparency and promote public participation, Article 9(4) of the TEN-E stipulates that at least one public consultation shall be conducted by the project promoters or competent authorities in each Member State involved in a given PCI before the submission of the final and complete application file. While this has enabled more public participation, it has not necessarily improved public acceptance.

The results from the desk research show that the public consultation provisions of the Regulation have increased the opportunities for the public to be informed and participate in the PCI permitting process and that TSOs perceive the consultations to be a valuable instrument for building connections with local communities and potentially affected groups ([65]). However, even though participation of the public in the process has increased, public opposition remains a key challenge

[64] Justice and Environment (2017), Energy Infrastructure Projects of Common Interest (PCI) – National Implementation of the EU Permitting Rules. Retrieved from: http://www.justiceandenvironment.org/fileadmin/user_upload/Publications/2017/TEN-E_Implementation_Study.pdf.

[65] Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

to PCIs, as has been pointed out in the Trinomics study, ACER reports ([66]) and Commission documents ([67]). According to ACER's most recent consolidated report, three electricity PCIs were delayed at a permitting stage due to public opposition, while three more are facing lawsuits and court procedures ([68]) that have resulted in delays as well. This was supported by the findings from the case studies, which showed that two of the examined PCIs (TAP and Suedlinks) are both subject to significant public opposition and despite efforts to improve their perception and engage the public, the pushback against them remains strong. For gas PCIs, such granular reasons for delay are not indicated in ACER's most recent consolidated report.

One explanation provided by the Trinomics study is that public consultations take place in the context of specific projects but have not increased awareness of energy infrastructure needs in general. This is in line with the findings of other recent studies ([69, 70]) that see an important connection between the early involvement of the public in energy infrastructure planning and lower opposition to projects because of an improved understanding of the infrastructure needs. Therefore, early public participation with a focus on raising awareness about infrastructure needs during the planning stages could lower opposition to PCIs at later stages. Transparent and accessible information about the need for new energy infrastructure at a European grid level can reduce public opposition ([71]).

The results from the targeted survey showed that the additional public consultation introduced for PCIs has been perceived to have increased public awareness of PCIs by half of the respondents ([72]). This opinion was particularly strong among industry representatives and NCAs. While half of TSOs also shared this opinion, the other half neither agreed nor disagreed, or indicated that they did not know, which suggests that the experiences vary significantly. In line with the results from the desk research, targeted stakeholders also specified that while public consultations may raise awareness among the public, they do not necessarily lead to public acceptance, which is supported by the evidence collected via the desk research. Additionally, a significant proportion of the respondents (41 %) also reported that the public consultation has improved public participation. However, a slightly larger proportion of respondents did not agree with the statement, or neither agreed nor disagreed. Furthermore, opinion was generally evenly split among stakeholders. The latter two statements indicate how challenging it is to conclude that public consultation provision has generally led to increased public participation. Moreover, it suggests that the opinions of stakeholders vary significantly based on their experiences and expectations.

The results also suggest that additional public consultations may have improved trust among participants – an opinion shared by 37 % of respondents. However, a significant proportion of respondents disagreed (21 %) or neither agreed nor disagreed (19 %). The opposing opinions were evenly distributed among stakeholder groups, which once again suggests that the perceived impacts of public consultations vary significantly. The results from the targeted survey showed that the picture is less clear with respect to the effect of public consultations on improving public acceptance and the design of the PCIs. In general, a larger proportion of respondents were likely to disagree rather than agree that public consultations have led to either of these two outcomes. It is important to note that a significant proportion of respondents neither agreed nor disagreed with these statements (32 % and 21 %, respectively) or indicated that they did not know (21 % and

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(66) ACER (2019a). Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

(67) European Commission (2017b), Commission staff working document accompanying the document commission delegated regulation amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/swd_accompanying_pci_list_final_2017_en.pdf.

(68) The lawsuits, however, do not have to be related to opposition by the public or local communities.

(69) Ecorys et al. (2019), Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure? Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/6700ba89-713f-11e9-9f05-01aa75ed71a1/language-en/format-PDF/source-96288082.

(70) Scope et al. (2020) Innovative actions and strategies to boost public awareness, trust and acceptance of trans-European energy infrastructure projects. Draft Revised Interim Report. Provided by DG ENER.

(71) Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

(72) 51% of respondents indicated that they completely agree or agree with this statement (N=111).

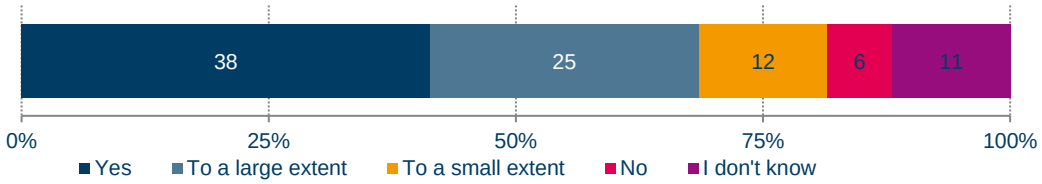
30 %, respectively), showing that more than half of the respondents found it difficult to provide a definitive assessment. Furthermore, the effect of public consultations on generating public acceptance and altering the design of PCIs is likely limited.

The targeted survey yielded results indicating that a similar number of respondents agreed (22 %) and disagreed (20 %) that the input provided during public consultation was used to guide the development of the PCIs, while a larger proportion neither agreed nor disagreed with this statement (30 %), showing once again that it is challenging to conclude definitively that the consultations necessarily led to significant changes in the PCIs. While the results suggest that that has been the case in some instances, there appears to be a general sense that the gathered input is not taken into account. The targeted stakeholders pointed to the general lack of guidelines and best practices with respect to the public consultation and the lack of a clear mechanism and transparency to ensure that the input collected as part of the consultation has been considered. It was also noted that for consultations to be more effective, their timing should be changed to the earlier stages of the development of PCIs and that the public should be kept better informed by regularly updating the webpages of the PCIs.

Lastly, a large proportion of survey respondents (46 %) agreed that one public consultation is sufficient for increasing transparency and participation. This opinion was particularly popular among TSOs, industry representatives and NCAs. A fifth of the respondents, primarily comprised of civil society representatives and energy producers, disagreed with this opinion and some suggested that several consultations or additional participatory processes such as workshops should be introduced. It is worth adding that several respondents explained that the public consultation provision under the Regulation was, in their opinion, redundant as the national legal frameworks of their Member States as well as the public participation requirements of the environmental impact assessments conducted in the permitting process already made public consultations obligatory. As such, this provision was seen by some as adding to the complexity of the permit-granting procedure.

The results of the public consultation conducted as part of this study showed that the public participation process is generally perceived to be useful, particularly by EU citizens and representatives of business associations and business organisations (Figure 4.6).

Figure 4.6 Usefulness of the public participation process (n=92)



Source: Public consultation 'Trans-European energy infrastructure – revision of guidelines' ([73]).

A number of reasons were provided in this regard, namely the public consultation process was seen as an opportunity to express different positions, to explain the project to the public and to potentially ensure acceptance. A limited number of responses indicated that the public consultations also provide an opportunity to introduce improvements in the design of PCIs. Additionally, it was noted that for a consultation to be useful, it should take place early in the process and that it is important for all relevant stakeholders to take part in it.

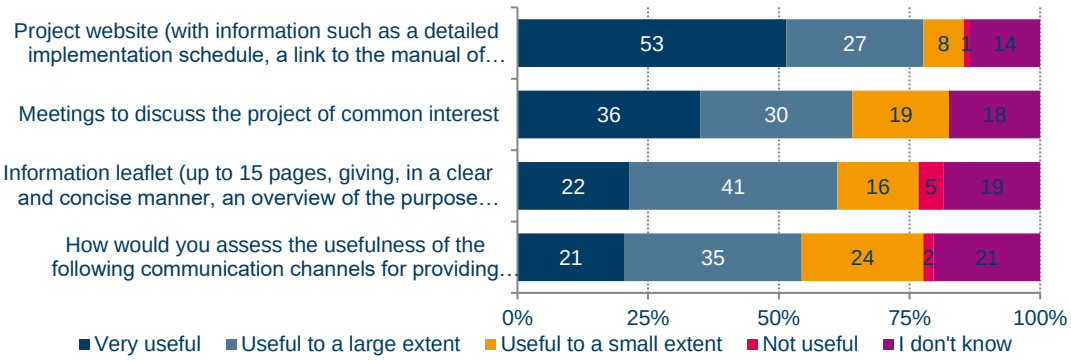
Some of the reasons for expressing scepticism about the usefulness of public consultation included the belief that it is not a sufficiently strong instrument to make a significant difference and that the inputs provided by the public have not been used. The latter was also given as one of the reasons for not taking part in public consultations in the past along with a lack of awareness not only of the

[73] European Commission (2020c), Public consultation: Trans-European energy infrastructure – revision of guidelines. Retrieved from: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Revision-of-the-guidelines-for-trans-European-Energy-infrastructure/public-consultation.

opportunity to participate but also of the notion of PCIs, which suggests that the public participation process is not sufficiently well known.

Generally, all communication tools (PCI websites, information leaflets, meetings to discuss PCIs and provision of information in writing) were considered to be useful by respondents who were able to provide an answer (Figure 4.7), with project websites being particularly highly rated.

Figure 4.7 Usefulness of the various communication tools (n=103)



Source: Public consultation 'Trans-European energy infrastructure – revision of guidelines' ([74]).

The interviews also supported the latter point as websites were deemed to be important for ensuring transparency by interviewees. In line with the results from the targeted survey, the evidence collected via the interviews also indicated that public consultations provide an opportunity to have a debate and to increase public awareness. Similarly, it was noted that it is important to organise them early in the process and some doubts were raised with regard to their effectiveness in contributing to public acceptance. Moreover, in line with the results from the targeted survey, some interviewees characterised the public consultation provision of the Regulation as unnecessary due to the pre-existing national obligations to conduct one or more such consultations for PCIs and non-PCIs alike.

One of the webinars, organised as part of the study, included an in-depth discussion about the public consultation process. In particular, it was noted that while the provision describes the main principles, there is a general lack of guidance about what the consultation should look like, how the feedback should be used and what the desirable outcome of the consultation is. It was noted that the public consultations of some PCIs were too short and did not give relevant stakeholders sufficient time to participate. It was also reported that the websites of some PCIs provide limited or outdated information and an example of a project in which the input from the local community was not considered was provided. The evidence collected via the webinar, which is also supported by the results from the targeted survey and the interviews, indicates that while the public consultation is considered to be an important and necessary tool, there is considerable room for improvement in ensuring the transparency and legitimacy of the process.

Summary

In summary, the objective of reducing permitting duration and complexity has partly been achieved. PCIs need on average less time for permit-granting procedures than they needed prior to the TEN-E Regulation. However, duration varies substantially between projects and the effectiveness of the TEN-E Regulation's provisions depends strongly on national implementation. The effectiveness of the one-stop shops differs among Member States and among projects, depending on size and complexity. Additionally, the TEN-E Regulation has created opportunities for the public to be involved and public consultation has improved public participation and increased awareness of PCIs, but public opposition remains a challenge for some PCIs and has led to delays in permit granting.

([74]) Ibid.

Regulatory framework

In response to the regulatory challenges for cross-border infrastructure projects, the TEN-E Regulation established the CBCA as well as other risk-based incentives.

CBCA – overall effectiveness

Similar to the assessment of the effectiveness of permit-granting provisions, the effectiveness of the CBCA provisions also provides diverging results. As presented in Section 3.2.3, 42 CBCA decisions have been taken so far. These aim at adjusting the costs of a PCI to the benefits that occur in different Member States. In that respect, they aim at supporting cross-border projects or national projects with strong cross-border impacts in sharing the financial burden.

In 2016, a Roland Berger study ([75]) found that such decisions did not create the desired effect because of a long and complex decision process that proved unclear to many project promoters. In contrast, the Trinomics et al. (2018) study concluded that CBCA are effective in enabling PCIs, even though the complexity of the process was confirmed. However, it was noted that the connection to CEF funding is an important criterion for giving incentives to project promoters rather than the decision itself. The objective of accessing CEF funding was indicated by stakeholders as more important than the allocation of costs between Member States, which points to minor shortcomings among the overall positive assessment in that study.

The stakeholder consultation revealed a picture that lies somewhere between the results of the two studies. In the responses to the targeted survey as well as in the interviews, stakeholders expressed a positive opinion on the existence of the instrument as an approach to share the contribution to cross-border projects, while at the same time pointing to the negative impacts of the complex process, as will be described below. For the main stakeholders to be involved in CBCA decisions, NRAs presented strong support of the innovative approach established by the CBCA provisions in the TEN-E Regulation. The understanding of the impacts of a project in other Member States and thus sharing the costs between countries provides an improved regulatory framework for projects with a cross-border dimension. Some project promoters also mentioned that the CBCA creates benefits for them. As explained in interviews, these benefits relate to the idea of the CBCA mechanism of establishing a common framework to assess projects in combination with the CBA methodologies and help achieve a full understanding of the effects of their project.

On practical implementation, however, the opinions of stakeholders emphasise the complex procedures. NRAs as well as project promoters indicated in interviews the difficulty in providing and obtaining all necessary data, making decisions based on different scenarios and reaching an agreement about the costs to be shared. While NRAs saw the main challenge in the existence of different scenarios that do not provide a clear basis for decision-making, TSOs criticised the length of the process that delays a final investment decision. Both arguments, however, present views on specific issues without also considering the benefits of shared costs.

Stronger criticism originates from ACER, which finds that all PCIs that request a CBCA decision also intend to apply for CEF grants for works ([76]). The section on financing of energy infrastructure below describes the existing process for access to CEF grants for works in which a CBCA decision is a necessary precondition according to Article 14(2). Given that several project promoters indicated in the targeted survey and the interviews that CEF funding is a main benefit of the TEN-E Regulation, this correlation may indicate that the value of a CBCA decision itself is smaller and only considered a step on the way to CEF grants. However, the evidence base does not allow causality between these remarks. A possible alternative explanation would be that a CBCA decision is

(75) Roland Berger (2016). Cost-Effective Financing Structures for Mature Projects of Common Interest (PCIs) in Energy. Retrieved from: https://op.europa.eu/nl/publication-detail/-/publication/4bcfb6f3-e13c-11e6-ad7c-01aa75ed71a1.

(76) ACER (2018a), Third Edition of the Agency's Summary Report on Cross-Border Cost Allocation Decisions – Status update as of March 2018. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Third%20Edition%20of%20the%20Agency's%20Summary%20Report%20on%20Cross-Border%20Cost%20Allocation%20Decisions%20-%20Status%20update%20as%20of%20March%202018.pdf.

requested to not bear all costs for benefits that arise in other Member States, but that an application for CEF is envisaged as an addition to this.

Detailed analysis of CBCA decision and the link to CEF funding

ACER's overview of CBCA decisions is combined with the internal project status data provided by DG ENER on the fourth PCI list, historical PCI list information ([77]) and PCI fiche and CEF funding data ([78]) to obtain insight into the outcomes of the decisions. As set out in Section 3.3.3, 42 CBCA decisions had been made at the time of writing, of which respectively 37 and 30 were reported in ACER's 2019 list of CBCA decisions and ACER's 2018 CBCA monitoring report. Of the 42 CBCA decisions, 2 were taken by ACER and the rest were coordinated decisions by NRAs.

Following the CBCA rationale of the Regulation (Section 3.2.3), three ways can be identified through which CBCA decisions support investment decisions:

- allocating overall project costs to specifically compensate net negative impact for at least one involved party, reducing the barrier to invest for these specific parties;
- providing clarity on the acceptance of the relevant costs to be covered by national system tariffs in each concerned Member State;
- providing access to (additional) financial support through CEF grants for works.

ACER indicated in its latest summary report on the CBCA decisions ([79]) that 70 % of all CBCA decisions (21 out of 30) made up to March 2018 concerned projects where the project was built on the territory of one country and the costs were allocated to that same country only. Despite showing a strong decrease in the latest period from 2018 to 2020, still a relatively large share of these PCIs in one country with one cost carrier remained as of March 2020 (24 out of 42 cases), possibly anticipating CEF-E grants and not necessarily seeking a decision on cost allocation. These PCIs mostly involved internal lines with cross-border impact. With the exception of four cases in 2014 (all gas PCIs), none of the CBCA decisions allocated costs to non-hosting countries. This indicates that almost half of all cases (20 out of 42) involve situations where CBCA decisions did not provide compensation of net negative impact for the hosting country through allocation of overall project costs. Since these projects were internal projects with benefits for the one involved party, it can be concluded that for 48 % of all cases the only intention for project promoters to have requested a CBCA decision was to gain access to CEF funding.

Another 30 % of CBCA decisions up to March 2018 (9 out of 30) concerned projects with multiple Member States involved. For five out of nine cross-border PCIs with CBCA decisions, the territorial principle (each country pays the part of the project on its territory) is relevant for the project crossing two countries without offshore sections. For two of these cases, all involved countries were estimated to be net beneficiaries, thus the territorial principle was applied to formalise the cost division and to clarify on the costs to be covered by each country's national system tariffs. CBCA decisions are thus rarely used to provide additional clarity on the acceptance of the relevant costs to be covered by national system tariffs in concerned Member States.

In three cases, applying the territorial principle would have resulted in a net loser and the CBCA decision included either a compensation payment from the net beneficiaries of the project to the net loser or an allocation of the investment costs to avoid a net loser. With only three cases, here, CBCA decisions are used to compensate negative impacts. CBCA decisions are clearly also rarely used to reallocate costs to compensate net negative impact for at least one involved party, reducing the barrier to invest for these specific parties.

The observed results of CBCA decisions indicate that a main driver for project promoters pursuing a CBCA decision is to gain access and eligibility for financial support through CEF grants for works.

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(77) Historical PCI list information refers to all previous lists (2013, 2015 and 2017) and corresponding Technical documents, Commission Staff Working Documents and other related documents.

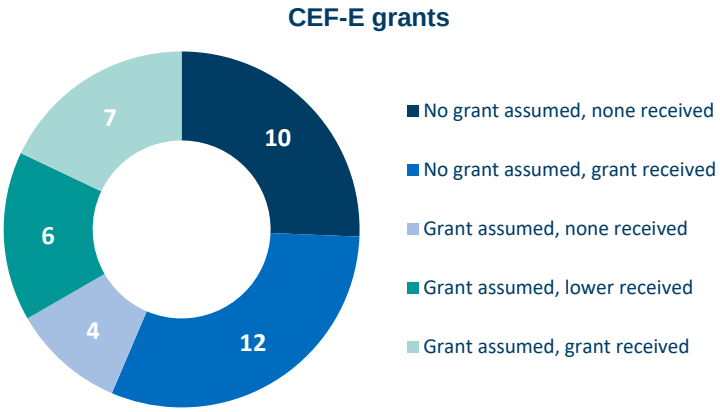
(78) https://ec.europa.eu/inea/en/connecting-europe-facility/cef-energy/cef-energy-projects-and-actions.

(79) ACER (2018a), Third Edition of the Agency's Summary Report on Cross-Border Cost Allocation Decisions – Status update as of March 2018. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Third%20Edition%20of%20the%20Agency's%20Summary%20Report%20on%20Cross-Border%20Cost%20Allocation%20Decisions%20-%20Status%20update%20as%20of%20March%202018.pdf.

This hypothesis is supported by the fact that the majority of the PCIs with a CBCA decision receive CEF assistance for works: 31 out of 39 cases (at the time of writing 3 cases have applied for grants but have not yet received a decision) with budgets ranging from 30 % to 75 % EU support to the action ([80]). Moreover, ACER states ([81]) that, as of May 2018, for all investment requests (30 out of 30 responses) the project promoter(s) expressed an intention to apply for EU grants from CEF-energy.

Looking closer at the CEF grants that were assumed in CBCA decisions and that were eventually granted, a specific issue concerning CBCA decisions being a sequential step towards CEF funding becomes more noticeable. Figure 4.8 shows how many CEF grants were assumed in the CBCA decision and whether (and to what extent) the PCIs received them. Based on a cross-check with the available information, to our knowledge in the 10 cases for which no grant was assumed in the CBCA decision and no grant was received, the project promoter did apply for CEF grants but they were not awarded. For 25 PCIs, CEF grants were awarded, although this was not anticipated in the CBCA decision in 12 cases. However, there have been four cases in which grants for works have been assumed in the CBCA decision, but they were not awarded, and six cases where a lower grant was awarded than assumed in the decision. These misjudgements are sometimes the result of the fact that grant assumptions are sometimes used to conclude a proper CBCA decision, meaning that in many cases the CBCA decision has been incomplete as grants must be assumed, which in turn may lead to a delay in the process. The evidence shows that in some cases the CBCA decision as a mandatory step towards CEF grants for works is not effective since certainty on the awarded CEF grant is required to agree on an accurate CBCA decision.

Figure 4.8 CEF-E grant assumptions in CBCA decisions and corresponding grant awards



Source: FSR and CSEI (2020). Making the TEN-E Regulation Compatible with the Green Deal: Eligibility, Selection, and Cost Allocation for PCIs.

A CBCA decision was requested and agreed upon for two case study PCIs: the GIPL pipeline hosted by Poland and Lithuania and the Estonia–Latvia third interconnection. The GIPL project CBCA decision was made by ACER after the involved NRAs failed to reach consensus on the cost allocations, resulting in net negative impact for Poland to be compensated by Lithuania (hosting country), Latvia (non-hosting country) and Estonia (non-hosting country). For the Estonia–Latvia third interconnection, the project promoters agreed on a CBCA decision based on the territorial principle: costs are distributed according to the length of the lines to be built in each hosting country. The PCI status and the CBCA decision can be considered as an intermediate step to gain access to CEF funding that is necessary to realise this project. Both projects later applied for and received CEF grants for works but did not use grant assumptions in the CBCA decision.

(80) INEA (2020). CEF Energy Projects and Actions. Retrieved from: https://ec.europa.eu/inea/connecting-europe-facility/cef-energy. Accessed on 20.5.2020.

(81) ACER (2018a), Third Edition of the Agency's Summary Report on Cross-Border Cost Allocation Decisions - Status update as of March 2018. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Third%20Edition%20of%20the%20Agency's%20Summary%20Report%20on%20Cross-Border%20Cost%20Allocation%20Decisions%20-%20Status%20update%20as%20of%20March%202018.pdf.

Stakeholder consultation highlights that the current governance on CBCA decision-making is effective, but the effectiveness of the decisions is in doubt and the link between CBCA and CEF is not widely supported. The majority of respondents to the targeted survey (79 %) either agreed (40 %) or completely agreed (39 %) that it is effective that NRAs are responsible for CBCA decisions and three project promoters expressed their support for the statement as well during the interviews. However, three TSOs mentioned through the survey that if the scenarios used for the CBCA assessment are decided through a decision reached by the involved NRAs, these scenarios are susceptible to a certain subjectivity. ACER, NRAs and project promoters highlighted during the interviews that CBCA decisions are mainly conducted due to the requirement for CEF applications. In such cases, the effectiveness of the CBCA provision is captured only in gaining access to CEF grants. As a result, the effectiveness of the CBCA process to compensate negative impacts through cost allocation is viewed as limited. ACER argues that the CBCA–CEF linkage should be revised and that for tariff affordability and other uses CBCA should not be mandatory. It is suggested by ACER and both an electricity and two gas TSOs to allow for conditional CBCA decisions and a second (final) decision to be taken after a grant decision is made. By using such a conditional approach, it is anticipated by the mentioned parties that delays can be prevented and possible misalignments in grant assumptions during the CBCA process and actual grant decision outcomes can be prevented. ENTSO-E is of the opinion that CEF funding should be considered if there are net benefits in non-hosting countries without a requirement for a CBCA decision.

In contrast, the Florence School of Regulation suggests that the concept of the CBCA can be taken a step further by allocating costs to **all** countries where there are benefits. CBCAs should not only avoid a jurisdiction facing negative net (welfare) benefits, but instead should allocate costs in such a way that all the jurisdictions involved end up with the same or similar benefit–cost (B/C) ratios ([82]). This would mean that ACER's threshold of 10 % of net benefits would no longer be applied. According to ACER, the threshold of 10 % is somewhat arbitrary but justified as it limits the number of Member States and stakeholders involved in CBCA decisions. ENTSO-E emphasised that if cross-border impact depends on modelling assumptions, this provides an additional argument for applying a threshold.

Risk-based incentives – overall effectiveness

Risk-based incentives as a second instrument have been used in very few instances. Thus, data availability is also low. ACER reports indicate that two requests for such incentives have been made for electricity and four for gas PCIs. In four cases overall (one electricity, three gas), risk-based incentives have been granted. Many project promoters have not yet decided if they will apply, but around half of the PCIs in both electricity and gas infrastructure indicate in ACER's 2019 consolidated PCI report that they will not apply for incentives. In the Trinomics et al. (2018) study, reasons for low application rates relate to assumptions from project promoters that NRAs do not see higher risks for PCIs or that the regulatory framework accommodates the risks anyway. Additionally, project promoters received negative feedback from NRAs and decided not to apply as a result. According to offshore energy industry stakeholders and project promoters, the instrument can become more relevant in the context of offshore grid infrastructure, which will be discussed in more detail in the assessment of relevance in Section 4.4.

Stakeholder views differ in respect to risk-based incentives. While some TSOs see an added value in these incentives in adjusting the financial risk, regulators refer to the low number of applications to illustrate the need for additional risk-based incentives. However, due to the limited experience of all types of stakeholders, these views remain largely theoretical rather than indicating the actual effectiveness of risk-based incentives.

Detailed analysis of risk-based investment incentive provisions

None of the PCIs in the third PCI list (2017) ([83]) applied for project-specific risk-based incentives; in 37 cases the project promoters explicitly mentioned having no intention of doing so in the future. In 3 cases the project promoters plan to apply for specific incentives and in 38 cases the project promoters have not decided whether to apply. Findings from the Trinomics et al. (2018) study mentioned above indicate that reasons for low application rates are found in NRAs frequently

[82] Florence School of Regulation (2020), Policy Brief: Making the TEN-E Regulation Green Deal compatible – Eligibility, selection and cost allocation for PCIs. Retrieved from: https://fsr.eui.eu/publications/?handle=1814/67673.

[83] The latest reports have been published before the publication of the fourth PCI list, therefore no monitoring data are available on the 2019 Union PCI list.

indicating there is no reason to assume higher risks for projects and that national regulatory frameworks can already accommodate the risks. Additionally, in nine instances, project promoters applied for non-project-specific incentives that ACER believes were mistakenly considered as 'Article 13 incentives'. In its report on specific incentives, ACER states that 'the distinction of incentives within the meaning of Article 13 versus that of other incentives provided by the general national regulatory frameworks may not always be clear, especially for project promoters' ([84]). One reason for this is that some national regulatory frameworks have incentives in place that are outside the scope of TEN-E. These misalignments are specifically known to be found in France, Italy and the UK.

Concerning exemptions for PCIs in the third PCI list, there are four in which project promoters applied for an exemption, of which three received exemptions from the NRAs. Project promoters of only two PCIs expressed their intention to apply for exemptions in the future. For the TAP project, exemptions were granted based on Article 36 of the gas Directive 2003/55/EC. They constitute an exception to the general rules on regulated TPA and unbundling in Directive 2009/73/EC concerning common rules for the internal market in natural gas. Based on the exemptions, ship or pay contracts for the forward capacity have been signed with the project promoter, thereby limiting the risks and securing the bankability of the project.

Regarding the application of incentives before the third PCI list, the GIPL pipeline was one of the three gas projects that applied for a risk-based regulatory incentive under Article 13, according to ACER's report on project-specific risk-based incentives. According to the decision of the NRA, assets that are not yet in operation can be included in the regulated asset base and with that the project promoter receives an additional return on investment. The additional measures taken by the NRA here mitigated the risks associated with investing in assets that will initially not be used.

With very few relevant applications known for specific incentives among PCIs, of which there are none on the third and fourth PCI lists, and a significant minority expressing the intention to apply in the future, project promoters have not widely used the regulations investment incentive provisions and show little interest in doing so. This case is supported by the fact that in multiple cases incentives that are part of the regulatory framework in a Member State are mistakenly considered a project-specific incentive in the context of Article 13, indicating that project promoters seek for provisions within their national framework(s) rather than specific risk-based incentives through TEN-E.

Although 54 % of the stakeholders who responded to the targeted survey share the opinion that investment incentives enable effective investments in PCIs and many support the idea of risk-mitigating incentives, many of the survey's respondents and interviewees eventually showed that they do not fully understand the intended application of Article 13. Some 40 % of the stakeholders appear to be either unaware of the incentives or unable to respond to the questions asked, and the majority of the stakeholders who did share their opinions seem to regularly confuse the Article 13 investment incentives with the general notion of incentives (e.g. national incentives provided by NRAs). Additionally, NRAs indicate that there is little to no need for additional incentives through TEN-E and argue that Article 13 may increase the risk of having too many incentives than benefits from successfully promoting the establishment of PCIs. NRAs generally support the suggestions by ACER and CEER, proposing that risk-related incentives be dismissed from the Regulation.

Encouragement of innovative solutions

In 2019 DG ENER commissioned a study on the treatment of innovation in regulatory frameworks in all Member States ([85]). The study broadly defines innovation as putting 'innovative' transmission infrastructure investments into practice. A specific type of investment may very well be perceived as innovative in one Member State but not in another. In the study, regulatory frameworks are grouped into four categories based on the extent to which they encourage innovation:

- countries with explicit references in the high-level regulatory framework (e.g. in legislation) to innovation or related concepts;

(84) ACER (2018), Summary report on project-specific risk-based incentives. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER-summary-report-on-project-specific-risk-based-incentives_2018.pdf.

(85) Ecorys et al. (2019), Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure? Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/6700ba89-713f-11e9-9f05-01aa75ed71a1/language-en/format-PDF/source-96288082.

- countries with explicit references to innovation (or related concepts) at a lower level of the regulatory framework, by means of various types of regulatory instruments;
- countries with references to the economic and efficient development of the network that could be interpreted as providing a basis for innovative approaches;
- countries with no evidence of support for innovative investments in the regulatory framework.

In many Member States innovation is not explicitly incentivised or recognised in the regulatory framework. Regulatory frameworks put a strong emphasis on the efficiency of the network. As a result, TSOs only pursue projects that they expect to be accepted by the regulator. Novel approaches that are not certain to be accepted often do not progress beyond the idea stage. An important issue is that the benefits from innovations are either uncertain, hard to quantify, or a combination of both, in which case some innovative approaches appear to lack direct benefits.

In the report, two suggestions for EU action are provided. The first is a requirement to consider innovative solutions. This will set a basis for Member States to then develop their own policies and incentives in this area. The second option is to perform a social CBA. A CBA could promote innovative solutions if benefits can be assessed. As it is not feasible to do a CBA for every project, a threshold based on the project size could be introduced above which a CBA is required. A CBA is of course already performed for PCIs. This makes it likely that, compared to non-PCIs, it is more likely that innovative solutions are considered. PCIs are also eligible for CEF funding if they satisfy various criteria to overcome the funding gap for commercially non-viable projects. One of the criteria is a CBA that provides evidence of 'significant positive externalities'. Innovation is one of the three positive externalities considered (the others are solidarity and SOS).

The report gives examples of innovative PCIs, including projects in the thematic area of smart grids such as the Advanced Linked Platform to enhance GRID performance project in Austria and Italy, ACON in Czechia and Slovakia, The Smart Border Initiative in Germany and France, and SINCRO.GRID in Slovenia and Croatia. Each of these projects seeks to implement technology-based solutions to integrate energy markets, which increases SOS in an innovative manner.

In the case studies on the cross-border carbon dioxide network CO2 TransPorts and the ACON smart grid project, both project promoters indicated that the granted EU support via TEN-E is essential for the viability of the projects. At the time of writing, market conditions suggest that neither project is commercially viable and both have managed to find support through CEF-E funding.

The stakeholder consultation shows that stakeholders generally agree that there should be a larger role for encouraging innovation in the TEN-E Regulation. Stakeholders are doubtful if smart sector integration, energy transition for fossil fuel regions, climate resilience and energy efficiency are sufficiently addressed; respectively, 45 %, 51 %, 43 % and 60 % of the stakeholders either disagree or completely disagree that these issues were well addressed by the Regulation at that time. The overriding sentiment is that the given topics require more innovative infrastructure categories that are not included or underrepresented. Some 81 % of the stakeholders who responded to the targeted survey also viewed 'innovation' as either important or important to a large extent and the majority considers new technologies such as smart gas, hydrogen and power-to-gas installations to be relevant for the TEN-E framework. Negative perceptions of the Regulation's support for innovation are generally based on the desire for the Regulation to emphasise the objective to achieve EU climate and energy targets. During the interviews, various stakeholders suggested that current eligibility criteria do not adequately support climate neutrality through network innovation and by including traditional, fossil fuel infrastructure. In the webinars on infrastructure categories and the PCI selection procedure this is further supported by the suggestions to exclude fossil fuel infrastructure, include hydrogen infrastructure, and support digitalisation of networks.

Summary

In summary, the CBCA approach improved the regulatory framework for cross-border energy infrastructure projects by establishing a common framework for assessing benefits and sharing costs between Member States. However, the practical implementation raises some points of criticism, in particular whether the CBCA decisions are used for their intended purpose or as a step to access CEF grants. While such a step is the goal on occasions, the direct value of the CBCA application and decision is limited. Regulatory incentive provisions have not been widely used and project promoters show little interest in doing so. The legal and regulatory frameworks current at the time of writing could encourage innovative solutions more than they do. The incentives for

TSOs to invest depend on the national regulatory framework in Member States and, traditionally, regulatory frameworks put a strong emphasis on the efficiency of the network. However, this does not mean that there are no examples of innovative PCIs. Compared to regular investments of TSOs (non-PCIs) there are more incentives to consider innovative solutions for PCIs due to the required CBA and eligibility for CEF funding.

Financing of energy infrastructure

Challenges to the financing of energy infrastructure represent the third need identified by the impact assessment. In response, the TEN-E Regulation provides mechanisms for improving the financing. In addition to the provisions assessed in the previous section, these mechanisms include the access to grants from the CEF for studies and for works, and also access to other public institutions such as the EBRD or the EIB that provide loans.

The funding support offered in the form of grants by the CEF is considered important for improving the financing conditions for PCIs in a study by Roland Berger ([86]). Public grants are described to enable private investment in energy infrastructure by absorbing risks and therefore effectively advancing PCIs. The baseline assessment in Section 2.2.1 already highlights the lack of financial support for works under the business-as-usual scenario, while the TEN-E framework offers this type of support. Therefore, access to CEF funding presents an improvement to the financing of the projects.

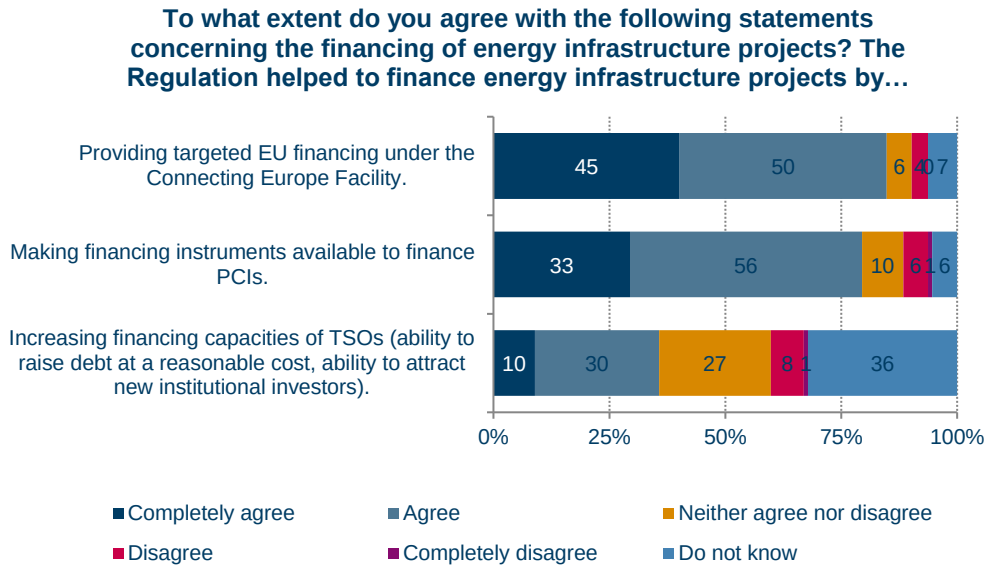
In practice, the CEF has provided EUR 3.7 billion to PCIs for 139 actions. The funding is split in the way described in Section 3.2.4. A large share of the funding provided has been used for works, and electricity projects have received more grants than gas projects. Smart grid and CO2 infrastructure – which represent smaller numbers of PCIs that also are less mature than electricity or gas transmission projects – only account for marginal shares of CEF grants provided. As indicated in the most recent CEF-Energy Report ([87]), transmission infrastructure projects attract the largest share of funding.

While grants for works account for the majority of the CEF funding provided, support for studies also constitutes an important factor in enabling projects. Both purposes combined are assessed as strongly helpful for the realisation of PCIs by stakeholders. As Figure 4.9 shows, an overwhelming majority of stakeholders stated in the targeted survey that the targeted financing from CEF represents a support in the financing of energy infrastructure projects, as stakeholders strongly agree that the mechanisms helped to improve the financing conditions. The direct funding under the CEF was most helpful to PCIs. However, the facilitation of access to other financing instruments (such as private financing because of higher security based on political support, and public loans based on the available data on net-positive social benefits) in general is considered almost equally helpful by stakeholder of all categories.

(86) Roland Berger (2016). Cost-Effective Financing Structures for Mature Projects of Common Interest (PCIs) in Energy. Retrieved from: https://op.europa.eu/nl/publication-detail/-/publication/4bcfb6f3-e13c-11e6-ad7c-01aa75ed71a1.

(87) INEA (2020a). Connecting Europe Facility Energy. Supported Actions – May 2020. Retrieved from: https://ec.europa.eu/inea/sites/inea/files/cefpub/cef_energy_supporting-actions_2020-web.pdf.

Figure 4.9 Responses to the targeted survey on the effectiveness of financing provisions (n=112)



Source: Targeted survey.

Also, all types of stakeholders describe the grants provided as a key enabler of complex PCIs, including grants for studies designed to reach an investment decision based on design development, and feasibility studies according to project promoters and other stakeholders. The list of actions supported by CEF grants for studies ([88]) not only confirms the support provided for the areas but also for environmental due diligence studies, in particular for electricity projects. This de-risking contribution of the financing element of the TEN-E Regulation was considered highly valuable by project promoters. The access to grants for studies is also mentioned in the interviews by TSOs as a direct benefit of the PCI status. In this respect, the initial stages of energy infrastructure projects have been effectively improved from a financing perspective.

Stakeholders in the interviews, in particular project promoters and NCAs, see the allocation of grants for works as helping to forge links between Member States. It was mentioned in several interviews that, particularly in central and eastern Europe, interconnection projects with high benefits to market integration and SOS would not otherwise have been constructed under market conditions at the time. One NCA from eastern Europe highlighted in the targeted consultation the importance of financial support for large-scale projects to maintain affordable tariffs for local consumers.

CEF grants were also highlighted as a central enabler for important interconnection projects by TSOs from other areas of Europe. As an example, electricity TSOs cite the valuable contribution of grants for the synchronisation project of the Baltic States' electricity networks. The project is one of the PCIs that received the highest amount of CEF funding for works, together with PCIs connecting the French to the Spanish (Biscay Gulf project) and to the Irish (Celtic Interconnector) electricity network ([89]). The volume of CEF grants provided to these three projects amounts to EUR 322.8 million (synchronisation of the Baltic States' electricity markets), EUR 530.7 million (Celtic Interconnector between Ireland and France) and EUR 578.5 million (Biscay Gulf interconnector between France and Spain). All countries involved in these projects were still facing SOS challenges ([90]) and low interconnection capacities in 2017 ([91]). As the projects are in line with

[88] INEA (n.d). CEF Projects by one Energy Sector. Retrieved from: https://ec.europa.eu/inea/connecting-europe-facility/cef-energy/projects-by-sector.
[89] INEA (2020a). Connecting Europe Facility Energy. Supported Actions – May 2020. Retrieved from: https://ec.europa.eu/inea/sites/inea/files/cefpub/cef_energy_supporting-actions_2020-web.pdf.
[90] Ministries of Energy and Economic Affairs of Latvia, Estonia and Lithuania (2015). Declaration on Energy Security of Supply of the Baltic States.
[91] European Commission (2017d), Communication on strengthening Europe's energy networks. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/communication_on_infrastructure_17.pdf.

the key energy infrastructure needs described in the impact assessment of 2011, these examples indicate that the financing mechanisms are used as targeted support to addressing the crucial gaps in the European energy market.

According to project promoters and NRAs, PCI status is also valuable for attracting public and private investors. NRAs mentioned in both interviews and contributions to the targeted survey that the visibility that PCI status brings has a positive impact on investor perceptions. The political support for those projects and the consideration as a European and national priority that have been mentioned by several project promoters can be seen as a key reason for this. In addition, loans from European financing institutions like EBRD and EIB are accessed by project promoters of PCIs. The assessment of benefits to the EU market is described by one TSO in the targeted survey as a supporting factor in accessing EIB loans. Also, from interviews, the financing institutions' view of the TEN-E Regulation is that it is beneficial in providing data about the projects based on the monitoring of projects and data collected for CBCA applications.

Taking all the aforementioned factors as well as the rarely used option of risk-related incentives into account, the TEN-E Regulation has clearly improved the financing conditions for energy infrastructure projects. The access to CEF funds and the funding volume of EUR 3.8 billion up to May 2020 provided security and enabled the realisation of PCIs. Grants for studies supported 108 actions and ensured the security necessary to enable the early stages of a project, and grants for works helped to realise crucial projects that forge links and remove bottlenecks at an affordable cost. The political support offered through PCI status also helped to attract both private and public investors, which further improved the financing conditions.

4.2.2 Evaluation question 2

How effective has the regulatory approach of the TEN-E Regulation been both in terms of scope and main provisions in contributing to the goals of market integration, SOS, competitiveness and the climate and energy targets for 2020 ([92])?

Sub-questions:

2.1 To what extent has the scope (93) ensured or hampered the achievement of the goals?
2.2 To what extent have the main provisions (94) ensured or hampered the achievement of the specific objectives (95)? What have been their contribution to the main objectives?
2.3 Should the scope or the main provisions of the Regulation be changed to meet the current objectives?
2.4 To what extent have external factors (96) influenced the achievements observed, how and which external factors?

Conclusions

The TEN-E Regulation and the selected PCIs have broadly achieved the overall objectives because of the support for cross-border transmission infrastructure that enables the interconnection of national energy grids across the EU. Increases in energy trade between Member States by 16.2 % for electricity and 2 % for gas, as well as decreased price divergence across the Union of 0.33 % for electricity prices and 2.63 % for gas prices, indicate the achievements in market integration and competitiveness. These are confirmed by the views of stakeholders.

(92) Specifically, achieving a 20% cut in GHG emissions (from 1990 levels); producing 20% of EU energy from renewables; and achieving a 20% improvement in energy efficiency through the refurbishment of existing energy infrastructure and/or the deployment of new energy infrastructure.
(93) Electricity, gas, oil, CO2, smart grids as well as the role of third countries.
(94) Including the regional approach with regional lists and regional groups, PCI selection process and criteria including qualitative criteria laid down in Article 4(4) of the Regulation, methodology for assessing benefits and contribution to the Regulation's objectives, permit-granting procedure, public participation including during regional group meetings, regulatory incentives/cross-border cost allocation.
(95) The specific objectives being: reduction of time for permitting procedures; increase in public acceptance and involvement in PCIs; allocation of costs and benefits in line with risks; provision of market-based and direct EU support.
(96) External factors are factors other than those stemming from the Regulation itself, but including the way in which it has been implemented (e.g. implementation by Member States and their relevant authorities including the permitting of one-stop shops).

SOS has also been strongly improved. The diversification of supply sources and interconnection of gas markets results in a situation that is resilient to major supply disruptions. Again, stakeholders broadly confirm the valuable contribution of the TEN-E Regulation for the achievements in SOS. In this context, the focus on interconnection projects, the identification and coordination of relevant infrastructure projects in regional groups and the support offered through CEF grants are important provisions for the success of those projects.

On the EU climate and energy targets, the modelling of the effects of the commissioned electricity PCIs up to 2020 results in a reduction of CO2 emissions of 2 804 kilotonnes. The effect of gas PCIs could not be fully captured. In contrast to the other objectives, climate target achievements are viewed differently among stakeholders. The debate revolves mainly around gas infrastructure: some stakeholders see gas as an achievement that replaces 'dirtier' sources of energy, while other stakeholders argue that the support for gas infrastructure reduces the effectiveness of climate achievements.

Several provisions have benefited the objectives of market integration, competitiveness and SOS. These include the selection of PCIs in regional groups with a coordinating role for the European Commission, the prioritisation of cross-border projects and the allocation of costs according to benefits between Member States as well as the enabling financial support through CEF grants. However, details of the process – such as the distribution of responsibilities or the specific assessment mechanisms – are a cause for criticism and prevent even stronger contributions to the objectives. In line with previous findings on the focus of the TEN-E Regulation at its inception, the sustainability criterion is often not prioritised enough to ensure that projects with strong benefits to the energy and climate targets are selected as PCIs.

All in all, considering the design of the Regulation at a time following important energy supply insecurities in Europe, the TEN-E Regulation has created and supported positive developments of its overall objectives. The details of the Regulation, however, offer room for improvement to make even greater contributions to the objectives.

Analysis

This section evaluates the contribution to achieving the overall objectives, the contribution of the scope and the provisions of the TEN-E Regulation, and the impact of external factors on the achievements. First, the objectives are assessed one by one. Second, the effectiveness of the scope and the provisions in achieving the objectives are assessed. Here, the focus is on those provisions not already discussed in the previous question. The need to change the scope or provisions is also assessed. Third, the role of external factors for the achievement of the objectives is presented.

Achievement of the objectives

This section presents the findings on the achievement of the overall objectives set by the TEN-E Regulation. The Regulation has contributed to the objectives of market integration, competitiveness and SOS through the selection of PCIs. The effect on climate and energy targets, in particular GHG emission reduction, is debated on the back of an unclear evidence base.

Market integration and competitiveness

The objectives of market integration and competitiveness have been largely promoted by the TEN-E Regulation. Energy interconnection has increased across the EU through PCIs in the priority corridors. According to European Commission documentation ([97]), the interconnection target of 10 % in 2020 will be reached in most Member States thanks to the TEN-E Regulation and the PCIs. While, in 2017, 11 Member States fell short of the target, forecasts show that only 4 Member States remained below 10 % in 2020 ([98]).

The focus on building new interconnectors in the PCI lists clearly supported market integration. As a result of the increased interconnection, wholesale prices for electricity are found by the European

[97] European Commission (2017e), Second Report on the State of the Energy Union – Monitoring progress towards the Energy Union objectives – key indicators. Retrieved from: https://ec.europa.eu/commission/sites/beta-political/files/swd-energy-union-key-indicators_en.pdf.

[98] European Commission (2017d), Communication on strengthening Europe's energy networks. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/communication_on_infrastructure_17.pdf.

Commission ([99]) to be decreasing in all Member States except for Bulgaria, Greece and Romania. Additionally, convergence across the EU is described as notably increased, showing clear evidence of increased competitiveness in the EU energy market.

The modelling performed for this study supports these findings. Trade between the EU Member States has increased substantially for electricity (16.2 %) and more marginally for gas (2 %) due to the commissioned projects compared to the 2020 market situation without these projects. At the same time, price divergence ([100]) across the EU is decreased by the commissioned PCIs by 0.33 % for electricity and 2.63 % for gas when comparing the situation in 2020 to the baseline.

In absolute terms it means that while the consumption weighted average of the absolute differences between the electricity wholesale market prices in the EU countries and the EU average price is EUR 0.6/MWh without the PCIs, this decreases to EUR 0.46/MWh due to the already commissioned electricity PCIs, given the 2020 market situation. In the case of the European gas markets the same absolute price dispersion decreases from EUR 2/MWh to EUR 1.5/MWh due to the already commissioned gas PCIs. Table 4.2 presents the findings from modelling on the market integration for electricity and gas PCIs.

Table 4.2 Modelling results for change in trade and price divergence for electricity and gas

	Electricity	Gas
Change in total yearly trade in EU28 (%)	16.2 %	2 %
Price divergence change in EU28 (%)	-0.33 %	-2.63 %
Change in absolute price dispersion in EU28 (EUR/MWh)	-0.14	-0.5

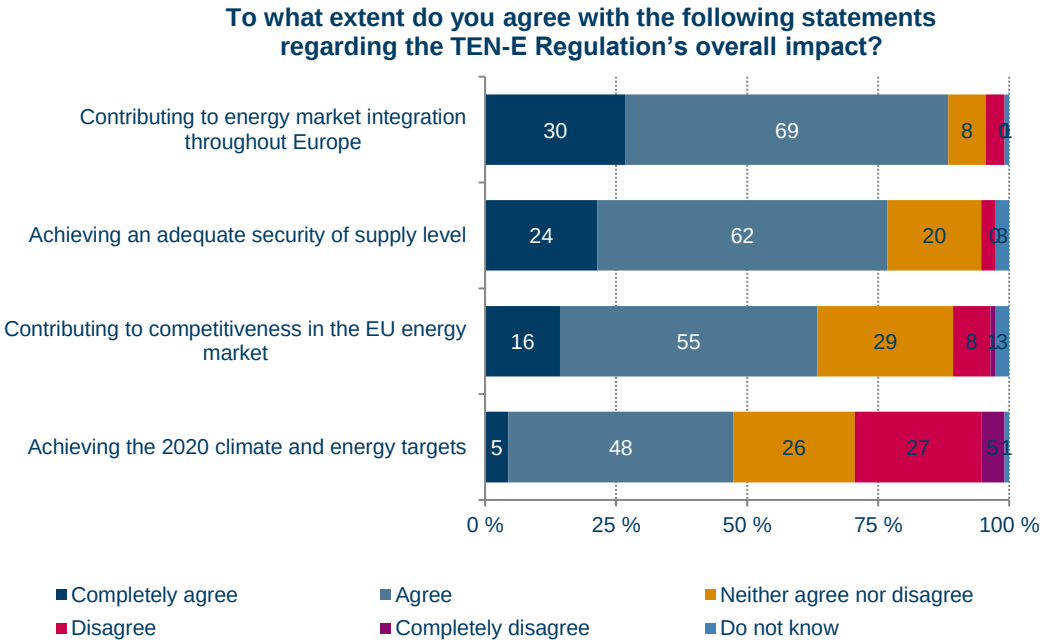
The responses to the targeted survey strongly support this positive assessment of the achievement of market integration. A large majority of stakeholders from all types see an overall impact of the TEN-E Regulation on this objective: just under 80 % (99 respondents) agree or completely agree on this (see Figure 4.10).

The impact on competitiveness is assessed slightly less favourably, with 63 % (71 respondents) agreement across all stakeholders (Figure 4.10). On competitiveness, the number of neutral answers is highest compared to the other objectives. The opposing opinions are as low as for market integration. For gas, several TSOs and an NRA indicate that LNG terminals have been an important factor in increasing the competition between sources and suppliers to achieve price decreases.

(99) European Commission (2019a), Quarterly Report on European Electricity Markets with focus on energy storage and 2019 wholesale prices. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/quarterly_report_on_european_electricity_markets_q_4_2019_final.pdf.

(100) Measured by the relative standard deviation of the European prices.

Figure 4.10 Responses to the targeted survey on the achievement of the overall objectives (n=112)



Source: Targeted survey.

In interviews, all types of stakeholders underline the achievements in market integration as a key impact of the TEN-E Regulation and cite the support for interconnectors between Member States as the main factor in that impact. The selection of such projects for the PCI lists was mentioned repeatedly as key in achieving higher integration in the energy market. Again, there is agreement from all sides on the benefits the TEN-E Regulation has achieved.

Considering all these indicators, the achievements in market integration and competitiveness are substantial. TEN-E has contributed to this by supporting the types of projects necessary to achieve interconnection between Member States and integrating new sources of supply to increase competition in the EU energy market. The impact of the specific provisions will be assessed and described further below.

SOS

A similar picture is found for SOS. In a recent study ([101]), the interconnected gas market was found to be resilient to supply disruptions if we consider the projects under construction to be commissioned by 2022: the network can ensure supply even in the case of disruptions of imports from important supply sources. This is also supported by the key indicators of the Energy Union ([102]). An increase in security of gas supply has been achieved through new interconnections and LNG terminals. In 2017, and excluding derogations from the rule, all but two Member States achieved the 100 % target for gas infrastructure resilience (N-1 rule). Thus, the EU has made substantial advances in SOS since the design of the TEN-E Regulation. Modelling results also show that, while at the time the Regulation came into force the SOS risks were serious due to lack of infrastructure, PCIs helped to alleviate the situation. Nowadays the European gas market is more resilient and the same projects would be less important: while the commissioned PCIs generated substantial SOS benefits under 2013 market conditions (EUR 193 million/year), they provide much lower benefits in 2020 (EUR 118 million/year).

[101] Artelys (2020). An updated analysis on gas supply security in the EU energy transition Final report. Retrieved from: https://www.artelys.com/wp-content/uploads/2020/01/Artelys-GasSecurityOfSupply-UpdatedAnalysis.pdf.

[102] European Commission (2017e), Second Report on the State of the Energy Union – Monitoring progress towards the Energy Union objectives – key indicators. Retrieved from: https://ec.europa.eu/commission/sites/beta-political/files/swd-energy-union-key-indicators_en.pdf.

As with the objective of market integration, stakeholders also see important contributions of the TEN-E Regulation to SOS. As shown in Figure 4.10 above, a majority of survey respondents agree that the TEN-E Regulation has had an effect on the SOS situation in the EU: 76 % of all stakeholders (86 respondents) indicate agreement. In interviews, the stakeholders confirmed the important contribution of the Regulation to providing interconnected networks to balance supply disruptions. Also, the construction of LNG terminals was mentioned by multiple stakeholders, mainly gas TSOs, as a positive effect of the Regulation, just as it was for competitiveness. LNG is described by these stakeholders as a diversification of supply sources that reduces dependency on the main pipelines. Although many stakeholders state that they are satisfied with the level of SOS, other stakeholders active in the gas sector – such as peripheral Member States – point out remaining gaps. Albeit not exclusively, these gaps are often mentioned in the context of south-east Europe where limited options exist to diversify supply sources within the internal energy market, sometimes simply because of large geographical distances. Therefore, these stakeholders point to the importance of continuous investment in gas infrastructure with a focus on these remaining bottlenecks.

Overall, the TEN-E Regulation therefore also makes an important contribution to improvements in SOS to date, with largely improved conditions since its establishment. However, it should be noted that the TEN-E Regulation is not the only instrument working towards the objective of SOS. External factors influencing the achievements of the goals will be assessed further below (see External factors influencing the achievements of the TEN-E Regulation below).

Climate and energy targets

While achievements in market integration and SOS are clearly observable and can be linked to the activities of the TEN-E Regulation, the effect on the achievement of climate and energy targets is less clear, from the perspective of both data availability and explaining the link between the Regulation and GHG emission reduction targets in particular: finding a direct link in the literature between TEN-E and climate achievements is rare. The Trinomics et al. (2018) study estimates a positive impact on GHG reduction targets due to the reduced curtailment of renewable energy sources (RES) arising from the improved interconnection between national grids. The same report states the impact on energy efficiency as unclear. A much clearer impact is found for the renewable energy target. Electricity PCIs in particular are important enablers of RES projects by connecting generation sites (e.g. of solar and wind installations) with consumption sites.

These results are underpinned by the modelling for the commissioned electricity PCIs. Compared to the baseline, a reduction of CO2 emissions of 2 804 kilotonnes was calculated for the year 2020. For gas, the effect on CO2 emissions can only partly be captured in the modelling and the impact is negligible compared to the benefits achieved in market integration and SOS benefits.

The debate around the contribution to climate targets is also reflected in the results of the targeted survey. As shown in Figure 4.10 above, agreement that TEN-E contributes to achieving the climate targets was lower than for the other objectives. Still, 47 % agree (n=53) while 29 % disagree (n=32) and 23 % of respondents neither agree nor disagree (n=26). TSOs for both electricity and gas networks and many other types of stakeholders such as NCAs and energy producers all strongly agree. Civil society organisations and other actors, including DSOs, disagree.

In the targeted survey and in the interviews, stakeholders across all types pointed out that the energy and climate targets were not at the centre of the TEN-E Regulation at its inception. SOS concerns were described as the key motive behind the Regulation at the time. As discussed, these objectives have been advanced through the various measures of the TEN-E Regulation.

Gas TSOs in particular indicated the need for gas infrastructure to replace power and heat generation based on solid fossil fuels. Multiple stakeholders from eastern Europe pointed to the potential for GHG savings from this transition. In contrast, civil society organisations and electricity industry actors opposed the support for gas infrastructure, arguing that it creates infrastructure lock-ins and path dependency for a time horizon beyond the transitional period. In this debate around the contribution to the EU climate targets, the positions of stakeholders can be understood by the point of reference and the prioritisation of the different overall objectives. Civil society representatives express that the assessment of climate effects is deprioritised behind SOS and market considerations. While none should be pursued in isolation, the overall notion is that the effectiveness of achieving climate targets – especially considering those in the future – and thus the effectiveness of the TEN-E Regulation could be better if gas infrastructure investments were assessed more carefully.

Similarly, for electricity projects, the interconnection of the power market and promotion of offshore networks was presented by stakeholders as beneficial for the promotion and integration of RES. However, stakeholders from civil society, DSOs and the European Commission see room for improvement for the achievement of climate targets. Of those stakeholders, NGOs mentioned the support for oil and gas infrastructure as inherently opposing the EU's climate ambitions, while DSO stakeholders presented the importance of distribution systems for RES integration. According to them, RES integration occurs to a large extent in a decentralised way on only a modest level. However, increasing electrification will require connection of larger RES inputs to the grid and European interconnection to balance the volatile nature of such sources, as argued by NGOs and industry stakeholders. One additional comment in relation to the climate targets argued that the construction of interconnectors supported the flow of cheap power across borders. Moreover, until recently, coal power was often the cheapest to generate and PCIs occasionally increased their use of solid fossil fuels instead of renewable energies. However, as discussed, the modelled impact of electricity PCIs is a reduction in CO2 emissions, which indicates that the effect of coal power flow is a small one that is positively offset by RES integration.

All in all, climate effects vary depending on region and point of comparison. There is broad agreement that GHG emissions and climate targets have not been the main driver of the Regulation so far. The TEN-E Regulation can be credited with contributions to the objectives of market integration, competitiveness and SOS. For climate and energy targets, a positive contribution to emission reductions is found in modelling the impacts of the commissioned PCIs, while stakeholders debate the effectiveness of reducing GHG emissions. One factor to be considered in the overall assessment of effectiveness is that although certain projects may contribute to the SOS of gas, more effective pursuit of the climate and energy targets is possible. Furthermore, while it is possible that all objectives are advanced by specific projects, the goals by their nature do not overlap.

Effectiveness of the scope

This section assesses the scope of the TEN-E Regulation on its effective contributions to the overall objectives. The selection of the electricity and gas categories as the core of the current TEN-E Regulation have advanced market integration, competitiveness and SOS in the EU. Other infrastructure categories target only specific objectives and have played a smaller role to date.

As mentioned previously, the scope of the TEN-E Regulation affected the achievement of the objectives in different ways; both the technological scope and the geographical scope need to be considered here.

The Trinomics et al. (2018) study describes the different contributions to the overall achievement of the objectives thus.

- Electricity transmission PCIs contribute to all objectives, mainly by reducing curtailment from RES. Integration of the electricity grid enables higher flexibility for RES generation, which contributes to achieving climate and energy targets and SOS which in turn benefit from the increased market integration due to electricity PCIs. As mentioned above, the only negative effect mentioned is that cheap coal power can flow through the interconnectors, creating an increase in CO2 emissions;
- Gas infrastructure PCIs are also described as clearly benefiting SOS and market integration, mainly through higher transmission capacity. A contribution to achieving the climate and energy targets is more controversial. While some believe that improved gas infrastructure can support the phase-out of coal ([103]) (resulting in even higher carbon emissions), gas infrastructure development is also described as generating higher demand for the entire lifetime of the investments and therefore undermining further reduction of GHG emissions ([104, 105]);

[103] Baltic Pipe Project (2019), Climate Report. Clean air, reduced carbon emissions and increased energy security for Poland and its neighbours. Retrieved from: https://www.baltic-pipe.eu/wp-content/uploads/2019/10/baltic-pipe-climate-report-en.pdf.

[104] Artelys (2020). An updated analysis on gas supply security in the EU energy transition. Retrieved from: https://www.artelys.com/wp-content/uploads/2020/01/Artelys-GasSecurityOfSupply-UpdatedAnalysis.pdf.

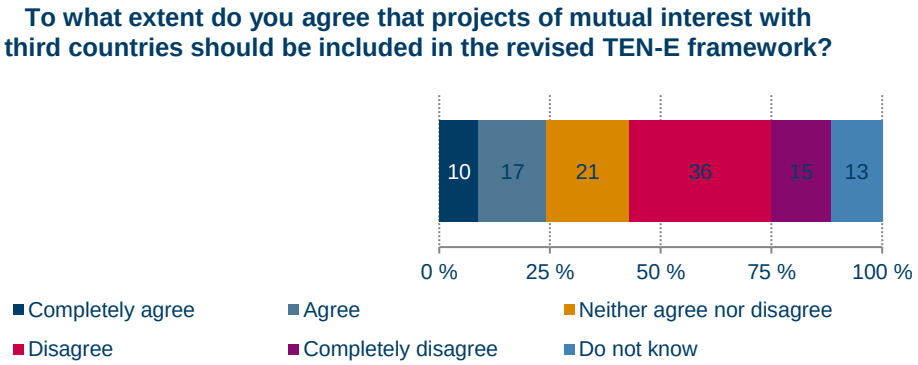
[105] European Commission (2017b), Commission staff working document accompanying the document amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest.

- Oil PCIs, which have a separate objective of diversifying oil supply, support the SOS but create similar infrastructure lock-ins as gas PCIs for the reduction of GHG emissions. In interviews with project promoters, the contribution to the overall goal for oil PCIs is acknowledged but the lack of implementation of the projects to date is presented as a limit to the effectiveness of oil in the scope of the TEN-E Regulation;
- CO2 infrastructure and smart grids are more difficult to assess. The inclusion of these two categories is recent and the number of PCIs in the categories is much smaller than transmission infrastructure with five and six PCIs on the fourth list respectively. Therefore, the availability of insights from literature is limited. Additionally, no CO2 or smart grid project has been completed to date. Thus, the effectiveness with regards to the overall objectives to date is difficult to assess. Project promoters of PCIs in these categories expressed the view that both CO2 and smart grids are additions to the scope. Many of the main provisions like national prioritisation, regulatory incentives or process provisions on CBA target energy transmission infrastructure at a TSO level and do not fit the characteristics of CO2 or smart grid projects. It is also mentioned that these projects do not advance the main objectives of the current TEN-E Regulation, being SOS and market integration. The build-up of an initial network for future use is however valued positively and can be seen to complement the announcements of multiple gas TSOs to decarbonise their gas networks through the use of carbon capture and storage (CCS) or usage.

Considering the geographical scope and the role of third countries, several stakeholders pointed to the importance of extending the scope of the Regulation to Energy Community countries and other possible third countries. This request was expressed mainly by TSOs of peripheral Member States with borders to non-EU countries as well as non-EU stakeholders. It was argued that SOS for such peripheral states cannot be achieved without taking the networks of third countries into account. Similarly, climate change mitigation is an international issue that benefits from a coordinated approach to the largest extent possible between the EU and its neighbouring countries.

The results of the targeted survey come to a similar result. Less than 25 % of stakeholders are of the opinion that projects of mutual interest should remain outside the scope of the TEN-E Regulation, while more than 50 % of respondents disagree or completely disagree with this position. Positive and negative answers are distributed across all types of stakeholders. Figure 4.11 illustrates the results from the targeted survey. Several respondents called for a specific regime for projects with non-EU countries to ensure that similar standards as EU projects are applied.

Figure 4.11 Responses to the targeted survey on the inclusion of projects of mutual interest in the scope of the TEN-E Regulation (n=112)



Source: Targeted survey.

In conclusion, the current scope of the TEN-E Regulation is mostly appropriate to achieve the overall objectives. However, the specific infrastructure categories in the scope reflect different objectives. While gas infrastructure prioritises SOS as an objective, CO2 infrastructure for instance will mainly advance the achievement of climate targets. Electricity infrastructure contributes to all of the objectives, even though there could be other effects in practice (see section on climate targets above). An inclusion of topics with third countries would be beneficial to peripheral countries in achieving better SOS.

Effectiveness of the main provisions

The impact of the main provisions on the specific objectives has already been assessed (see Section 4.2.1). This section analyses the key provisions for the achievement of the overall objectives. In this respect, the criteria and the process used to select PCIs as well as the monitoring of progress and CEF funding will be assessed in the following sub-sections. The first seven sub-sections focus on the analysis of the PCI selection and process, followed by sections on the reporting and monitoring of, and access to, CEF grants. The main findings of how each of these provisions contributes to the overall objectives is then presented in a summary section at the end.

Regional group model for the PCI selection process

This section analyses the contribution of the regional groups to the achievement of the overall goals. It appears that the exchange and cooperation that the TEN-E Regulation has established in the regional groups has been a key contribution to the achievement of the overall goals.

Regional groups are established for the purpose of proposing and reviewing PCIs, leading to the establishment of regional lists of PCIs. As conceived by the TEN-E Regulation to ensure broad consensus, they comprise the representatives of Member States, NRAs, TSOs, project promoters, ENTSOs, ACER and the European Commission. As defined in Article 3, decision-making powers in the regional groups are restricted to Member States and the European Commission only (DMB). Decision-making in the regional groups is based on consensus and there are regional groups for all active priority corridors and thematic areas. The coordinating role of the European Commission is an essential factor to facilitate the collaboration of the involved parties as well to ensure the achievement of the overall goals ([106]). As part of the DMB, the European Commission is directly involved in the selection of projects for the PCI list. At the same time, the support for the projects from the European Commission throughout the PCI process is a benefit from the Regulation.

ACER, in its position paper on the revision of the TEN-E Regulation ([107]), pointed out that the discussion and decision criteria have been progressively harmonised across the regional groups and to some extent across the sectors. In its opinion, groups should evolve to a European dimension. ACER proposed the following EU-wide groups: (1) electricity transmission investments group; (2) electricity smart grids group; (3) gas investments group; (4) carbon dioxide and hydrogen networks group; (5) energy storage investments group; (6) cross-sectoral investments group.

In interviews ACER also mentioned the importance of the coordinating approach and the collaboration in the regional groups as a central benefit of the Regulation ([108]). All types of stakeholders indicated that improved cooperation was a main achievement of the Regulation. TSOs and NCAs in particular expressed their satisfaction with the cross-border communication in the project selection process. According to one NCA, the regional groups helped to understand the respective needs and existing projects and therefore enabled decisions on cross-border projects. These projects create the interconnections between national networks that are important for advancing the objectives of market integration and SOS.

Nevertheless, according to ACER on the draft regional lists of proposed electricity ([109]) and gas ([110]) PCI 2019, some issues were found in the assessment of projects by the regional groups. These

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([106]) European Commission (2017b), Commission Staff Working document accompanying the Commission Delegated regulation amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest.

([107]) ACER (2020), Position on Revision of the Trans-European Energy Networks Regulation (TEN-E) and Infrastructure Governance. Retrieved from: http://www.acer.europa.eu/Official_documents/Position_Papers/Position%20papers/ACER_CEER_paper_on_TEN_E.pdf.

([108]) ACER (2019c). Opinion no 19/2019 on the draft regional lists of proposed gas projects of common interest 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2019-2019%20on%20Gas%20PCI%20list.pdf.

([109]) ACER (2019d), Opinion on the draft regional lists of proposed electricity projects of common interest 2019. Retrieved from: https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2018-2019%20on%20Electricity%20PCI%20list.pdf.

([110]) ACER (2019c), Opinion on the draft regional lists of proposed gas projects of common interest 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2019-2019%20on%20Gas%20PCI%20list.pdf.

were related to inadequate communication of assessment methodologies, limitations in the methodologies applied, and traceability of the selection process from the assessment of proposed projects until the decision of projects to include in the final draft PCI list. In particular, for electricity: (1) non-disclosure to the regional groups of the specific rules and specific values applied for some calculations; (2) assessment results were not provided to the regional groups for some of the projects included in the draft lists; (3) inclusion of some candidate projects that did not pass the assessment threshold; and (4) ambiguity on the role of two candidate projects due to their inclusion in the category 'Projects still under analysis and consideration for possible inclusion in the regional lists'. As for gas projects: (1) lack of full transparency of needs and project assessment methodologies; (2) non-replicability of the results of the application of the methodologies; (3) discretionary setting of thresholds that projects must meet in order to be selected for the draft PCI list; and (4) not applying the assessment methodology in the same manner to all PCI candidates.

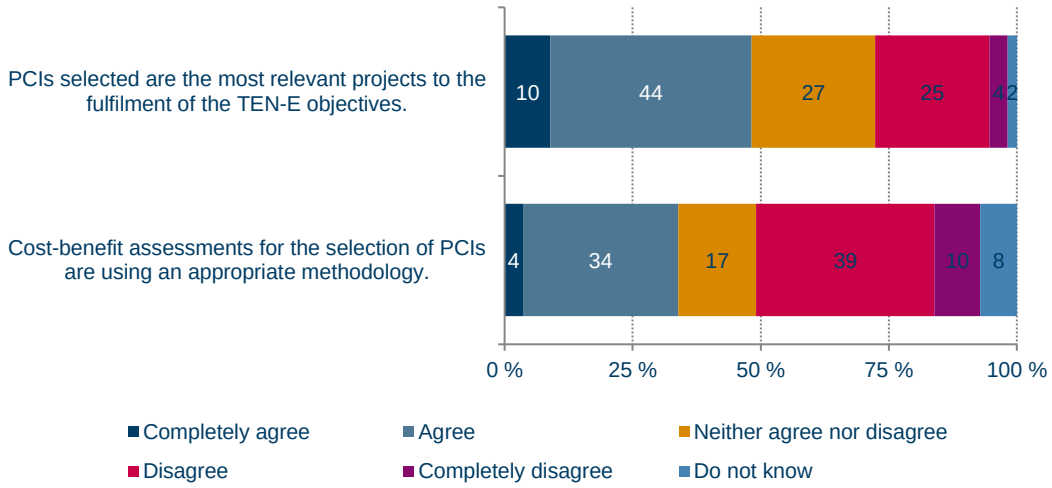
In line with ACER's observations on the PCI selection in the regional groups described above, we received several comments in the interviews and targeted consultations pointing at inconsistency in the application of CBA methodologies, not receiving methodologies in advance to be able to provide meaningful comments, and lack of transparency in the decision-making process. ACER also recommended to make available to the regional group members the detailed information from the DMB complementary evaluations (if any) in addition to the assessment conducted in the regional groups. Yet, on the matter of transparency of regional groups' projects evaluation and PCI selection, it should be stated that presentations held in regional groups are available at the CIRCABC website upon registration and these were also web-streamed. Documents containing the methodologies used for the project rankings in the regional groups are also available at the CIRCABC.

PCI selection criteria

The second provision analysed for its contribution to the overall effectiveness is the PCI selection criteria. Section 3.2 describes the specific selection criteria in more detail; in this section it is analysed to what extent it contributed to the overall effectiveness. The discussion is split into three parts: analysis of the sustainability criteria, analysis of the selection criteria for electricity smart grids, and the analysis of the cross-border criterion.

Figure 4.12 shows that there is a higher share of respondents that agree that the PCIs are the most relevant projects for the fulfilment of the TEN-E objectives (54 of 112 agree, while only 29 disagree). There is more disagreement, however, regarding the methodology used in the CBA (49 disagree, 38 agree) – see section on CBA methodology and related procedures.

Figure 4.12 Responses to the targeted survey: To what extent do you agree with the following statements concerning the PCI selection process? (n=112)

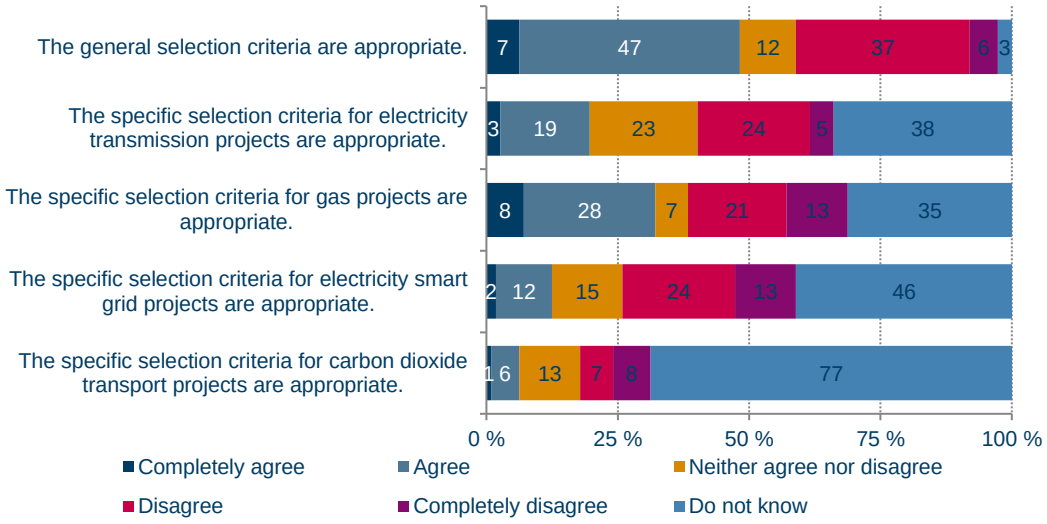


Source: Targeted survey.

As for the selection criteria for PCIs in Figure 4.13, stakeholders showed higher agreement than disagreement (54 agree, 43 disagree), but the level of disagreement is still considerable (43 of 112, 38 %). Another remarkable result is the level of disagreement on the selection criteria for electricity smart grid projects, which is more than double the level of agreement (37 disagree, 14

agree). This last point was also raised in the interviews and targeted consultations, in which stakeholders indicated that the current criteria for smart grids is limiting their inclusion on the PCI lists, especially in view of the 10 kV voltage threshold.

Figure 4.13 Responses to the targeted survey: To what extent do you agree with the following statements on the selection criteria for projects of common interest? (n=112)



Source: Targeted survey.

The main shortcomings of the PCI selection process regarding fulfilling objectives are the sustainability criteria and the selection criteria for electricity smart grids, as explained below.

Sustainability criteria

A hindering provision in respect of the objective of climate targets is the sustainability criterion in the PCI selection process. The assessment of sustainability in the PCI selection process for gas is described by ACER as 'unclear' ([111]) and deprioritises the selection of gas projects ([112]).

According to the last CBA methodologies of ENTSO-E and ENTSOG, sustainability is assessed by the following indicators: (1) for electricity projects: CO2 reduction, RES integration, and non-CO2 emissions; and (2) for gas projects: CO2 savings based on fuel-switching from more pollutant fuels to gas.

As for their use in the regional groups for the project candidates' assessments and final rankings, in the electricity regional groups, sustainability was part of the socioeconomic welfare benefit. In the case of gas projects, sustainability was disregarded in the project candidates' ranking, the reason being that all gas projects had been positively evaluated in the CBA in terms of CO2 savings, on the grounds of fuel-switching from coal or lignite to gas. If focus is to be maintained on sustainability, sustainability assessment seems to need further development and application in the PCI selection process. Suggestions on sustainability assessment may include using life cycle assessment (LCA) of CO2 levels that would account, for example, for methane leakage on gas

[111] ACER (2019c). Opinion no 19/2019 on the draft regional lists of proposed gas projects of common interest 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2019-2019%20on%20Gas%20PCI%20list.pdf.

[112] ACER (2020), Position on Revision of the Trans-European Energy Networks Regulation (TEN-E) and Infrastructure Governance. Retrieved from: http://www.acer.europa.eu/Official_documents/Position_Papers/Position%20papers/ACER_CEER_paper_on_TEN_E.pdf.

projects or an indicator for use rate of the project under a net-zero scenario to check compatibility with decarbonisation targets ([113]).

In addition, several NGOs and industry stakeholders indicated that the weak assessment of climate impact is causing projects to be selected that do not have a positive effect on CO2 emissions. A need for revision of the PCI selection criteria in light of sustainability and the climate effect is also echoed by some NRAs. TSOs do not appear to have strong opinions on the sustainability criterion. Taking into account the disagreement of stakeholders on the contribution to climate targets, it should be noted that the criterion does not provide strong support for the selection of projects that make the greatest contribution to the climate targets.

Selection criteria for electricity smart grids

The ACON case study indicated that the selection criteria in current TEN-E Regulation to facilitate the deployment of electricity smart grid projects might be too restrictive. Project promoters complained of the current low voltage threshold of 10 kV, set in Annex IV.1.e of the Regulation, which excludes essential infrastructures of smart grid projects like smart meters connected at low voltage level that allow demand-side management. The European Commission's vision of a new energy system as an integrated system with decentralised production advocates for facilitating the deployment of the energy grids at distribution level, where most RES are connected.

In the targeted survey, smart grid project promoters complained about the exclusion of low voltage infrastructures in Annex IVe, as well as the 20 % RES generation requirement in the network covered by the project, since this hinders the deployment of smart grid projects in regions with a lower penetration of RES. Another challenge is that there are six specific criteria for smart grids while there are only three for other project categories (four for gas projects).

Cross-border criterion

Another main provision is the focus on cross-border projects and the establishment of a cost-sharing mechanism between Member States. This point is also mentioned in the Trinomics et al. (2018) study that emphasises the contribution of the cross-border criterion for PCIs. It ensures the selection and implementation of interconnection projects that create the main benefits for the objectives of market integration, competitiveness and SOS, as described above. In this setting, the allocation of the costs of a project according to benefits across borders is valued by most stakeholders of all types. While details can be improved (e.g. the administrative burden; the role in respect to CEF funding – for more details see Section 4.2 on the CBCA method), the approach is described by many actors to promote coordination between Member States and their TSOs as well as understanding the benefits of a project in a wider context. In particular, TSOs that have benefited from a CBCA decision, and others that had to bear costs, all mentioned a positive impact on the realisation of cross-border projects. In turn, as described above, these support the integration of the EU energy market and, in the case of gas, can have positive effects on the SOS.

The cross-border criterion is discussed in more detail in Section 4.4.2 (Relevance). According to our analysis of reports and, particularly, stakeholder consultations, the cross-border criterion considered may need a revision to foster deployment of decentralised solutions. In this sense, it is still considered necessary to ensure that all PCIs have a trans-European impact. Nonetheless, the cross-border criterion can be redefined to widen the concept of cross-border impact in view of the potential decentralisation of the system.

Adequacy of the electricity and gas network planning and modelling as a basis for PCI selection

The third provision analysed for its contribution to the overall effectiveness is the electricity and gas network planning and modelling.

The electricity and gas network planning exercises are related to the PCI selection process. Energy infrastructure needs are identified in the network planning process and potential projects

[113] Artelys (2020a), TEN-E Regulation: How should it evolve to support the emergence of a net-zero future? Recommendations for scenario building, project assessment and PCI selection. A note commissioned by the European Climate Foundation.

addressing those needs must be evaluated according to the general objectives of the TEN-E Regulation (SOS, market integration, competition and sustainability). The EU network planning process is defined in the TYNDPs, developed by the ENTSOs, as mandated by Article 11 of the Regulation. By the same article, a CBA methodology must be developed by the ENTSOs to assess the projects they shall include in the TYNDP. This CBA is also the basis upon which to evaluate the candidate projects for PCI. Lastly, the network planning and CBA involve a modelling exercise for which scenarios must be developed of how the future energy sector is likely to be along the projects lifetime. Scenario development methodologies and CBA methodologies have been updated by the ENTSOs over the successive PCI lists following stakeholder consultations.

The network planning process from the ENTSOs is being developed towards an energy integrated system approach. The current TYNDP 2020 joint scenarios have been developed together for electricity and gas network plans by the ENTSOs. The joint scenarios form the basis of an interlinked model of ENTSO-E and ENTSOG being developed at the time of writing and will be able to capture the interdependencies of electricity and gas systems through energy conversion technologies, such as power-to-gas, gas-to-power, hybrid heat pumps, etc. ENTSO-E ([114]) has recently published its road map for the development of multisectoral planning support (MSPS) towards 2030. With this road map, ENTSO-E will improve the consideration of smart sector integration in the infrastructure planning process, enhancing flexibility across various energy sectors and allowing development of a more energy- and cost-efficient energy system. According to ENTSO-E, MSPS will serve as an umbrella for infrastructure planning activities, to ensure coordination and consistency between pictures of possible futures developed by different sectors. It will be the starting point for system and sector development plans and focus on even more comprehensive and consolidated scenarios compared to today's joint scenarios of ENTSO-E and ENTSOG. The MSPS also identifies the need for dual or multiple-sector assessment of infrastructure projects via a screening process. Projects that have relevant interactions with other sectors, or that compete with projects of other sectors addressing the same needs, will be compared through a transparent CBA.

As for past network planning exercises, different limitations have been found. In a study ([115]) regarding the evaluation of cross-border gas infrastructure projects for 2013 and 2015 PCI lists, the following shortcomings were identified: (1) not providing impact estimates on stakeholders other than consumers and producers; (2) not breaking down benefits by EU Member States; (3) not including non-EU members; (4) failing to adequately identify complementary and competing projects; and (5) oversimplifying transport costs. Instead, a market-based (model) approach was proposed to address the issues. By considering every feasible PCI configuration, rather than single projects in a selected order, the study also evaluated an endogenous determination of which projects are competing, and which are complementary. The lack of a holistic view in the evolution of the European energy system to fulfil the EU climate targets and timely investment, let alone weak synergies between the project-hosting country and its neighbouring countries, might lead to the construction of underutilised infrastructures (stranded assets). In the medium and long run this could affect consumers through higher regulated tariffs and could, consequently, augment the risk of future stranded assets. In Trinomics et al. (2018), it was stressed that the current set-up for selecting PCIs is partially adequate given the deficiency in accounting for energy efficiency in the evaluation process. According to the last TYNDP 2020 Scenario Report, however, energy-efficiency gains are accounted for in the demand levels of the scenarios to be modelled ([116]).

The first step for the TYNDP is development of the scenario. We received several comments in the interviews and in the targeted consultations about the misalignment of ENTSOs scenarios and the European Commission scenarios. Some stakeholders questioned why scenarios needed to be developed by the ENTSOs instead of adapting scenarios from the European Commission or ACER. This touches upon the independent role of the ENTSOs in the PCI selection process (see the section on *Adequacy of roles of the different agents in the PCI selection process* below).

([114]) ENTSO-E (2020), Roadmap for Multi Sectoral Planning Support. Retrieved from: https://eepublicdownloads.azureedge.net/clean-documents/Publications/Position%20papers%20and%20reports/l_entsoe_RM_MSPS_09.pdf.

([115]) Kiss, A. et al. (2016). A top-down approach to evaluating cross-border natural gas infrastructure projects in Europe. Retrieved from: https://www.iaee.org/ej/ejexec/ej37si-Kiss.pdf.

([116]) ENTSOs (2020), TYNDP 2020 Scenario Report. Retrieved from: https://www.entsos-tyndp2020-scenarios.eu/wp-content/uploads/2020/06/TYNDP_2020_Joint_ScenarioReport_final.pdf.

There are three scenarios in the latest TYNDP 2020 joint scenarios:

- 'National Trends', based on the latest available data from the national energy and climate plans (NECPs) developed by the Member States under the Regulation on the governance of the Energy Union and climate action (EU)2018/1999, agreed as part of the Clean energy for all Europeans package, adopted in 2019;
- 'Global Ambitions', compliant with the 1.5° C target of the Paris Agreement and the EU's climate targets for 2030 with a centralised generation approach;
- 'Distributed Energy', with a decentralised approach (energy prosumers as key aspect).

Data from the scenarios can be downloaded in the visualisation platform of the ENTSOs ([117]).

The European Commission, in the document 'A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy' ([118]), developed eight pathways to the decarbonisation of the economy, as outlined in the European Green Deal.

- Scenarios 1 to 5 look at different technologies and actions that foster the move towards a net-zero GHG economy. They vary the intensity of application of electrification, hydrogen and e-fuels (i.e. power-to-X) as well as end-user energy efficiency and the role of a circular economy as actions to reduce emissions;
- Scenario 6 combines all five options but at lower levels, reaching net GHG reductions as high as 90 %;
- Scenarios 7 and 8 explore how biomass can be supplied in a sustainable way while enhancing our natural carbon sink or in combination with CCS to assess how to reach GHG neutrality (net-zero emissions) by 2050 and net negative emissions thereafter.

Given that scenarios form the input data assumptions for the modelling in the network planning exercise, it seems natural that it is the ENTSOs that develop these scenarios. It may be difficult to input scenarios from other entities, such as the eight pathways from the European Commission described above, which may have other scopes and purposes. The ENTSOs' ([119]) view is that TYNDP scenarios aim at remaining technology and energy-carrier neutral and do not push any political agendas associated with the use or non-use of specific energy carriers or technologies. Nevertheless, the climate neutrality goals for 2050 and the recently published European Commission strategies for the energy sector ([120, 121]) call for enhancement of certain technologies, such as hydrogen network infrastructures, which should be represented in the scenario-building process. The approach to build the central policy scenario 'National Trends', built upon the most up-to-date data of the Member States' NECPs, in line with the European 2030 energy strategy targets, seems an objective approach to align to European Commission energy and climate targets.

Maximum consensus should be sought among all stakeholders involved in the European energy infrastructures. As reviewed in the TYNDP 2020 Scenarios documentation, these were developed following stakeholders' participation and the methodologies to build the scenarios were shared. Ten consultations (workshops, webinars and web-consultations) were identified according to the TYNDP 2020 Scenario Report, including the TYNDP Cooperation Platform with the European Commission and ACER. Additionally, as stated in the interviews with the ENTSOs and TSOs, they agree that stakeholder participation needs to be fostered in relation to the system integrated approach across all energy carriers, network levels and sectors of energy demand. ACER ([122]), however, thinks that

[117] ENTSOs visualization platform TYNDP 2020 Scenarios https://tyndp-data-viz.netlify.app/.
[118] European Commission (2018a), A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0773&from=EN.
[119] ENTSOs (2020) TYNDP 2020 Scenario Report forewords. Retrieved from: https://www.entsos-tyndp2020-scenarios.eu/.
[120] European Commission (2020d), Powering a climate-neutral economy: An EU Strategy for Energy System Integration. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/energy_system_integration_strategy_.pdf.
[121] European Commission (2020e), A hydrogen strategy for a climate-neutral Europe. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf.
[122] ACER (2020) Position on Revision of the Trans-European Energy Networks Regulation (TEN-E) and Infrastructure Governance. Retrieved from:

it should be conferred the powers to issue binding guidelines on the scenario development report from the ENTSOs. Along the same lines, the Florence School of Regulation ([123]) points out that scenarios should be approved by the European Commission.

The elaboration of the TYNDP involves the modelling of the electricity and gas systems. This is used to identify the infrastructure needs according to the TEN-E objectives and is also applied to evaluate projects following the CBA methodology. The details of the modelling exercise are beyond the scope of this section (see next section for more details). Nonetheless, as commented in the interviews and targeted consultations, the modelling exercise needs development towards an energy integrated system approach where all energy carriers' interdependencies can be captured when evaluating the benefits of projects. This is agreed by the ENTSOs and steps are being taken in this direction. The 'interlinked model' will join electricity and gas systems. Further developments in the future might be needed to incorporate other energy carriers like heat, cooling and hydrogen towards more holistic energy systems infrastructure planning. The Florence School of Regulation ([124]) also recommends integrating all energy vectors in the modelling of the networks. Additionally, the Florence School suggests using an open-source model to allow replicability of results and foster transparency in the PCI selection process, which ACER ([125]) and stakeholders viewed in the interviews and targeted consultations as a limitation in the assessment of project candidates for PCI.

The targeted surveys revealed considerable levels of disagreement about the TYNDPs. Out of the 112 responses, the highest levels of disagreement are on the following topics:

- 53 disagree / 27 agree that the current TYNDP framework matches the needs for system integration;
- 51 disagree / 27 agree that the TYNDP reflect enough coordination with the DSO networks;
- 50 disagree / 35 agree that the TYNDP involves the relevant actors with adequate roles.

System integration and the role of DSO projects is perceived to need further improvement in the network planning processes. ENTSOG stated in the targeted consultation that DSO–TSO coordination at national and European level must be enhanced. In its view, this coordination should concentrate on data collection, notably on renewables generation and on demand technology deployment. The issue of the predominant role of the ENTSOs, as commented earlier, seemed to concern 50 of the 112 respondents, who disagreed that the relevant actors and their roles are adequate in the TYNDP (Figure 4.14).

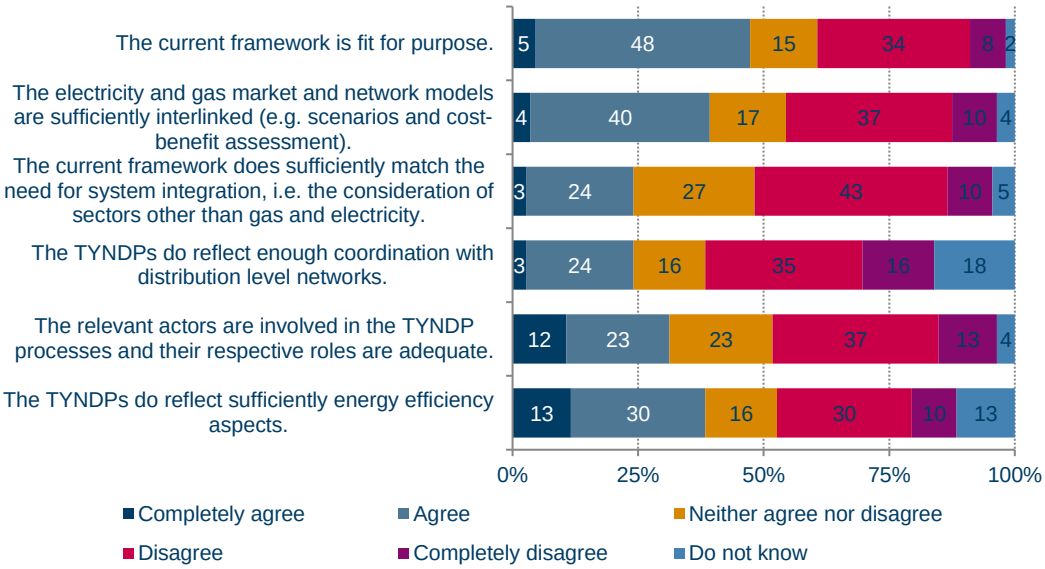
http://www.acer.europa.eu/Official_documents/Position_Papers/Position%20papers/ACER_CEER_paper_on_TEN_E.pdf.

[123] Florence School of Regulation (2019), Study on recommendable updates and improvements of the entsog methodology for cost-benefit analysis of gas infrastructures. Retrieved from: https://fsr.eui.eu/publications/?handle=1814/64688.

[124] Florence School of Regulation (2019), Study on recommendable updates and improvements of the entsog methodology for cost-benefit analysis of gas infrastructures. Retrieved from: https://fsr.eui.eu/publications/?handle=1814/64688.

[125] ACER (2019d), Opinion on the draft regional lists of proposed electricity projects of common interest 2019. Retrieved from: https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2018-2019%20on%20Electricity%20PCI%20list.pdf.

Figure 4.14 Responses to the targeted survey: To what extent do you agree with the following statements concerning the gas and electricity EU-wide TYNDPs? (n=112)



Source: Targeted survey.

CBA methodology and related procedures

The CBA methodology and related procedures are the fourth aspect analysed for their contribution to the Regulation's overall effectiveness. This section splits the analysis into three parts. First the CBA methodology is analysed at a more general level, combining both electricity and gas. Then the methodologies for gas and electricity are discussed. The section concludes with a discussion on the methodologies for assessing project candidates for PCI.

Overview of the CBA methodology for gas and electricity combined

As defined by the European Commission in its 'Guide to Cost-Benefit Analysis of Investment projects' ([126]), CBA is an analytical tool to be used to appraise an investment decision to assess the welfare change attributable to it. The purpose of CBA is to facilitate a more efficient allocation of resources, demonstrating the convenience for society of an intervention rather than possible alternatives.

The CBA methodology is developed by the ENTSOs as required in Article 11 of the TEN-E Regulation. It is based on a multi-criteria analysis, combining a monetised CBA with non-monetised elements to measure the level of completion of the pillars of the EU Energy Policy from an infrastructure perspective. The CBA methodology is used to assess the system needs to elaborate the TYNDP, and then to assess the projects through an incremental approach and CBA for the TYNDP and the PCI selection process. As part of the CBA analysis, network and market modelling are necessary for system and project assessment. The result of the CBA assessment from the ENTSOs is a series of monetised and non-monetised indicators over which all projects are evaluated. These indicators are then used by the regional groups in the evaluation of the candidate projects to the PCI list before submitting the proposal for draft PCI list.

There are two different CBA methodologies: one for the electricity projects, developed by the ENTSO-E, and one for gas projects, developed by ENTSOG. The methodologies used for the fourth

[126] European Commission (2014), Guide to Cost-Benefit Analysis of Investment projects. Retrieved from: http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf.

PCI list were the second versions of these two ([127, 128]). It must be noted that there is a draft for a third CBA methodology for electricity projects by ENTSO-E ([129]).

Before going into detail in the two different CBA methodologies, from the analysis of the main CBA methodology documentation and opinion reports from ACER and other stakeholders, our general concluding remarks are listed below:

- The modelling tools that have been used for electricity and gas projects are independent and therefore cannot account for interdependencies between the gas and electricity systems. As concluded by Artelys ([130]), separate CBA assessments for electricity and gas projects lead to underestimation or overestimation of project benefits. A joint CBA should be pursued to consider interlinkages of energy vectors, for example gas-to-power, power-to-gas, hybrid projects, hybrid heat pumps and electric/hydrogen vehicle demand. In this sense, the ENTSOs are developing an interlinked model to simulate electricity and gas systems that will allow this joint modelling framework;
- CBA assessments are based on a static approach of simulating the systems with and without the projects. As suggested by Artelys ([131]), a dynamic assessment comparing the project against a set of alternative solutions would add robustness to the conclusions for the project. The model would optimise how much is invested in the project versus a set of alternatives;
- In the context of the Paris Agreement and the European Green Deal, sustainability/decarbonisation shall be further addressed in the evaluation, especially in the gas CBA methodology;
- Projects should be modelled in all scenarios and all years. Otherwise, a limited conclusion is reached that might not apply in the remaining scenarios and years;
- The Florence School of Regulation ([132]) points at the lack of full monetisation of the CBA indicators as a pitfall of the CBA methodologies on the grounds of transparency and objectivity of the assessment process. The ENTSOs, however, have kept a multi-criteria approach in the successive versions of their CBA methodologies, with both monetised and non-monetised indicators.

Social discount rates need to be used to calculate present values of projects, as indicated by the Florence School of Regulation[132] and Copenhagen School of Energy Infrastructure (second webinar 'Selection procedure and criteria for PCIs'). In the case of ENTSO-E, on its draft third version of the CBA methodology, a unique discount rate (on real prices) is suggested, but no specific value is given nor a mentioning to a social discount rate, whereas ENTSOG suggests using a social discount rate of 4 %.

Additional suggestions for improvements have been found in the literature: various lifetimes depending on technology; account for renewable and decarbonised gases and their benefits; value the change in land use and local value; improved inclusion of the complexity of the electricity

[127] ENTSO-E (2018), 2nd Guidelines for Cost Benefit Analysis of Grid Development Projects. Retrieved from: https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/tyndp-documents/Cost%20Benefit%20Analysis/2018-10-11-tyndp-cba-20.pdf.

[128] ENTSOG (2018), 2nd ENTSOG Methodology for Cost-Benefit Analysis of Gas Infrastructure Projects. Retrieved from: https://www.entsog.eu/sites/default/files/2019-03/1.%20ADAPTED_2nd%20CBA%20Methodology_Main%20document_EC%20APPROVED.pdf.

[129] ENTSO-E (2020a), 3rd ENTSO-E Guideline for Cost-Benefit Analysis of Grid Development Projects. Retrieved from: https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/tyndp-documents/Cost%20Benefit%20Analysis/200128_3rd_CBA_Guideline_Draft.pdf.

[130] Artelys (2020a). TEN-E Regulation: how should it evolve to support the emergence of a net-zero future? Recommendations for scenario building, project assessment and PCI selection. A note commissioned by the European Climate Foundation.

[131] Artelys (2020a). TEN-E Regulation: how should it evolve to support the emergence of a net-zero future? Recommendations for scenario building, project assessment and PCI selection. A note commissioned by the European Climate Foundation.

[132] Florence School of Regulation (2020), Policy brief: Making the TEN-E Regulation compatible with the Green Deal: eligibility, selection, and cost allocation for PCIs. Retrieved from: https://fsr.eui.eu/publications/?handle=1814/67673.

systems ([133, 134]); two-step model approach (first: project within reference network, then project within new reference network including all projects that showed benefits in Step 1, which allows to compare competing projects); sensitivity analysis to be performed over most influencing project parameters; and LCA of GHG emission factors for full view of GHG impact, accounting for methane leakage in gas projects ([135]).

ENTSO-E CBA methodology for electricity projects

ACER stated its opinion ([136]) in the draft version of the third CBA methodology developed by ENTSO-E. Overall, ACER considers that the draft third CBA guideline exhibits improved methodologies for already existing indicators and introduces new ones compared to the second CBA guideline. However, ACER identified some missing elements in the methodology that should be addressed by ENTSO-E before its final version.

Yet, the two CBA methodologies between ENTSO-E and ENTSOG are not aligned (different indicators, different calculation procedures, etc.). ACER considers that an alignment of the CBA methodologies across electricity and gas sectors would increase the consistency of project-related decision-making and promote fairer comparison of electricity and gas infrastructures when they are potentially competing.

It should be noted that electricity storage projects and smart grid projects have different CBA methodologies. While electricity storage CBA methodology was developed by ENTSO-E (and included in the third CBA methodology), smart grid project CBA methodology was developed by the European Commission's JRC.

ENTSOG CBA methodology for gas projects

ENTSOG CBA methodology builds on multi-criteria analysis on the basis that not all benefits of projects can be monetised. For this reason, economic performance indicators and Economic Net Present Value only partially represent the balance between project costs and benefits. According to ENTSOG recommendations on its CBA methodology, when considering if the potential overall benefits of a project outweigh its costs, as per Article 4.1.b. of the TEN-E Regulation, the regional group members should also consider non-monetised benefits in addition to the economic performance indicators.

In the draft regional lists of proposed gas projects for the fourth PCI list ([137]), ACER states that ENTSOG did not provide the economic performance indicators to the NRAs for their assessment of candidate projects to comply with eligibility criteria, and they were not always available for the regional groups in their evaluation of the project candidates. According to ACER ([138]), only non-monetised indicators were used in the regional group evaluations (this is further explained in the regional groups analysis hereafter), the reason being, from ACER's opinion report, that the European Commission judged the monetised benefits results as too high due to erroneous application of the CBA methodology or errors in the methodology itself.

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[133] European Commission (2019b). Public engagement and acceptance in the planning and implementation of European electricity interconnectors. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/3rd_report_on_public_acceptance_b5.pdf.

[134] European Commission (2017a). Towards a sustainable and integrated Europe. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/report_of_the_commission_expert_group_on_electricity_interconnection_targets.pdf.

[135] Artelys (2020a). TEN-E Regulation: how should it evolve to support the emergence of a net-zero future? Recommendations for scenario building, project assessment and PCI selection. A note commissioned by the European Climate Foundation.

[136] ACER (2020a), Opinion no 03/2020 on the ENTSO-E draft of the 3rd Guideline for CBA. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2003-2020%20on%20ENTSO-E%20Guideline%20for%20cost%20benefit%20analysis.pdf.

[137] ACER (2019c), Opinion on the draft regional lists of proposed gas projects of common interest 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2019-2019%20on%20Gas%20PCI%20list.pdf.

[138] ACER (2019c), Opinion on the draft regional lists of proposed gas projects of common interest 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2019-2019%20on%20Gas%20PCI%20list.pdf.

The most recent CBA methodology (second version), published by ENTSOG in October 2018 ([139]) and approved by the European Commission in February 2019 ([140]), builds on feedback given to the draft version by Deloitte/Florence School of Regulation ([141]), ACER ([142]) and the European Commission ([143]). Webinars and working sessions were organised by ENTSOG to engage stakeholder participation. Many limitations pointed to by stakeholders were addressed by ENTSOG in its 2018 report ([144]). However, the following relevant issues remain to be solved or improved:

- Non-replicability of results: the system-wide modelling used for project assessment relies solely on tools and analytical processes implemented by ENTSOG and cannot be replicated by any other entity. Transparency is recommended by providing all calculation descriptions on the indicators and, for model-based indicators, detail of the model characteristics, network topology modelled, solver used, assumptions taken, input data, etc.;
- Simplification of results: overlapping indicators have been discarded but ENTSOG concedes further simplifications might be possible ([145]);
- Monetisation of benefits: benefits are not monetised to the maximum possible extent. In this regard, it must be said that monetisation is desirable but, in some cases, not achievable or too simplistic. ENTSOG intends to improve the current monetisation of some indicators and apply it to the maximum possible extent to the remaining non-monetised indicators. Cost of disruption of gas supply and social cost of CO2 are being addressed for future updates of the CBA methodology;
- Sustainability: sustainability assessment of gas projects is based on CO2 reduction derived from fuel-switching from more pollutant fuels like coal or lignite (all gas project candidates were evaluated as sustainable by ENTSOG for this reason). This may need to be revised and ensure that projects are compliant with full decarbonisation targets;
- Interlinked model for electricity and gas: at the time of writing the interlinked model is being developed.

Methodologies for assessing project candidates for PCI

Although the CBA methodologies outlined before are the basis for both the TYNDP and the PCI selection, the latter ultimately relies on the scoring and ranking of projects in the regional groups. These scores correspond to methodologies developed jointly by the European Commission (DG ENER), ACER and the ENTSOs under the Cooperation Platform, which provides technical assistance to the regional groups. The CBA methodologies for assessing electricity and gas candidates for the PCI list are different. As checked in the documentation from the last regional groups meetings to elaborate the draft PCI list, uploaded in the CIRCABC, the scoring methodologies used can be briefly described as follows:

Electricity projects methodology
Final score = weight x monetised benefits / costs + weight x non-monetised benefits.

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[139] ENTSOG (2018), 2nd ENTSOG Methodology for Cost-Benefit Analysis of Gas Infrastructure Projects. Retrieved from: https://www.entsog.eu/sites/default/files/2019-03/1.%20ADAPTED_2nd%20CBA%20Methodology_Main%20document_EC%20APPROVED.pdf.

[140] ENTSOG (2018), 2nd ENTSOG Methodology for Cost-Benefit Analysis of Gas Infrastructure Projects. Retrieved from: https://www.entsog.eu/sites/default/files/2019-03/1.%20ADAPTED_2nd%20CBA%20Methodology_Main%20document_EC%20APPROVED.pdf.

[141] Deloitte (2017), FSR Webinar: Public Consultation on Recommendable Updates for Gas CBA 2.0. Retrieved from: https://fsr.eui.eu/wp-content/uploads/20170310-webinar-gas-CBA2.0.pdf.

[142] ACER (2017), Opinion on the draft 2nd ENTSOG Cost-Benefit Analysis Methodology. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2015-2017.pdf.

[143] European Commission (2018b), Commission opinion on the draft cost-benefit analysis methodology concerning trans-European gas infrastructure. Retrieved from: https://ec.europa.eu/transparency/regdoc/rep/3/2018/EN/C-2018-6649-1-EN-MAIN-PART-1.PDF.

[144] ENTSOG (2018a), Stakeholders feedback and main changes to first CBA Methodology. Retrieved from: https://www.entsog.eu/sites/default/files/2019-03/3.%20ADAPTED_2nd%20CBA%20Methodology_Accompanying%20document%20-%20Stakeholders%20feedback_for%20Commission%20Approval_EC%20APPROVED.pdf.

[145] ENTSOG (2019) ENTSOG Roadmap for future Projects CBA Assessment. Retrieved from: https://www.entsog.eu/sites/default/files/2019-03/4.%20ADAPTED_2nd%20CBA%20Methodology_Accompanying%20document%20-%20Roadmap%20for%20future%20projects%20CBA%20assessment_for%20Commission%20Approval_EC%20APPROVED.pdf.

This is where the monetised benefits comprise socioeconomic welfare gain, adequacy, losses, reduction of costs for ancillary services, reduction of necessary reserve or redispatch, reduction of non-CO2 emissions. The non-monetised benefits include 15 % interconnection target thresholds, system flexibility and system resilience and total physical isolation. Costs correspond to CAPEX + OPEX.

The monetised part can attain a value of 20 according to a conversion table of B/C ratio to points, whereas the non-monetised part can attain 5 points.

Gas projects methodology
Final score = non-monetised benefits / costs score.

This is where non-monetised benefits include SOS (curtailed demand, single largest infrastructure disruption, access to new source), competition (supply source dependence, supply source access, LNG and interconnection capacity diversification) and market integration (physical isolation, adaptation to high-calorific gas). Costs are CAPEX + OPEX and are converted to a score from 0 to 10. Non-monetised benefits either contain discretional thresholds that must be met by the projects or are binary values (1 = yes, 0 = no).

ACER's opinion in the draft regional lists of proposed electricity ([146]) and gas ([147]) PCI 2019 pointed at different limitations on the assessment methodologies applied to electricity and gas projects:

- CBA indicators calculated for only one scenario, 'Distributed Generation', and one year, 2030. The choice of this scenario was motivated by its alignment with the EU targets and scenarios (in particular, for RES penetration, CO2 savings and gas demand levels). Although there was a motivation behind the selection of the scenario, evaluating projects under one single scenario and one year might give a limited evaluation since alternative futures and more long-term uncertainties are obviated. All years and scenarios should be considered as far it is practically possible for the final scoring and ranking;
- Use of non-monetised indicators for gas projects: contrary to the aim of the second CBA methodology of monetising to the maximum possible extent the evaluation indicators, all indicators considered to rank the projects were non-monetary and based on discretional thresholds that projects should meet;
- Disregard of sustainability for gas projects: the only sustainability indicator defined by ENTSOs CBA assessment is CO2 reduction. According to the scoring and ranking methodology used in the regional groups ([148]), this indicator was positive for all projects after fuel-switching from coal or lignite to gas. This needs further improvement and is considered to be of no use in the regional group assessments. Although the indicator may need further development, it could still have been considered as different levels of CO2 reductions must have presumably been found for the different projects. There was no proper consideration of the merits of the projects in terms of potential contribution to sustainability.

No assessment methodologies have been found in the CIRCABC for smart grids, cross-border CO2 network projects and oil projects. For smart grids, according to ACER on the fourth PCI list of electricity projects ([149]), smart grid projects were assessed primarily on KPIs instead of using the CBA methodology.

[146] ACER (2019d), Opinion on the draft regional lists of proposed electricity projects of common interest 2019. Retrieved from: https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2018-2019%20on%20Electricity%20PCI%20list.pdf.

[147] ACER (2019c), Opinion on the draft regional lists of proposed gas projects of common interest 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2019-2019%20on%20Gas%20PCI%20list.pdf.

[148] Methodology for assessing the gas candidate PCI projects PCI 2018-2019 exercise 27.6.2019 FINAL.

[149] ACER (2019d), Opinion on the draft regional lists of proposed electricity projects of common interest 2019. Retrieved from: https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2018-2019%20on%20Electricity%20PCI%20list.pdf.

Periodicity of the PCI lists

The periodicity of the PCI lists is the fifth provision analysed for its contribution to overall effectiveness. According to Article 3 of the TEN-E Regulation, PCI lists shall be established every 2 years, based on the regional lists adopted by the decision-making bodies of the regional groups as set out in Annex III.1. In recital 24 of the Regulation, it is explicitly mentioned that a new Union list should be established every 2 years and that all candidate projects undergo the same selection process, regardless of their inclusion on the prior PCI list. The rationale for assessing all projects for a new PCI list, including existing PCIs, is that all projects can be assessed on an equal basis and changes in (market) circumstances can be considered. Some project promoters do not see those benefits and consider it too burdensome that all projects go through the full application process for every PCI list (for more details see Section 4.3.1).

Optimal definition of priority corridors and thematic areas

The optimal definition of priority corridors and thematic areas are the next aspects analysed for their contribution to overall effectiveness. However, priority corridors and thematic areas are analysed in more depth in Section 4.4 (Relevance). In general, there is consensus on the need to revise priority corridors to adapt to the new reality of the energy sector, where sustainability/decarbonisation is the main priority. There are different suggestions for this revision, some of which are conflicting. The following suggestions were collected from stakeholders:

- ACER suggests: (1) new thematic area for cross-sectoral projects, in line with the EU Strategy for Energy System Integration. ACER has not provided more detail on what technologies to include under this category. Cross-sectoral projects can refer to any technology coupling the different energy-consuming sectors and energy carriers: power, gas, hydrogen, liquid fuels, heat, transport, industry. Technologies included can be power to heat or cooling, power-to-gas, power to vehicles, vehicles to power, etc. The EU wants to foster synergies between transport and energy in the revision of TEN-E and the Trans-European Transport Network (TEN-T) regulations through cross-border high-capacity recharging as well as possibly hydrogen refuelling infrastructure; (2) dismiss the thematic area electricity highways, given that projects included in this area are also included in electricity priority corridors; and (3) dismiss the oil priority corridor, not compatible with any road map towards the sustainability targets;
- ENTSO-E proposes priority corridors based on joint gas–electricity–hydrogen corridors, also in line with an energy integration approach;
- ENTSOG advocates for: (1) maintaining regional differentiation with distinct geographical priority corridors for the gas sector, in view of the gas infrastructure development being still necessary for fuel-switching in some regions; (2) readjusting priority corridors and areas to further enhance RES, decarbonisation, sector coupling projects and smart gas grid projects; (3) ensuring a flexible definition in view of uncertainties around emerging technologies. Infrastructure needs will vary according to the development of the emerging technologies market, which is uncertain. Periodic revision of priority corridors can be considered to adjust to markets and infrastructure needs;
- Other stakeholders have mentioned the following proposals for priority corridors and areas: (1) hydrogen, (2) clean gases, (3) sector coupling, (4) smart gas grids, (5) digitalisation, (6) distribution projects, (7) energy storage, (8) hybrid wind offshore, (9) hybrid solutions, (10) electric priority corridor to south Mediterranean/North Africa, (11) decarbonisation of islands, (12) smart sector integration, (13) electrification of heating and cooling systems, (14) peripherical countries, (15) include sector coupling and conversion to hydrogen in the priority corridor NSOG, (16) sector integration technologies and solutions, (17) renewable heating and cooling infrastructures, (18) dismiss oil and gas priority corridors.

According to the targeted survey results, there is more disagreement than agreement in the fitness of the current priority corridors and thematic areas to meet future challenges, as can be seen in Figure 4.27 in the coherence analysis (Section 4.5.1).

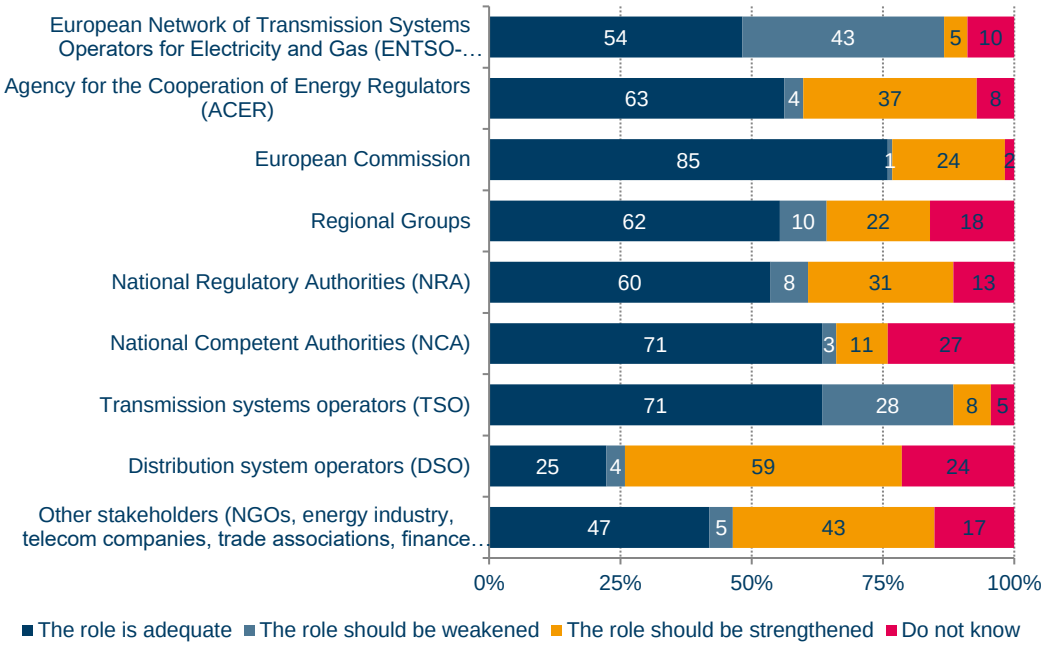
Adequacy of roles of the different agents in the PCI selection process

The seventh provision is that of the different agents in the PCI selection process and their role in contributing to the overall effectiveness of the Regulation. In the current process there is an important role for ENTSOs, which define the scenarios, implement the modelling exercise and define the CBA methodologies. The ENTSOs are in a good position to lead these processes, since these processes are also the basis for the TYNDP, and they have the most complete information of how the transmission networks operate and can be modelled. Thus, they seem to be best placed to assess and identify the energy infrastructure needs.

However, a considerable number of stakeholders do not consider them independent and are of the opinion that ENTSOs have an incentive to prioritise electricity and gas transmission infrastructure projects over other projects at a DSO level, electricity storages, LNG terminals or CCS projects. It may be controversial that the ENTSOs act as project promoters and at the same time set the methodologies for the overall assessment. Some stakeholders think that a more independent body like ACER or the European Commission should take a stronger role in the PCI selection-related procedures. More stakeholder consultation and validation of ENTSOs methodologies (scenarios, models and CBA) may be needed to ensure trust in the process.

This can be observed in Figure 4.15, where 43 % of stakeholders think that the role of the ENTSOs should be diluted, followed by the TSOs. No other actor is perceived similarly, according to the targeted survey. It should be noted that more stakeholders think that the ENTSOs' role is adequate (54 %) or should be strengthened (5 %) than the percentage of stakeholders that think the ENTSOs' role should be diluted (43 %).

Figure 4.15 Responses to the targeted survey: To what extent do you agree that the role of the different actors listed below is adequate in the selection procedure? (n=112)



Source: Targeted survey.

It should also be noted that the ENTSOs have been developing stakeholder engagement and consultation in recent years around scenario developments and CBA methodologies, as can be seen in the number of consultations, webinars and working groups organised when releasing new updates of their methodologies. Some stakeholders consider that their views are not sufficiently addressed and see a conflict of interest in the ENTSOs, being project promoters and developers of the methodologies against which the projects are assessed. ACER holds the same view, stating in its position paper of the revision of the TEN-E Regulation ([150]) that the ENTSOs have an inappropriately attributed role in the Regulation. ACER believes it should be conferred the powers to issue binding guidelines on the scenario development report, the CBA methodology and the TYNDP, as well as requesting amendments for the TYNDP. The Florence School of Regulation also

[150] ACER (2020), Position on Revision of the Trans-European Energy Networks Regulation (TEN-E) and Infrastructure Governance. Retrieved from: http://www.acer.europa.eu/Official_documents/Position_Papers/Position%20papers/ACER_CEER_paper_on_TEN_E.pdf.

suggests in its recent policy brief ([151]) to make scenarios developed by the ENTSOs subject to the approval of the European Commission and reallocate the approval decision for the CBA methodologies from the European Commission to ACER. The Florence School also presented this view on the third webinar 'TEN-E Regulatory toolbox and criteria for CEF financial assistance', which took place on 9 June 2020 as part of this revision work.

In view of the potential conflicting role of the ENTSOs, as project promoters and developers of the scenarios and CBA methodology over which projects are evaluated, and given the shared perception among stakeholders that ENTSOs have a predominant role that is not seen as fully independent, some mitigation measures may be taken to ensure trust on the PCI selection process from all stakeholders. Two different approaches can be taken: (1) enhance stakeholder engagement in all relevant steps of the PCI selection process, in particular, the scenario development and CBA methodology revisions approach that has been agreed by ENTSOs; or (2) consider giving ACER the power to approve and amend scenarios and CBA guidelines.

Reporting and monitoring

The reporting and monitoring provisions are another set of provisions analysed for their contribution to overall effectiveness. This section first analyses the PCI implementation plans and monitoring procedures, followed by the analysis of the transparency platform, the role of the regional groups and the added value of the high-level groups.

PCI implementation plans and monitoring procedures

Project promoters must submit a PCI implementation plan that includes a timetable containing dates on deliverables for studies, the estimated dates of approval by NRAs, construction and commissioning dates and a detailed permitting schedule (Section 3.3.2). The information in the PCI implementation plan is used by ACER to assess and report on project implementation. Certain delays are highlighted by monitoring the progress of a project through yearly updates and, additionally, comparing the progress with the initial PCI implementation plan. The implementation plans, regular updates and the monitoring procedures applicable to PCIs are intended to accelerate progress of PCI implementation by providing transparency and sharing lessons learned.

The CO2 TransPorts case study shows that parts of the monitoring criteria (e.g. information to be reported annually) can be either difficult to report or less relevant for project promoters of PCIs involving sources other than electricity or gas. Some stakeholders, in particular two non-TSO project promoters and one involved NCA, verified in interviews that a lack of adequate formats and clarity in the monitoring process causes unnecessary difficulties for project promoters.

Other stakeholder consultation findings highlight that although the need for monitoring is generally acknowledged, stakeholders have doubts about the accelerating effect of the relevant tools. Only 40 % of the project promoters and 25 % of the NRAs consider the tools to benefit timely project implementation. Overall, only 32 % of the stakeholders believe that the PCI implementation plans and regular updates ensure timely project implementation. Project promoters generally do not acknowledge any impact from the implementation procedures and monitoring outcomes. Both ACER and project promoters argue that, given the lack of impact, the monitoring exercise should be done biennially instead of annually. The main issues raised are that the transparency platform is outdated and that it is not clear what is done with the monitoring results.

We used the monitoring data during the portfolio analysis as part of the evaluation. We can confirm that there is still room for improvement in the monitoring procedures in terms of data quality, consistency and usability. Project promoters' responses vary in what is or is not included (it appears that project promoters are not obligated to respond to all questions in the monitoring forms), the formats of the monitoring data for different infrastructure categories are inconsistent and not all categories are included in the data summaries (cross-border carbon dioxide networks, smart grids and oil projects are not included), which created difficulties in the analysis. Although response rates and consistencies have significantly improved over the years, there is still room for improvement by aligning and possibly combining the available datasets and including remaining infrastructure categories.

([151]) Florence School of Regulation (2020), Policy Brief: Making the TEN-E Regulation Green Deal compatible – Eligibility, selection and cost allocation for PCIs. Retrieved from: https://fsr.eui.eu/publications/?handle=1814/67673.

Transparency on fundamental project information is regarded as a profound value underpinning the reliability of the PCI selection process of the Regulation ([152]). However, as outlined above, not only does ACER monitoring report present an issuing frequency that does not allow sufficient project advancement from the time the project is added to the PCI list, but it also lacks accurate and up-to-date information, for which some project promoters claim confidentiality. To overcome this hindrance, ACER proposes to change the frequency of issuing from once a year to once per PCI list, while it underlines the importance of public availability of project information, including project costs, project status, capacity increase and commissioning date, etc. Such a degree of information availability should be applicable for projects included in the PCI list, the TYNDPs and the National Network Development Plans (NNDPs).

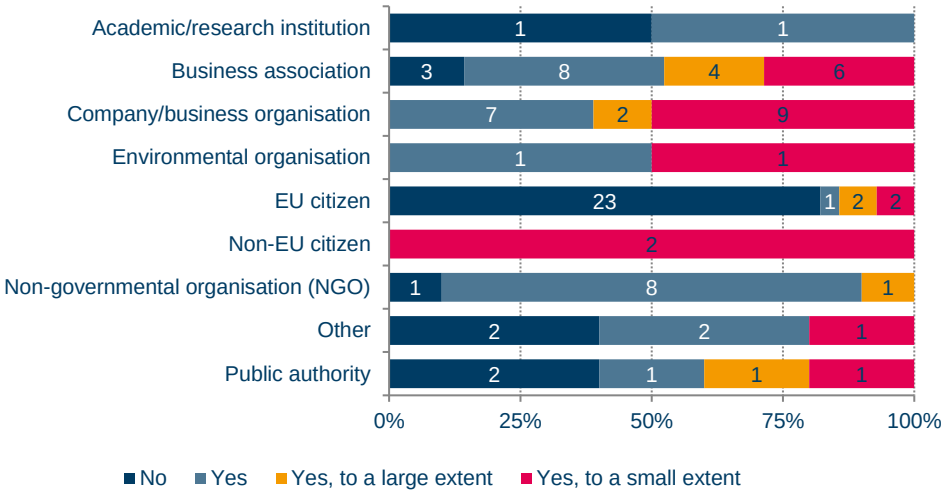
In the interview and targeted consultation, the ENTSOs have a slightly different opinion on the current monitoring set-up offered by the Regulation. In response to the question 'Are current reporting and monitoring procedures on the PCI progress sufficient to ensure transparency on PCI development?', ENTSOG adopted a neutral position by neither agreeing nor disagreeing, while ENTSO-E saw some level of redundancy on the current monitoring and reporting procedures. The ENTSOs also suggest that ACER monitoring report should not be issued annually but published to focus on specific changes of project developments and implementation.

Transparency platform

The transparency platform is a service to enhance public access to information about the ongoing PCIs. It is maintained by INEA ([153]).

The results from our targeted survey outline that very few stakeholders, mainly belonging to business associations, are familiar with the PCI interactive maps on the transparency platform (Figure 4.16).

Figure 4.16 Responses to the survey: Are you familiar with the PCI interactive map on the transparency platform? (n=93)



Source: Targeted survey.

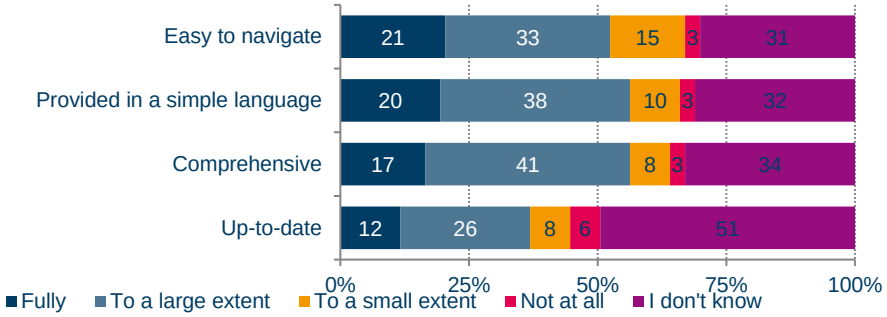
Looking at the responses in Figure 4.16, the predominant message is that 50 % of the respondents are unable to critically assess how up-to-date the information presented in the transparency platform is. Yet, more than 50 % of the stakeholders responded positively to the 'easiness' of the

[152] ACER (2020), Position on Revision of the Trans-European Energy Networks Regulation (TEN-E) and Infrastructure Governance. Retrieved from: http://www.acer.europa.eu/Official_documents/Position_Papers/Position%20papers/ACER_CEER_paper_on_TEN_E.pdf.

[153] The transparency platform: https://ec.europa.eu/energy/infrastructure/transparency_platform/map-viewer/main.html.

navigation feature, the simplicity of the language utilised and the level of comprehensiveness of the platform.

Figure 4.17 Responses to the survey: How would you assess the PCI interactive map on the transparency platform, which includes the geographic information, implementation plan, amount of EU financial support and the benefits that each project brings at national and local level? (n=103)



Source: Targeted survey.

In general, NGOs are of the opinion that the PCI interaction map is a useful tool, but it is not always considered up-to-date. There is also missing climate information, such as references to parameters included in GHG emissions assessments. While companies, business associations and organisations recognise the step towards a more ample spectrum of transparent information on PCIs, they also ask for an update of the platform which should include additional information on, for instance, heating infrastructures, CO2 equivalent intensity, benefits at national and cross-country level and less technical language.

The role of regional groups in monitoring

The establishment of regional groups is aimed at supporting regional cooperation. These groups, whose work is managed by the European Commission, play a leading role in the underlying processes of the TEN-E Regulation and have been meeting regularly since 2013 (for a detailed description of the processes and the role of regional groups, see Section 3.3.1). The identification and selection process of PCIs as well as the streamlining and standardisation of permitting processes are based on regional cooperation. Regional groups address their specific priority corridors or thematic areas and identify pressing infrastructure needs and bottlenecks in the region that could not be effectively addressed by more efficient use of the existing infrastructure and/or market measures and thus require an investment in new infrastructure ([154]).

For the regulated electricity and gas sectors, there are dedicated methodologies for needs identification and project candidate assessment. Additionally, aiming for consistent needs identification and assessment in each sector, the procedure for other sectors is similar to the methodologies for gas and electricity projects. However, due to possible misalignments caused by the application of the dedicated methodologies to other sectors, an important role lies with regional groups in supporting project promoters during the process and possibly during the application ([155]). Recognising the important role of the energy regulators in the process, during the selection of PCIs for the fourth PCI list the European Commission invited ACER and the NRAs to actively engage in the process. As members of the regional groups but not being part of the DMB of the groups, this action aimed to support the involvement of the regional group.

[154] European Commission (2019f), Commission staff working document accompanying the document commission delegated regulation amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/swd_2019_395_1_other_staff_working_paper.pdf.

[155] European Commission (2015), COMMISSION STAFF WORKING DOCUMENT Accompanying the document COMMISSION DELEGATED REGULATION amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest.

Stakeholder consultation shows that a large majority of stakeholders consider the regional group model to be appropriate and effective, although issues are raised concerning a lack of transparency and high administrative costs in the process. Some 83 % of the respondents to the targeted survey either agree (67 %) or completely agree (14 %) that the regional group model enables regional cooperation, although six TSOs mention that regional cooperation sometimes needs other layers as some regions are too large to have a shared regional interest. In the context of new technologies, stakeholders questioned the use of regional groups in the future where a thematic approach is considered a better fit for this purpose: four NGOs, two NCAs and at least three TSOs (some were supportive but did not explicitly express a preferred approach) acknowledged that emerging technologies should be treated as thematic groups such as CO2 networks and smart grids. Furthermore, some stakeholders (two NGOs and two TSOs) agreed that an EU-wide approach would be more fit for purpose in light of the EU targets on the integration of renewables. During the interviews, two TSOs stated that the (administrative) costs for participation in regional groups can be high when compared to other types of costs and two NCAs also experienced inefficiencies in the administrative burden of the regional group process. Six interviewees (two academics, three TSO/project promoters and one NGO) raised issues on the transparency of the decision-making process of the regional groups: the decisions made during the PCI selection process were not considered fully transparent due to the unavailability of relevant information on the consideration, comparison and ranking of the PCI candidates (threshold values and underlying data were mentioned).

The added value of high-level groups

Regarding the alignment of regions and Member States, in 2015 and in light of the TEN-E Regulation, four high-level groups (Section 3.3.1) were established to enhance regional cooperation underpinned by the highest political support for specific areas by 'preparing a common regional political vision, drawing up regional priorities, providing strategic guidance and political support for the implementation of PCIs requiring strong consensus' ([156]). Although no insights are available in studies regarding the added value, weaknesses or potential overlap with regional groups of the high-level groups, the European Commission's Staff Working Document highlights that the Commission's initiative to form these groups was adopted successfully for all four high-level groups within a time span of 6 months in 2015. The high-level groups have since steered the PCIs in addressing the specific infrastructure needs of the priority regions, as is shown by, among others, PCIs established to speed up construction of missing gas infrastructure links within the Central Eastern and South-Eastern European Gas Connectivity (CESEC) High-Level Group and multiple offshore connections within the North Seas region reinforcing interconnectivity between the North Seas Countries Offshore Grid Initiative (NSCOGI) high-level groups.

In the stakeholder consultation, most stakeholders acknowledged the value added through strategic steering and political guidance, and some considered their role in monitoring effective. The majority of the respondents of the targeted survey agreed (56 %) or completely agreed (17 %) that high-level groups provide added value through strategic steering and political guidance as well as monitoring PCIs in the priority region, while 25 % were neutral and only one respondent, an NCA, disagreed. Two NRAs mention that high-level groups have the advantage of bringing together experts from various areas and providing support on a political level, but also highlight that the work of such groups is potentially very intensive, capacity can be scarce and the value added is lower on a detailed level, emphasising that high-level groups should only be deployed in specific circumstances. Following a similar rationale, a TSO added that, regarding monitoring, regional groups are more adequately involved in the process.

Access to CEF grants

A final key provision of importance is the access to CEF grants. As discussed in Section 4.2.1, CEF has provided substantial grants to PCIs for both studies and works. Multiple TSOs acknowledge the role of such grants in enabling projects that would otherwise be commercially unviable. In interviews, gas TSOs mentioned grants specifically as the primary benefit from PCI status. This indicates strong support for achieving an integrated gas market and advancing SOS by supporting projects that forge weak or absent links.

[156] European Commission (2015), COMMISSION STAFF WORKING DOCUMENT Accompanying the document COMMISSION DELEGATED REGULATION amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest.

Summary

In summary, given the objectives of market integration, competitiveness, SOS, and energy and climate targets, the main provisions that are ensuring the contribution to these objectives are the regional group set-up for the PCI selection, the focus on cross-border infrastructure projects and the approach of sharing costs according to benefits (CBCA) as well as the financial support from CEF grants. Of the main provisions, those establishing and ensuring a cross-border dimension of projects are most important in promoting the overall objectives.

However, detailed selection provisions prevent higher achievement of the climate objective. Although PCIs have helped to fulfil most of the current objectives of the TEN-E Regulation (as conceived in 2013), the transformation needed for the energy sector to comply with the decarbonisation targets of the Paris Agreement and the European Green Deal will challenge the achievement of sustainability in the future. More focus should be put on sustainability as, at the time of writing, it is not being fully assessed, especially for gas projects. Procedures and techniques for the proper assessment of the projects' contribution to sustainability need to be further developed.

Some of the current selection criteria might be too restrictive for the inclusion of projects at DSO level, in particular: for example, the cross-border impact criteria, and the 10 kV voltage threshold and 20 % RES origin for smart grids. A more flexible definition of the cross-border impact may allow to include relevant projects in one Member State with significant and quantifiable benefits in other Member States with regards to the objectives of the TEN-E Regulation.

In the network planning process, the models of the electricity and gas systems are independent, not allowing to consider interdependencies between systems. However, the ENTSOs are developing an interlinked model with a view to develop in the future the network planning process to a 'system of systems' approach, including all energy vectors and demand sectors. This approach is welcomed and aligned with the European Commission European Strategy for Energy System Integration.

CBA methodologies are not aligned between electricity and gas, which does not allow fair comparison between electricity and gas projects since they can potentially compete to address system needs. Additionally, ACER found some specific limitations (regarding indicator calculations, etc.) on the current methodologies that shall be addressed by the ENTSOs.

On the one hand, the ENTSOs, as TSO operators, have the highest technical knowledge of the electricity and gas network conditions and their operation. Thus, they seem to be the right actors to lead the evaluation of system needs and of the projects that may address those needs more effectively. On the other hand, the ENTSOs may have a conflict of interest as project promoters and designers of the methodologies against which PCI candidates are evaluated. In both the targeted survey and interviews, stakeholders have expressed their concern on the ENTSOs' independency and objectivity when designing the scenarios, the models and the CBA methodologies, as the basis of the PCI selection process. Greater stakeholder consultation and validation/approval of ENTSO assumptions (in scenarios and modelling) and CBA methodologies by a third party may be needed to ensure trust in the process.

Some stakeholders find the biennial periodicity of the PCI lists unnecessarily burdensome. They suggest that full reassessments should not be performed every 2 years, but only relevant changes on the project development should be reported to update their PCI status. Additionally, some project promoters commented that the risk of losing the PCI label every 2 years carries a risk for investors.

Priority corridors and thematic areas need to be updated to address future challenges and incorporate new types of projects. A wide range of suggestions was received from targeted surveys and interviews with stakeholders.

- Consider new infrastructure categories, including energy system integration, digitalisation and smart grids, clean gases, hybrid projects, and others. While some of the categories imply new technologies not as yet addressed by the TEN-E Regulation, others refer to existing technologies but focus on infrastructure needs that define specific priority corridors or thematic areas:
  - energy system integration: cross-sectoral projects, joint gas–electricity–hydrogen corridors, sector coupling projects, sector integration technologies and solutions;
  - digitalisation: smart gas grid projects, digitalisation, distribution projects, smart sector integration;
  - clean gases: hydrogen, clean gases;

  - hybrid projects: hybrid wind offshore, hybrid solutions;
  - other: energy storage, electric priority corridor to south Mediterranean/North Africa, decarbonisation of islands, electrification of heating and cooling systems, peripherical countries, renewable heating and cooling infrastructures.
- Discard existing infrastructure categories: electricity highways, oil priority corridor. Additionally, some stakeholders (NGOs and RES promoters) suggested that gas infrastructures should no longer be eligible on the grounds of decarbonisation. However, as stated in Section 4.4 (Relevance), gas infrastructure represents a ready and cost-effective transitional solution for some regions and, since it has the potential to be refurbished to transport clean gas in the future, other stakeholders recommended keeping it.

According to ACER's opinion on the fourth PCI list, the documentation reviewed from regional group meetings and impressions received in the stakeholder consultation, the assessment of projects in the regional group meetings lacks transparency and traceability regarding the process of inclusion of projects on the draft list.

As for reporting and monitoring, the transparency platform and the PCI interaction map are valued positively. The need for PCI implementation plans, regular updates and monitoring procedures is generally acknowledged, and the process has improved over the years. However, in their form at the time of writing specifically, their added value remains questionable and stakeholders are doubtful of any accelerating effects because of the quality of the process and a lack of follow-up on the information. ACER proposed publishing its annual monitoring report biennially with every PCI list and then only focusing on relevant changes, according to some stakeholder claims.

Although there are concerns over a lack of transparency and high administrative costs in participation, the regional groups' role in project monitoring is considered adequate, successful and to sufficiently enable regional cooperation. Stakeholders consider the high-level groups to provide added value through strategic steering and political guidance in their corresponding priority regions.

Need for changes in the scope or provisions

A thorough assessment of the adequacy of the infrastructure categories and the considerations for change in the scope will be provided under the criterion of Relevance (see Section 4.4). In short, there is strong debate around the broadening of the technological scope to integrate more technologies supporting a decarbonised energy system. Possible technologies to be considered include distribution with a stronger focus on demand response and energy efficiency, sector integration through projects like power-to-gas and infrastructure for hydrogen transmission ([157, 158, 159]).

As discussed, broadening the geographical scope to include projects with third countries as PCIs can create benefits towards achieving the current objectives of SOS as well as climate targets for peripheral Member States.

It should be noted that the contribution of the main provisions described in the previous section refers to the set of objectives at the time of writing. As described, the criterion to assess sustainability in the PCI selection process would need to be strengthened to ensure a consistent contribution to the EU's climate and energy targets. In addition, the focus on cross-border projects and the resulting improved capacities for energy flow between Member States, as well as regional groups for the selection of PCIs, have proven beneficial in relation to the objectives of market integration and SOS. While there is no doubt that these overall objectives remain important, closer alignment of the key provisions to the climate targets may be necessary. As previously described,

[157] Trinomics (2019). Impact of the use of the biomethane and hydrogen potential on trans-European infrastructure. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/10e93b15-8b56-11ea-812f-01aa75ed71a1/language-en?WT.mc_id=Searchresult&WT.ria_c=37085&WT.ria_f=3608&WT.ria_ev=search.

[158] Artelys (2020). An updated analysis on gas supply security in the EU energy transition Final report. Retrieved from: https://www.artelys.com/wp-content/uploads/2020/01/Artelys-GasSecurityOfSupply-UpdatedAnalysis.pdf.

[159] Florence School of Regulation (2018), Policy brief: Sector Coupling: the New EU Climate and Energy Paradigm? Retrieved from: https://fsr.eui.eu/wp-content/uploads/QM-AX-18-017-EN-N.pdf.

this strongly relates to the sustainability criterion. Further possible changes to the scope will be discussed in the section on Relevance (see Section 4.4).

External factors influencing the achievements of the TEN-E Regulation

As discussed, the effectiveness of the TEN-E Regulation is affected by external factors: national legislation and implementation, national energy strategies and wider political development influence the different overall and specific objectives. Other EU legislation also has an impact on the effectiveness of the Regulation.

One factor described as strongly influencing the effectiveness of permit-granting provisions is the surrounding national legislative framework for permitting requirements and the implementation of the one-stop shop approach in the Member States. Multiple stakeholders indicate in both the survey as well as the interviews the important effect these factors have on the duration of the process. Project promoters mentioned that national provisions need to be fulfilled and therefore shape the process to a high degree. An example of national requirements that extend the permit-granting process is the number and form of public consultations that can differ from the provisions of the TEN-E Regulation. Moreover, implementation from the one-stop shop was described by some project promoters as providing little support in the case of their projects and their national contexts, while other project promoters reported strong improvements from the establishment of a single authority for the permit-granting process. These differences show that the national permitting legislation and procedures are an important external factor that ensure or hamper the shortening and facilitation of the permitting process.

The different causes for delays to projects also often do not fall within the scope of the TEN-E Regulation. In fact, other pieces of EU legislation can be the basis for higher barriers to obtain permits. The EU environmental *acquis* establishes the assessment of environmental impacts for the decision about granting a permit. Project promoters referred to this requirement in interviews to describe the causes for delays. Public opposition to the initial planning was also found to be a common reason for delays. In combination, environmental requirements and public opposition form a specific development that was described multiple times by different project promoters, predominantly with regard to electricity projects. An environmental impact assessment was obtained for the initial route, which subsequently had to be changed due to public opposition. Additional impact assessment and design studies were subsequently necessary to obtain the permit for the revised route. These processes and provisions obviously ensure the rights of citizens and the conservation of habitats and species across the EU. They are indicated here as an external factor influencing the permit-granting duration of PCIs. In this context, while duration can be strongly impacted by external factors, the grants for studies from CEF need to be emphasised again as an important factor in enabling PCIs. With 104 study actions supported, including the need for additional studies, the grants increase financial security in cases of permitting delays due to re-routing.

The achievement of overall objectives is also impacted by other pieces of EU legislation. As described in Section 2.2 above, the TEN-E Regulation is part of a broad range of energy policies, most of which pursue the same objectives of market integration and competitiveness of the internal energy market. Achievements of SOS have notably also been promoted by the Security of Supply Regulation ([160]) and the Network Codes Regulations ([161]) have contributed to the improvement of the SOS for gas by creating a common framework and enabling cooperation between Member States. Statements by stakeholders from the energy industry in the targeted survey also mentioned the influence of these other regulations. Energy Union and Climate Action Governance regulation, notably through the NECPs, also promotes increased regional cooperation between Member States in relation to energy policy planning and implementation.

As the TEN-E Regulation targets the energy infrastructure, the objectives for SOS as well as the contribution to climate targets also depend on the choice of energy source to satisfy the demand in Europe. Whether gas, lignite, oil, nuclear energy or certain RES are used depends therefore on additional external factors. The choice in turn depends on national political decisions, technological developments and price developments (including the price for CO2 emissions) as mentioned by stakeholders of different categories in interviews.

[160] Regulation 2017/1938/EU and previously Regulation 2010/994/EU.
[161] Inter alia: Regulation 2014/312/EU, Regulation 2015/703/EU, 2017/460/EU.

Geopolitical decisions were mentioned by a stakeholder as an additional external factor. According to a non-national stakeholder, the selection of certain PCIs over others was subject to political influences that go beyond energy politics but may influence the achievement of the overall objectives.

4.2.3 Evaluation question 3

What unintended or unexpected positive and negative effects, if any, have been produced by the TEN-E Regulation (e.g. in terms of human health, use of resources and natural ecosystems)?

Conclusions

No conclusions on unintended or unexpected effects from the TEN-E Regulation can be drawn.

Analysis

There is no evidence for unintended or unexpected effects from the TEN-E Regulation from the data available at the time of writing.

4.3 Efficiency

4.3.1 Evaluation question 4

To what extent are the costs resulting from the implementation of the TEN-E Regulation proportionate to the benefits that have been achieved? What are the major sources of inefficiencies?

Conclusions

The Regulation's socioeconomic benefits include increased SOS with more integrated and competitive energy markets. The Regulation also contributed to improved information availability, coordination and transparency. The modelling shows that the net socioeconomic benefits for gas PCIs for 2020 are positive. Forward-looking analysis for a 2030 market situation shows positive net benefits in a high price environment scenario. For electricity PCIs, the TEN-E Regulation realises positive net socioeconomic benefits in 2030 in higher CO2 price scenarios (from EUR 25/tonne).

The costs of the Regulation consist mainly in the administrative burden for project promoters, NRAs, NCAs, ACER, the ENTSOs and the European Commission (indicated by EC in the figure below). A detailed cost assessment is outside the scope of the study, but, based on a cost-driver analysis, we conclude that the benefits of the TEN-E Regulation outweigh the costs, despite the conservative estimate of those benefits. It is unlikely that the benefits could have been achieved in a more efficient way.

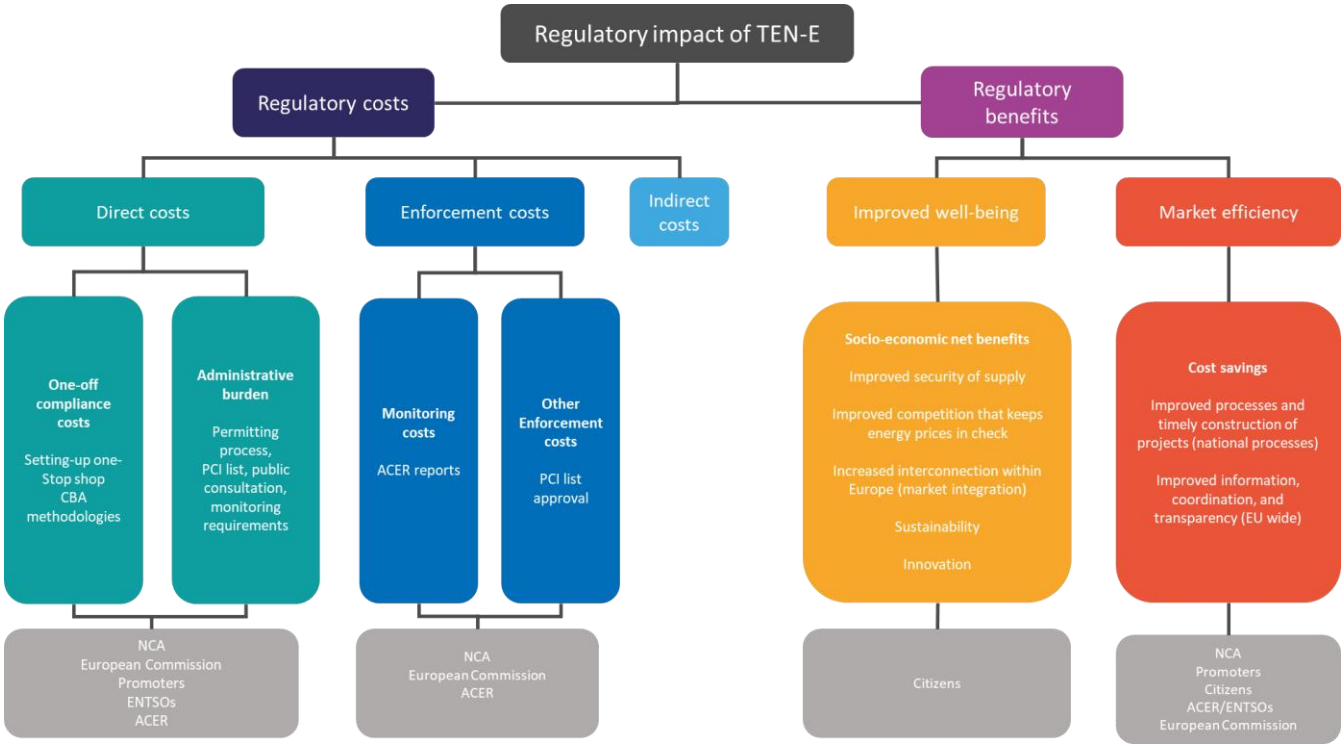
Nonetheless, there are opportunities to reduce the administrative costs of some provisions, such as the monitoring requirements and the PCI selection process in the case of application renewal.

Analysis

To answer to what extent the costs are proportionate to the benefits of the TEN-E Regulation, a typology of costs and benefits is developed in Figure 4.18. That typology of costs and benefits follows the Better Regulation Guidelines ([162]) and includes an overview of which stakeholders are impacted by the different cost and benefit categories. Figure 4.18 provides an overview of the realised benefits and costs.

[162] European Commission (2017), Better Regulation Guidelines. Retrieved from: https://ec.europa.eu/info/sites/info/files/better-regulation-guidelines.pdf.

Figure 4.18 Typology of costs and benefits of the TEN-E Regulation



Benefits

The typology of benefits includes two main categories of benefits: socioeconomic benefits (improved well-being) and market efficiency.

Socioeconomic benefits

The improved well-being benefits include the socioeconomic benefits of implementing the TEN-E Regulation, such as improved SOS, improved competition that keeps energy prices in check, increased interconnection and sustainability (including RES integration). Those societal benefits are closely related to the objectives of the Regulation and, thus, there is a close link to the Effectiveness questions and their findings. Furthermore, the focus is on the benefits for gas and electricity. The main benefits realised include SOS, improved competition and increased integration. Sustainability and innovation are benefits that were realised to some extent, but to a lesser extent than the other benefits. This section discusses each of the benefits and the analysis conducted.

Based on the Regulation effectiveness analysis and the modelling results, the net socioeconomic benefits are positive. The modelling found that for gas PCIs the net socioeconomic benefits for 2020 are positive. Forward-looking analysis for a 2030 market situation shows positive net benefits in a high price environment scenario. For electricity PCIs, the TEN-E Regulation realises positive net socioeconomic benefits in 2030 in higher CO2 price scenarios (from EUR 25/tonne). Overall, the modelling shows that the past and present socioeconomic net benefits of gas projects implemented to date are positive. The effectiveness analysis finds that the main socioeconomic benefits realised include SOS, improved competition and increased integration. Table 4.3 summarises the specific socioeconomic benefits.

Table 4.3 Assessment of socioeconomic benefits of the TEN-E Regulation

Socioeconomic benefit	Assessment
SOS	Realised benefit primarily for gas
Improved competition	Realised benefit
Increased integration	Realised benefit
Sustainability	Realised to some extent (especially for electricity projects)

Socioeconomic benefit	Assessment
Innovation	Realised to some extent, difficult to quantify/monetise. Not the main benefit of TEN-E.

The Regulation realised clear SOS benefits, primarily for the gas infrastructure. The effectiveness analysis concludes that the TEN-E Regulation has benefited the SOS in European energy networks, with largely improved conditions compared to those recorded prior to its establishment. Stakeholders also see important TEN-E Regulation contributions to SOS and stress the importance of continuous investment in gas infrastructure with a focus on the remaining bottlenecks. The modelling exercise also shows that TEN-E mainly realised positive net benefits in the gas sector in terms of SOS, but those benefits declined over the period. The modelled SOS benefits of the already commissioned PCIs are substantial under a 2013 market situation (EUR 193 million/year), but they provide lower benefits under current 2020 market conditions (EUR 118 million/year). The modelling results show that the electricity PCIs have helped several Member States to either reach or get closer to the 10 % interconnection target. A number of Member States have further improved their interconnection level.

The TEN-E Regulation also realised the benefits of improving competition on the EU energy market. The evaluation of TEN-E effectiveness highlights that the Regulation has contributed to the EU achievements in competition by supporting interconnections between Member States and integrating new sources of supply to increase competitiveness of the EU energy market. The modelling exercise further shows that price divergence across the European Union is decreased due to the commissioned PCIs, by 0.33 % for electricity and 2.63 % for gas, when comparing the situation in 2020 to the baseline, thereby indicating a positive effect on competitiveness.

The intended increase of integration on the EU energy market is also found to be benefited by the TEN-E Regulation. TEN-E has contributed to the substantial EU achievements in market integration by supporting interconnections between Member States and integrating new sources of supply. Modelling results underpin that commissioned PCIs have increased trade between EU Member States substantially for electricity (16.2 %) and marginally for gas (2 %) compared to the 2020 market situation without those projects.

The modelling results show that improved competition and increased integration provide about EUR 127 million and EUR 205 million of benefits each year for gas and electricity, respectively, assuming 2020 market circumstances. Those estimates are conservative, as modelling cannot capture part of the competition-related benefits (e.g. price reduction given by incumbent supplier).

Regarding sustainability, the TEN-E Regulation has realised benefits to some extent, especially for electricity projects. The discussion on effectiveness in Section 4.1.2 concluded that electricity PCIs contributed to EU climate targets as they allow integration of renewable energy sources into the market. The modelling results highlight that the realisation of electricity PCIs has resulted in a decrease of CO2 emissions by 2 804 kilotonne in the EU28 by 2020 and will continue decreasing emissions by up to 10 051 kilotonne by 2030. For gas PCIs, the modelling estimates the emission reduction benefit to be around EUR 6 million per year.

It is particularly difficult to quantify or monetise whether the TEN-E Regulation has realised benefits concerning innovation. Innovation is not a main benefit of TEN-E, but the effectiveness analysis indicates that there are some benefits for innovation. However, the benefits have been limited because the TEN-E focus on SOS and market integration benefits traditional infrastructure primarily.

Market efficiency

The market efficiency benefits refer to benefits that improve information, increase cost savings and ensure that a wider range of products or services are provided. In the context of the TEN-E Regulation, such benefits include improved processes (e.g. faster permitting processes, effective CBCA process, etc.), information and transparency. Those benefits are difficult to monetise as stakeholders have a hard time disentangling them, but the benefits are indirectly captured in the modelling. Improved market efficiency ensures that the PCIs would be completed in a timely manner and, thus, increase the benefits of the overall regulation. This section provides a qualitative assessment of the market efficiency benefits, with a summary shown in Table 4.4.

Table 4.4 Assessment of the market efficiency benefits

Market efficiency benefit	Assessment
Improved processes and timely construction of projects	There is mixed evidence. The effect of the TEN-E Regulation on permitting processes differs between Member States. The main observed benefit of CBCA decisions is to gain access to CEF funding for works, not the allocation of costs across borders.
Improved information, coordination and transparency	Increased data availability and improved cooperation are clear benefits. TEN-E improved transparency, but there can be improvements made to the transparency of the decision-making process of regional groups and to the data quality.

One of the TEN-E Regulation's market efficiency benefits is that it led to **improved processes and timely construction projects**. The processes analysed are the permit processes and the CBCA processes. The information collected provides mixed evidence on whether they improved processes.

With regard to the permitting processes, there is mixed evidence on the benefits of the TEN-E Regulation because the effects on the permit processes differ between Member States. Based on the findings from the effectiveness assessment, permit-granting procedures have shortened for PCIs compared to the pre-TEN-E situation. The introduction of a one-stop shop provides a good approach to reducing the complexity of the permit process, but the effectiveness is limited, as it depends on the national implementation and existing permit requirements in the Member States. Only a minority of respondents to the targeted survey agree that the Regulation has reduced administrative costs. The success of the one-stop shop varies across Member States. Where the Regulation may have helped to reduce the time required for project implementation, those benefits are already included under socioeconomic benefits.

The main observed benefit of CBCA decisions is to gain access to CEF funding for works, not the allocation of costs across borders. CBCAs prove to be effective in some cases, but a question remains on the valuation of the mechanism, as it is a step in an application for CEF grants. For all cases where CBCA decisions were made, the project promoters consecutively applied for CEF grants. The objective of accessing CEF funding was indicated by stakeholders as more important than the allocation of costs between Member States. Furthermore, in the targeted survey, stakeholders consider the CBCA to be burdensome and that it can result in project delays. Although it has been effective in specific cases, CBCA decisions are almost exclusively requested as the mandatory step towards applying for CEF grants for works. Where the CBCA decisions contributed to project completion, those benefits are already included under socioeconomic benefits.

The second set of market efficiency benefits is that of **improved information, coordination and transparency**. The effectiveness analysis found that TEN-E improved transparency. The TEN-E Regulation provides insight into the system needs and progress of PCIs. The PCI selection process has facilitated cooperation, but the effectiveness analysis also found that transparency can be improved in the decision-making processes of regional groups and, although already improved over the period, in terms of data quality. The stakeholders in the targeted survey and interviews acknowledge that TEN-E has contributed to cooperation in the European Union. Stakeholders are generally positive about information and transparency, but there are opportunities for improvement regarding the DMB decision-making processes, where ACER, for instance, suggests making available complementary evaluations by the DMBs (if any) on top of the assessments carried by the regional groups (see Section 4.2.2). Based on this evidence, increased data availability and improved cooperation are clear benefits. Not all such benefits are captured under socioeconomic benefits in the modelling, as non-PCIs may also benefit as part of the benefits will result in the future.

Costs

The Better Regulation Guidelines outline three main categories of costs: direct costs (including compliance costs, administrative burden and hassle costs), enforcement costs and indirect costs. The typology of costs developed for the TEN-E Regulation (see table below) includes the direct costs of administrative burden and one-off compliance costs that the project promoters, NRAs, NCAs, ENTSOs and ACER incur as a result of implementing the Regulation. The typology also includes the enforcement costs, which consist of the monitoring requirements for ACER, ENTSOs and the European Commission (indicated by EC in the table below), and other enforcement costs such as the PCI list approval. As part of this typology of costs, the regulatory incentives/CBCA are

not considered as costs because they are a reallocation of costs between stakeholders that would be incurred regardless of the Regulation.

It is generally difficult for stakeholders to disentangle the costs associated with TEN-E, so only limited quantitative data could be collected. For that reason, the questions in the targeted survey and interviews focused on the (qualitative) cost drivers that stakeholders experience, i.e. which part of the Regulation results in the most costs and why. Using that information, we identified the main cost drivers per stakeholder group. Table 4.5 shows an overview of our findings. The following sections discuss the analysis of the cost drivers per stakeholder group.

Table 4.5 Overview of cost drivers

	Type of cost	Project promoter	NRA	NCA	EC	ACER	ENTSOs	Citizens	Consumers
PCI Process									
TYNDP ([163])	Admin burden	X	X	X	X	X	X		
PCI reporting and monitoring	Monitoring				X	X	X		
Participation in regional groups	Admin burden	X	X	X	X	X			
Permitting processes									
Setting up one-stop shop	One-off compliance cost			X					
Application for permit	Admin burden	X							
Granting of permit	Admin burden			X					
Public participation									
Organisation of stakeholder consultations	Admin burden	X		X					
CBCA processes and regulatory incentives									
Application regulatory incentives, CBCA process	Admin burden	X							
Review of project promoter's application	Admin burden		X						

Project promoters

Project promoters are responsible for their PCIs. Their role includes participation in regional groups within the PCI selection process, applying for permits, organising stakeholder consultations, when applying for regulatory incentives and in the CBCA process. According to the result of the targeted survey, most project promoters consider the costs of most provisions to be acceptable. Figure 4.19 shows that a limited number of project promoters consider the costs of the permitting process and CBCA process to be 'very high'. A more considerable number of project promoters indicated that the costs of the permitting process, the organisation of stakeholder consultations and the CBCA process are 'high'.

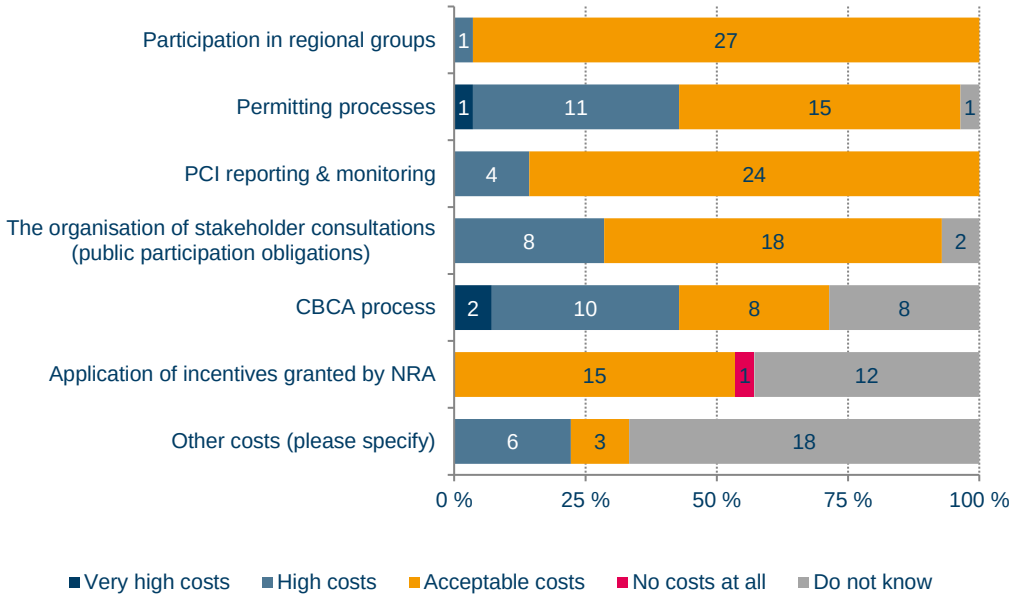
Only four of the 28 project promoters that responded to the targeted survey consider the costs of PCI reporting and monitoring to be 'high'. All other respondents consider the costs to be acceptable. That was corroborated in the interviews, but project promoters (seven electricity TSOs, three gas TSOs and one non-TSO project promoter) indicated that they see opportunities to reduce the cost of the monitoring process. Almost all project promoters who responded to the targeted survey indicated that costs for participation in regional groups are acceptable: only one gas TSO regarded the costs to be high. The interviews verified all that information, with some project promoters (four electricity TSOs, one gas TSO and two non-TSO project promoters) indicating that they see opportunities for reducing the costs for the PCI selection process as well. One TSO indicated that gaining PCI status is quite resource intensive. They explained that three to four

[163] TEN-E Regulation is not the only basis for the TYNDP, so not all costs should be allocated to TEN-E.

people are involved and usually supported by a consultant on technical issues. Furthermore, high-level staff are involved in the discussions with the European Commission and ENTSO-E.

Based on the evidence, the main cost drivers that provide unacceptable costs for project promoters appear to be the permitting process, the organisation of stakeholder consultation and the CBCA process. Regarding the administrative burden of the permitting process, however, from the interviews it is observed that generally the high administrative burden is considered not to be due to TEN-E, but rather relates to issues on a national level, although three TSOs specifically pointed out that the requirements of the Regulation add another bureaucratic layer on top of the national system. A similar effect is indicated regarding the stakeholder consultation: through national guidelines, similar consultations can be applicable in an earlier stage of the process, with significant overlaps with the exercise required by TEN-E. Finally, regarding CBCA, the interviews show that many TSOs identify high costs in this area as they create an administrative burden. Some of the project promoters indicate that those are high costs because the process is complex, with simplification needed. Other project promoters indicate it creates an unnecessary administrative burden for those seeking CEF funding without CBCA. With answering evaluation question 5 in Section 4.3.2 we elaborate further on the differences between Member States regarding permitting and consultations.

Figure 4.19 Survey results: provisions that trigger costs for project promoters (n=28)



Source: Targeted survey.

To estimate the average FTE project promoters, use to comply with the TEN-E Regulation, multiple sources (case study, interviews, targeted survey and expert judgment) are used. From the CO2 TransPorts case study, an estimated 0.5 FTE per year is given for the administrative costs for reporting and compliance to the PCI monitoring procedure. Additionally, regarding both PCI and CEF applications combined, an administrative burden is estimated to be a little under 1 FTE per year. In the targeted survey, the respondents who considered cost categories to be high or very high were asked to provide an estimate of the number of FTEs and out-of-pocket costs. One respondent estimated that the full process including PCI selection, CBCA and grant application requires 1.5 FTE for each promoter for two to three years. Another respondent mentions that it depends on the project but that several FTE and supporting external services are involved. Based on the available information, an administrative burden of 1.5 FTE for project promoters was estimated for compliance with the TEN-E Regulation.

NRAs

NRAs mainly have a role in the PCI selection process, in the CBCA process, and take a decision on regulatory incentives. Although response rates were low (four NRAs), the outcomes from the targeted survey suggest that NRAs do not experience high costs in general: only one NRA indicated high costs for the CBCA process and one indicated high costs for participation in regional groups.

During the interviews, however, three out of four interviewed NRAs highlighted that the CBCA process is very difficult and a relatively heavy burden is experienced.

Trinomics et al. (2018) found that NRAs had to carry out further work to verify CBA results in more than 50 % of the CBCA requests and that the PCI selection resulted in extra costs for NRAs, since candidate projects have to be assessed and coordination with other NRAs is essential. NRAs were, however, in general, not able to quantify the total additional administrative burden, providing very different figures (from 40 days in total and up to 20 days/year).

In conclusion, based on the evidence above, the costs for NRAs as a result of TEN-E are low, but the main cost driver for the NRAs is the CBCA process. The survey and interviews do not provide a quantitative estimate of the costs involved. Based on the available information, for most NRAs less than 1 FTE is estimated to be involved.

NCAs

NCAs are involved in the selection process as well as the implementation of projects. The targeted survey showed that overall the administrative burden is considered to be acceptable: with the exception of one out of seven NCAs reporting high costs for permitting, one out of eight NCAs reporting high costs for setting up the one-stop shop and two out of eight NCAs reporting high and very high costs for the participation in regional groups. All other respondents who valued the costs for the different cost categories indicated the costs to be either acceptable or 'no costs at all'.

During the interviews, all NCAs supported the findings from the targeted survey indicating that the administrative burden is low. One NCA indicated that the largest portion of the burden is found in the permitting process and, particularly, the one-stop shop can be difficult, though they do not believe this burden could be lowered through TEN-E, but rather through changes in the national system. The involvement of NCAs in the permitting process and public participation differs per Member State.

Of the consulted NCAs, one respondent to the targeted survey and one interviewee indicated that, on average, around one FTE is required for activities related to TEN-E. Trinomics et al. (2018) reported that some NCAs quantified additional costs for regional and high-level group meetings at EUR 1 200 per meeting, with about 3 to 10 meetings per year. During the interviews it was verified by two NCAs that the participation costs for regional groups can be relatively high due to high travel costs, although that is situational.

Based on the above evidence, the costs for NCAs are low; however, the higher travel costs for some Member States are recognised, but the travel costs are often dependent on specific situations (i.e. time of year, day in the week for travel, when the train or plane ticket is booked, distance to meeting, etc.). An estimate of the additional administrative burden for NCAs due to the TEN-E Regulation would require more in-depth research, but an average of 1 FTE is estimated for NCAs, based on the current findings.

ACER

ACER has a role in the PCI selection process and monitoring. According to ACER about four to six FTEs are involved, but not all of their work is directly a result of the TEN-E Regulation since this may include overlaps between activities regarding TEN-E, TYNDP, CBA, tariffs and R&D.

ENTSOs

The ENTSOs have dedicated teams working mainly on the TYNDP. The ENTSOG team consists of 12 FTEs. The ENTSO-E estimate of 50 people being involved includes its members' contributions.

Conclusion on costs

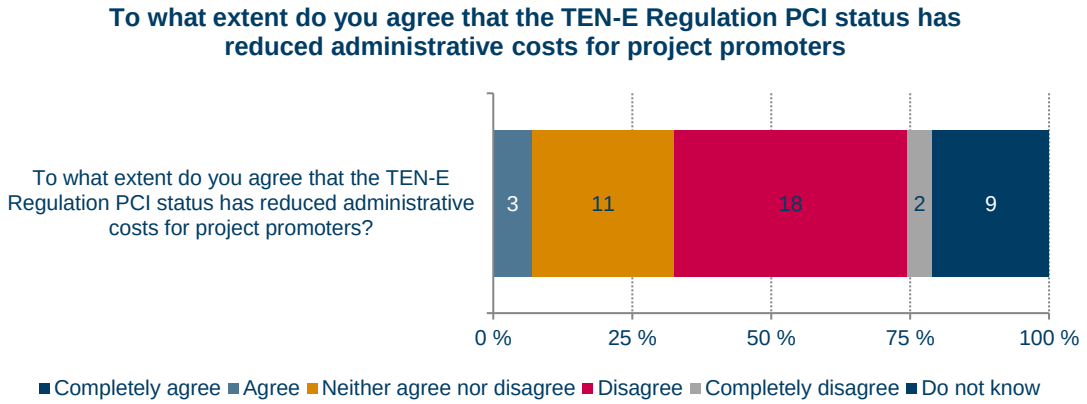
Based on the results of the survey and interviews with stakeholders, it is not possible to provide a robust estimate of the costs involved. Overall it is estimated that several hundred FTEs are involved for all PCIs combined (excluding the permit-granting process and stakeholder consultation). If a wide bandwidth of 250-500 FTE (based on about 150 PCIs) is applied and an

assumption for the average costs per FTE of EUR 100 000 is used, the total annual costs are EUR 25-50 million ([164]).

Justification of costs

In Trinomics et al. (2018), the question as to whether the additional costs could be justified by benefits received mixed answers; however, through stakeholder consultation for this study, stakeholders generally indicated that the costs are proportionate to the benefits they receive. The TAP, GIPL, ACON and the CO2 TransPorts case studies confirm that, accompanied by the targeted surveying in which a majority of stakeholders agreed or completely agreed that the benefits of the TEN-E Regulation provisions outweigh the costs (Figure 4.20). Additional comments were added by 19 TSOs that, although the process can be cumbersome and a certain administrative burden is involved, the benefits are valuable. All four NCAs who responded to the targeted survey believe that the benefits significantly outweigh the costs of the Regulation. However, some respondents did not agree: an NRA remarked that with no CEF funding, project promoters can face a high level of effort during the selection process, but the only advantage left to them might be the PCI label as a marketing instrument.

Figure 4.20 Survey results: extent to which benefits outweigh costs (n=39)



Source: Targeted survey.

The interviews also verify that stakeholders share the general belief that the benefits of the Regulation outweigh the costs. Although the overall administrative burden is generally considered to be acceptable, the most burdensome costs are mainly driven by several inefficiencies.

Furthermore, based on the stakeholder analysis and on the analysis of the benefits and costs, the benefits of the TEN-E Regulation outweigh the costs of the Regulation. It is unlikely that benefits could have been achieved in a much more efficient way. Opportunities exist for reducing the administrative costs of some provisions, such as the monitoring, the PCI selection process and the CBCA process, which are discussed in the next section.

Major inefficiencies

As mentioned previously, respondents generally view the costs of provisions as acceptable; however, the cost-drivers analysis highlighted that there are certain inefficiencies with the TEN-E Regulation provisions. Those inefficiencies are described below.

Permitting process

In the targeted survey, 39 % of the stakeholders (11 out of the 28 that provided an answer) indicate that the administrative burden for the permitting process is high or very high (Figure 4.19). However, seven TSOs elaborated on their answer to the survey by explaining that this is due to external factors and not directly related to an inefficiency of the TEN-E Regulation. As stated earlier during the assessment of cost drivers for each stakeholder group, the external factors are in

([164]) The assumption of EUR 100 000 per FTE is based on an estimate by the Consortium considering that mostly highly qualified workers are involved. No data is available for a more precise estimate of average wages across Europe.

many cases related to the national systems in place and sometimes to how the one-stop shop has been implemented in the nation system. In our answer to evaluation question 5 (Section 4.3.2), we discuss this aspect further.

PCI selection process

The targeted survey results and the interviews with TSOs and non-TSO project promoters show that project promoters are generally of the opinion that the costs for the PCI selection process are acceptable.

The stakeholders mentioned some issues regarding the PCI selection process. In the interviews, five electricity TSOs, two gas TSOs, and four non-TSO project promoters indicated that they are opportunities to reduce costs in the PCI selection process. Some project promoters do not see the added value of renewing the application for every PCI list (for ongoing projects). Four project promoters indicate that they consider the renewal of PCI lists inefficient, especially when seeking extension of their PCI status. Renewal of the PCI list makes it possible to consider changes in market circumstances and to assess projects on an equal basis. That makes sense in dynamic markets where market circumstances can change quickly (gas and electricity). In an interview, ENTSO-E countered this argument by pointing out that the horizon of infrastructure is much longer and argued that it creates unnecessary uncertainty for project promoters. In a CO2 project case study, the project promoter pointed out that the business case for a CO2 project does not fundamentally change over a horizon of two years.

PCI reporting and monitoring

Potential inefficiencies in monitoring were identified by Trinomics et al. (2018), especially the fact that reporting is required for different entities, 'each of which imposes its own reporting format and periodicity'. That is supported by our own experiences during the portfolio analysis, which showed that different formats are used and the information provided by project promoters is not consistent, thereby negatively impacting on the overall data consistency and usability.

Both the CO2 TransPorts and the ACON Smart Grid case studies build on possible improvements of the efficiency of the procedures by emphasising the need for more flexibility in the reporting procedures. No dedicated reporting formats are available for non-electricity and -gas projects, creating an unnecessary additional burden for the relevant project promoters. Overall, the quality of the monitoring procedure, regarding both relevance of formats and data consistency, can again be improved.

The SuedLink case study highlights that the added value of the PCI monitoring is not always clear. Based on German regulations, the Federal Network Agency monitors the implementation of the projects four times a year, so a parallel yearly monitoring by ACER brings reduced benefits.

In the interviews, one non-TSO project promoter, seven electricity TSOs, three gas TSOs and two NRAs highlighted that the administrative burden of monitoring, although acceptable, is in some cases unnecessary. Two NRAs highlighted that it would be sufficient to perform the monitoring procedure once during every PCI list. Four electricity TSOs and three gas TSOs indicate that is because the monitoring exercise could be done biennially instead of annually. Two electricity TSOs and two non-TSO project promoters further explained that the monitoring exercises lack follow-up on the information that is gathered. One gas TSOs, five electricity TSOs and two NGOs argued that the online platforms are not easy to use: the transparency platform is not always up-to-date and it is difficult to extract a complete dataset, with the CEF data being particularly difficult to find, the data can be inconclusive or incomplete and ACER monitoring platform is difficult to use. Two electricity and two gas TSOs remarked that the new ACER monitoring platform is a step towards improvement, but there is still more room for further improvement. Some project promoters stress that efficiency can be improved by making it possible for project promoters to provide all the required information for the PCI selection process, PCI fiche, ACER monitoring exercise and the transparency platform through a single form. All the arguments combined, however, show that a main issue seems to be the lack of data utilisation, which triggers a lack of the experience needed for the exercise. Further increasing data quality and consistency would make the monitoring results more useful and provide more perspective for follow-up actions. Reducing the administrative burden by reducing the frequency of the monitoring procedure would also disadvantage the actuality and decrease the usefulness of the data. That trade-off identifies the need for a choice to be made between either significantly improving the usability and usage of the monitoring process or considerably reducing the administrative burden for project promoters.

CBCA and CEF

As shown in Figure 4.19, 60 % of all respondents who expressed an opinion on the costs resulting from the CBCA process consider the costs to be either high or very high. In the interviews nine TSOs (four gas and five electricity) expressed the view that the CBCA process is rather difficult and involves a heavy administrative burden. Some of the project promoters indicated that the high costs are due to the complexity of the process. Others indicated it creates an unnecessary administrative burden for those seeking CEF funding when there is no CBCA. Note that a CBCA is a requirement for an application for CEF funding to ensure that European funding is only used when a project would otherwise not be viable (see the three-step logic in Section 3.2.4.). As a result, the CBCA administrative burden is not necessarily unnecessary when there is no allocation of costs across borders.

Participation in regional groups

Project promoters consider the administrative burden for their participation in regional groups to be acceptable. Most NRAs and NCAs agree, but two NCAs, an NRA and a TSO were of the opinion that the participation comes at very high costs compared to other costs, mainly driven by the high travel costs involved when attending a regional group meeting. Possibly inspired by their experiences with working from home as a result of COVID-19, a TSO, an NRA and an NCA remarked that the possibilities of remote participation in regional group events should be positively highlighted, as they could result in a reduction of emissions and costs for society.

4.3.2 Evaluation question 5

To what extent do the different types of costs resulting from the implementation of the TEN-E Regulation vary based on the approach taken to implement the legislation (while achieving the same results)? Which approach was most efficient?

Conclusions

The costs related to the permit-granting processes and public consultation differ by Member State, depending on the Regulation implementation. Other costs of the Regulation are more or less the same in all Member States, although there can be differences in total costs due to differences in the characteristics of the Member States and relevant PCIs.

The evaluation provides limited evidence on the efficiency of various approaches taken to implement the legislation. Data on the costs of the Regulation is not sufficiently precise for a detailed comparison between Member States. Moreover, it is difficult to disentangle the costs resulting from the TEN-E Regulation from other costs. Variations in costs of the permitting and public consultation processes are not only a result of the approach taken to implementing the Regulation, but also of the national legislation.

Analysis

Two main areas where the implementation approach may differ across Member States were identified: permit-granting processes and the stakeholder consultation. During the desk research, sources were found that indicated differences in implementation in Member States, but no sources were identified that expanded on the efficiency of the various approaches.

In the targeted survey, respondents were requested to provide an estimate of costs for those they considered 'high' or 'very high'. Most project promoters consider the costs of the permitting process and stakeholder consultation to be acceptable. As a result, no cost estimates were provided for most Member States, making it impossible to compare quantitatively the efficiency of approaches based on the results of the targeted survey.

The analysis of the effectiveness of the provisions regarding permitting includes the observation that project promoters describe varying experiences with the permitting process, which are essentially shaped by the national implementation of the TEN-E Regulation permitting rules. Section 4.2.2 concluded that the effectiveness of the Regulation provisions depends strongly on the national implementation.

Respondents to the targeted survey remarked on the effectiveness and efficiency of the one-stop shop. The ENTSO-E response reflects responses by project promoters and other stakeholders in Member States:

Provisions like the introduction of the one-stop shop have increased the efficiency of procedures for some Member States, but, on the other hand, the TEN-E Regulation also adds additional steps and obligations that are linked to the PCI status.

The success of the one-stop shop varies across Member States. In general, the principle contains the potential for more efficient permitting – for PCIs and beyond. In countries that introduced the one-stop-shop principle even before the introduction of TEN-E and/or beyond PCIs, processes might be better established, with learning curves for both project promoters and permitting authorities having led to a smoothening out of the processes. Nevertheless, discussions on responsibilities and obligations remain, e.g. which authority is responsible for granting permits for assets related to the PCI, but that under national provisions are in the hands of local authorities rather than of the authority representing the one-stop-shop.

Differences in how the TEN-E Regulation affected specific Member States can also be observed in the responses of stakeholders to questions on the impact of 'one-stop shops'. Table 4.6 shows an overview of how stakeholders from different countries responded to the relevant questions. A majority of respondents from Czechia, Spain, Austria, and the United Kingdom disagreed that the one-stop shop provided added value in four out of the five statements. For Greece, France and Portugal, the majority responded positively in at least four of the statements.

Table 4.6 Breakdown of stakeholders responses by country and implementation scheme on the one-stop shop questions in the targeted survey

Targeted survey: majority response by country on question, 'To what extent do you agree that the permit granting in 'one-stop shops' has…:'						
Country	*Implementation scheme*	… Reduced complexity	… Increased efficiency	… Increased transparency	… Enhanced cooperation	… Would allow addressing challenges for offshore RES infrastructure
Belgium	**Collaborative**	Neutral	Neutral	Neutral	Neutral	Neutral
Czechia	**Collaborative**	Disagree	Disagree	Neutral	Disagree	Neutral
Denmark	**Collaborative**	Neutral	Neutral	Agree	Disagree	Agree
Germany	**Collaborative**	Disagree	Disagree	Neutral	Neutral	Neutral
Estonia	**Collaborative**	Neutral	Neutral	Neutral	Disagree	Agree
Ireland	**Collaborative**	Agree	Neutral	Neutral	Agree	Neutral
Croatia	**Collaborative**	Neutral	Neutral	Disagree	Agree	Agree
Hungary	**Collaborative**	Neutral	Neutral	Neutral	Agree	Neutral
Poland	**Collaborative**	Neutral	Neutral	Neutral	Neutral	Neutral
Slovak Republic	**Collaborative**	Neutral	Neutral	Neutral	Neutral	Neutral
Finland	**Collaborative**	Agree	Agree	Neutral	Disagree	Neutral
United Kingdom	**Collaborative**	Disagree	Disagree	Neutral	Neutral	Disagree
Greece	**Coordinated**	Agree	Agree	Neutral	Agree	Agree
Spain	**Coordinated**	Disagree	Disagree	Neutral	Neutral	Disagree
France	**Coordinated**	Agree	Agree	Agree	Agree	Agree
Italy	**Coordinated**	Agree	Neutral	Neutral	Agree	Agree
Netherlands	**Coordinated**	Neutral	Neutral	Neutral	Agree	Disagree
Portugal	**Integrated**	Agree	Agree	Agree	Agree	Agree
Austria	**Integrated, Collaborative**	Disagree	Disagree	Neutral	Disagree	Neutral
Slovenia	**Integrated, Collaborative**	Neutral	Neutral	Neutral	Neutral	Agree

This table presents an overview of how stakeholders from different countries responded on the targeted survey to questions under, 'To what extent do you agree that the permit granting in 'one-stop shops' has…:'. The majorities are based on the survey results excluding 'don't know' responses. (Dis)agree or completely

(dis)agree answers are combined. A majority is considered achieved when 50 % or more of the stakeholders from a certain country express the indicated answer and less than 50 % answered the opposite.

A further look into the opinions per implementation scheme shows that for countries which applied the collaborative scheme or a combined integrated/collaborative scheme, the respondents are generally neutral or rather divided in their opinion on the performance of the one-stop shop. Respondents from countries with the coordinated scheme generally share a more positive view of the application. Finally, the respondents from the only country where the integrated scheme is chosen, Portugal, have very positive opinions towards permit granting in 'one-stop shops'.

Finally, there are also differences in how Member States streamlined the environmental assessment procedures for PCIs, according to the targeted survey respondents. Stakeholders from Czechia, Denmark, Germany and Greece are of the opinion that the Member States have streamlined the procedures for PCIs, but stakeholders from Austria and Portugal point out that the process is not sufficiently efficient. However, stakeholders from Czechia and Germany added that the procedures were streamlined in general, not just for PCIs. During an interview, an electricity TSO also noted that the TEN-E Regulation has improved permitting for some regions more than others: NSI East is mentioned as having improved the alignment of the Member States, but less so for cooperation between northwestern Member States.

The case studies also provide insights into the impact of differences in Regulation implementation approaches. The SuedLink and the CO2 TransPort case studies found that the permit-granting process is not seriously affected by the TEN-E Regulation, since the national legislation in Germany and the Netherlands had already provided the relevant tools, with the administrative costs being at the same level as other non-PCI investment on a national level.

In the TAP case study, the Greek legal framework adapted the one-stop shop, the Italian framework adapted the SA and in Albania the legal framework was partly missing or under consideration. Despite the PCI label, the challenge was high at the implementation level, especially at regional and local levels. In Italy, critical issues remain regarding the limits of SA substitute efficacy, compliance with the very high number of conditions (mainly from the EIA Decree) to be satisfied and their implementation due to the high number of Administrations involved. For that particular case, the adaption of the one-stop shop did provide the most efficient approach on the permitting process from the project promoter perspective. The TAP project also points out that the differences themselves can negatively impact on process efficiency.

4.4 Relevance

4.4.1 Evaluation question 6

To what extent do the objectives ([165]) of the TEN-E Regulation still respond to the needs of the EU in relation to energy infrastructure?

Sub-questions:
6.1 What are the relevant new/emerging issues within the field of energy infrastructure?
6.2 To what extent are the needs initially identified by the TEN-E Regulation still relevant?
6.3 In light of new/emerging issues and needs, to what extent is there a need to rebalance the objectives of the Regulation?

Conclusions

The Paris Agreement and the European Green Deal involve a high level of transformation of the current energy infrastructures into a fully carbon-neutral energy integrated system by 2050. Although the initial objectives of the TEN-E Regulation - SOS, market integration, competition and sustainability - are still relevant, the changes needed in the energy infrastructures require a rebalancing of the objectives in order to fulfil the decarbonisation targets and be aligned with the EU energy strategies. Along the pathway towards a decarbonised economy in 2050, energy

[165] Market integration, security of supply, competitiveness, climate and energy targets for 2020.

infrastructure needs will gradually evolve as emerging technologies are deployed and the sectors gradually switch to sustainable sources. Realistic planning is required for network progression from its current state to the targets in 2050.

In the analysis performed in the desk review and the stakeholder's consultation, many emerging technologies were identified as necessary in the future energy infrastructure. The following technologies currently not specifically addressed by the TEN-E Regulation include: decarbonisation of gas – hydrogen, green gas infrastructures, retrofitting of existing gas networks, bidirectional gas flow projects, energy system integration – power-to-gas, smart system integration, gas smart grids, digitalisation, electric vehicle charging infrastructures, decarbonisation – carbon storage, RES deployment and integration – hybrid offshore wind and meshed offshore wind hubs.

In terms of TEN-E Regulation objectives, sustainability/decarbonisation may need to be prioritised. In view of the necessary growing shares of intermittent renewable energy generation, RES integration and SOS are becoming increasingly more relevant. The flexibility needs of the system can also be addressed by energy system integration, potentially an additional objective of the Regulation. On the other hand, although market integration and competition are still relevant, they have lost importance. Lastly, it is worth noting that innovation as an objective, as addressed by many stakeholders, is indeed necessary at this transforming stage of the energy sector.

A revision and rebalancing of the objectives of the TEN-E Regulation may be needed to facilitate the deployment of emerging technologies that are now deemed necessary for ensuring that the Paris Agreement and the European Green Deal targets are accomplished.

Analysis

Relevant emerging issues within energy infrastructure

The European Green New Deal ([166]), with its overarching objective of making Europe climate neutral in 2050 featuring net-zero GHG-emissions, calls for a reconfiguration of the gas and electricity transmission infrastructures, with a view to accommodating the coupling of different energy sectors and integrating renewable energy efficiently. One of the main dilemmas with impact on the future configuration of Europe's energy infrastructure is whether the additional renewable energy capacity, required to comply with the European Green New Deal targets, should be centralised or decentralised. Although massive offshore wind ([167]) capacity expansion may push towards centralised RES generation and a need for reinforced transmission power infrastructures, RES-distributed energy production combined with demand-side management can also shift the need for investments from transmission to distribution lines.

Although the future targets are set for a decarbonised economy by 2050, the current status of the energy sector cannot be forgotten. According to Eurostat data ([168]), in 2018, the largest energy sources in Europe were petroleum products (36 %) and gas (23 %). Large differences were noted between Member States. To name a few, Cyprus and Cyprus petroleum products account for over 80 % of the gross inland consumption, natural gas accounts for a third of the total mix in Italy and the Netherlands, and nuclear energy accounts for 42 % and 32 % in France and Sweden, respectively. The progressive effort in pursuing the decarbonisation target must bear in mind the actual European energy mix. Transforming the current predominantly fossil-fuel energy systems towards a decarbonised integrated energy system in 2050 will entail progressive changing needs for the energy infrastructures, differentiated across time and regions. The restructuring needs to unfold following a timeline where changes are introduced incrementally while ensuring secure and cost-effective energy systems. Oil and gas cannot be ignored in today's system. In sustainability terms, it is difficult to see oil infrastructures within the scope of the future TEN-E Regulation, whereas gas infrastructures are acknowledged as transitional solutions for some countries

[166] European Commission (2019), The European Green Deal. Retrieved from: https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf.

[167] Wind Europe (2019), How offshore wind will help Europe go carbon-neutral. Retrieved from: https://windeurope.org/wp-content/uploads/files/about-wind/reports/WindEurope-Our-Energy-Our-Future.pdf.

[168] Eurostat (2020), Infografic energy. Retrieved from: https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2a.html.

switching from more polluting fuels or nuclear power. Within energy infrastructure, we find the following list of relevant technologies for the future ([169]):

- **Smart grids.** Demand-side management and distributed generation will help renewable energy integration and reduce the need for new electric transmission lines. The development of smart grids is, however, dependent on the digitalisation of the energy sector. Digitalisation will also improve asset management by digital monitoring via control units and, potentially, reduce outages and increase system efficiency ([170]);
- **Electricity transmission.** Although overhead lines will still be important, underground cables and HVDC will be increasingly relevant. That will be especially true in urban areas and for underwater transmission. The use of HVDC can also improve system reliability due to its ability to deliver system-bearing properties;
- **Power-to-X and green gases.** In the EU28 the share of hydrogen and biomethane in the gas infrastructure will still be limited until 2030; higher volumes of biomethane are expected by 2050 than the 2030 level, independent of which energy carrier from electricity, methane or hydrogen will be the dominant end-use energy ([171]). Furthermore, the need for power-to-X (either liquid or gas fuel) will be required to match the electricity supply and demand to prevent curtailment of renewable energy. Power-to-X will enable the integration of the electricity and natural gas sectors ([172, 173]);
- **Renewable energy and sector coupling.** A full decarbonisation of Europe will follow a path of renewable energy development and sector coupling. The challenge of integrating renewable energy can be met by combining energy markets and infrastructure, with use of excess electricity to produce renewable gas or thermal energy ([174]);
- **Energy storage.** Large-scale energy storage (electricity, gas, thermal) is essential on all pathways towards decarbonisation ([175]);
- **Hybrid offshore wind system.** Nowadays, offshore wind installations are connected to the grid of the project-hosting country by single point-to-point connections. Owing to the major role of offshore wind production in the electricity production in Europe moving towards 2050, there is a need for a combined use of offshore connection and interconnecting grid infrastructures among different wind farms to enable wind energy to strengthen the flexibility of the electricity flows in the European electricity system.

The technologies listed are set to pave the way to a new reality where a green economy comes to the fore and for which a review of the TEN-E Regulation is deemed necessary ([176]). Considering the

[169] Set-Nav (2018), Infrastructure prerequisites: Upcoming network challenges. Retrieved from: https://www.set-nav.eu/sites/default/files/common_files/deliverables/WP10/D10.4%20Issue%20paper%20on%20Infrastructure%20prerequisites_Upcoming%20Network%20Challenges.pdf.

[170] IEA (2017), Digitalization and energy. Retrieved from: https://webstore.iea.org/digitalization-and-energy.

[171] European Commission (2020f), Impact of the use biomethane and hydrogen potential on trans-European infrastructure. Retrieved from: https://ec.europa.eu/energy/studies/impact-use-biomethane-and-hydrogen-potential-trans-european-infrastructure_en.

[172] European Commission (2019c), Impact of the use of the biomethane and hydrogen potential on trans-European infrastructure. Retrieved from: https://www.europeangashub.com/wp-content/uploads/2019/11/Trinomics-biomethane-and-hydrogen-study.pdf.

[173] ENTSOG (2018b), Power to gas – A Sector Coupling Perspective. Retrieved from: https://entsog.eu/sites/default/files/2018-11/ENTSOs%20Position%20on%20Sector%20Coupling_Madrid%20Forum.pdf.

[174] European Commission (2019d), Potentials of sector coupling for decarbonisation. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/60fadfee-216c-11ea-95ab-01aa75ed71a1/language-en.

[175] Asset (2018), Sectoral integration – long-term perspective in the EU energy system. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/final_draft_asset_study_12.05.pdf.

[176] ENTSOG (2019a), 2050 roadmap for gas grids. Retrieved from: https://entsog.eu/sites/default/files/2019-12/ENTSOG%20Roadmap%202050%20for%20Gas%20Grids.pdf.

sector-coupling aspects, a review of the TEN-E Regulation across gas and electricity is required to avoid investing in assets that may risk becoming stranded in the future ([177, 178]).

The targeted survey showed the shift of energy system needs as perceived by the stakeholders. We first highlight the responses provided by the ENTSOs, representing the TSOs, and ACER ([179]), representing the NRAs, as they are considered particularly relevant in the TEN-E Regulation. For the remaining stakeholders, we present the results of the survey in successive graphs:

- ENTSOs agree that the TEN-E Regulation should be revised to include all projects that are necessary to achieve socioeconomic benefits and fulfil the needs of the energy infrastructure, and that they must be compatible with the objectives of the European Green Deal. System Integration must be the priority, with the perspective and planning of the energy networks taking a holistic view of all energy systems together. The ENTSOs are already working in that direction in developing the TYNDP 2020. New common scenarios and interlinked modelling processes between ENTSO-E and ENTSOG reflect significant methodological advancements of such an integrated approach. Nonetheless, they stated that further advancements are needed towards a fully 'one-system view' planning exercise. The ENTSO-E Roadmap for MSPS ([180]) sets the vision of the ENTSOs on how to develop that smart sector integration view into their planning exercises. As for new or emerging technologies relevant under the TEN-E framework, the following were highlighted: hydrogen infrastructures, biomethane plants, reverse gas flows DSO-TSO, power-to-gas, hybrid offshore wind, CCS, and smart grid integration;
- ACER recommends revising the energy infrastructure categories to better reflect the need for addressing energy system decarbonisation. In this regard, for new sustainable infrastructure categories to be under the umbrella of the TEN-E Regulation, it would be necessary to develop specific criteria to assess them. They specifically suggest sector-coupling projects such as power-to-gas as new infrastructures to be covered.

According to the targeted survey, Figure 4.21 , the three most important challenges that need to be addressed in today's energy infrastructure field, compared to the situation of 2013, are GHG reduction/climate neutrality, integration of RES and energy system integration. SOS comes in fifth place, with market integration and competitiveness regarded as the second and third least important challenges today from the 17 options.

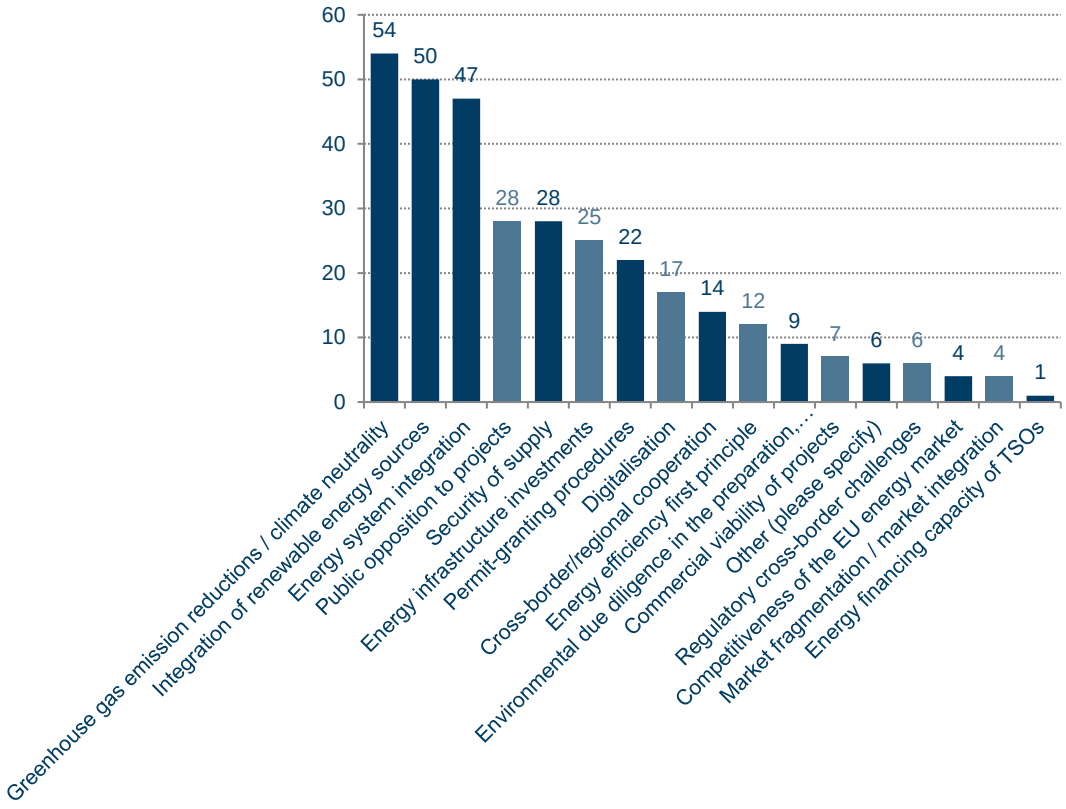
[177] SET-Nav (2017), Projects of Common Interest and gas producers strategy. Retrieved from: http://www.set-nav.eu/sites/default/files/common_files/deliverables/WP6/D6.5%20Issue%20Paper%20on%20PCI%20and%20gas%20producers%20pricing%20strategy.pdf.

[178] ACER (2019e), The bridge beyond 2020 conclusion paper. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/SD_The%20Bridge%20beyond%202025/The%20Bridge%20Beyond%202025_Conclusion%20Paper.pdf.

[179] ACER opted not to answer the targeted survey and consolidate their views on the Position Paper on the Revision of the TEN-E Regulation, published on the 19 June 2020. The statements reflected belong to this paper. http://www.acer.europa.eu/Official_documents/Position_Papers/Position%20papers/ACER_CEER_paper_on_TEN_E.pdf.

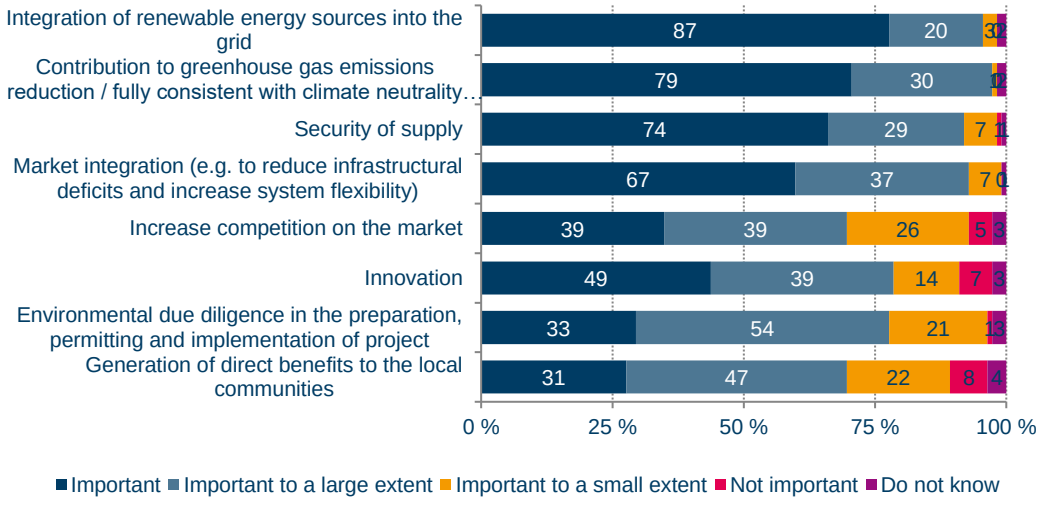
[180] ENTSO-E (2020), Roadmap for a multi-sectorial planning support. Retrieved from: https://eepublicdownloads.azureedge.net/clean-documents/Publications/Position%20papers%20and%20reports/l_entsoe_RM_MSPS_09.pdf.

Figure 4.21 Responses to the targeted survey: Which of the challenges would you say are most important to address in the field of energy infrastructure today, compared to the situation in 2013? Please select up to three most important challenges. (n=112)



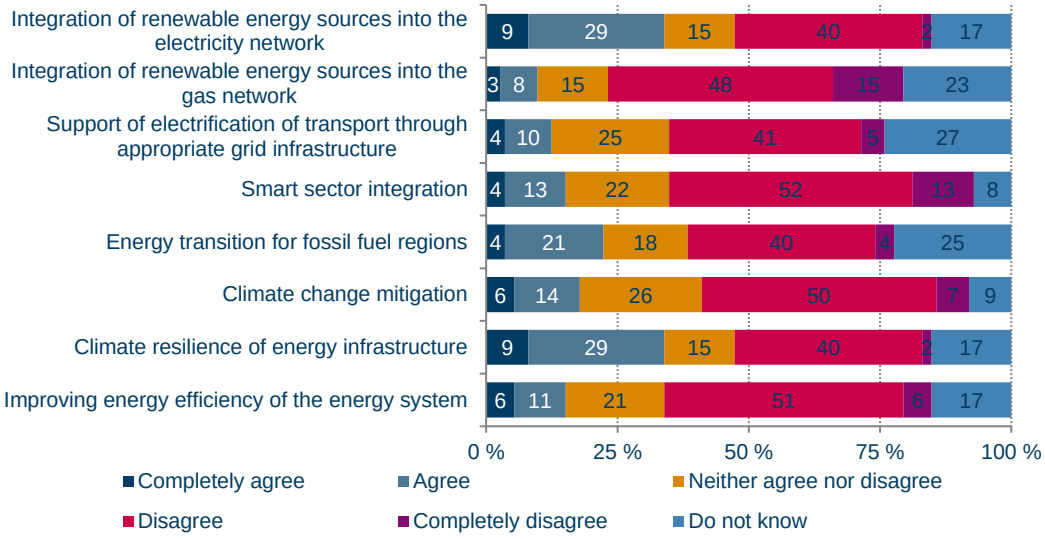
In the same line, on Figure 4.22, stakeholders agreed that integration of RES, GHG reduction and SOS are the most important features for a PCI (86 %, 78 % and 74 % agreements, respectively).

Figure 4.22 Responses to the targeted survey: Which features do you consider the most important for a project of common interest (PCI) as part of trans-European energy networks? (n=112)



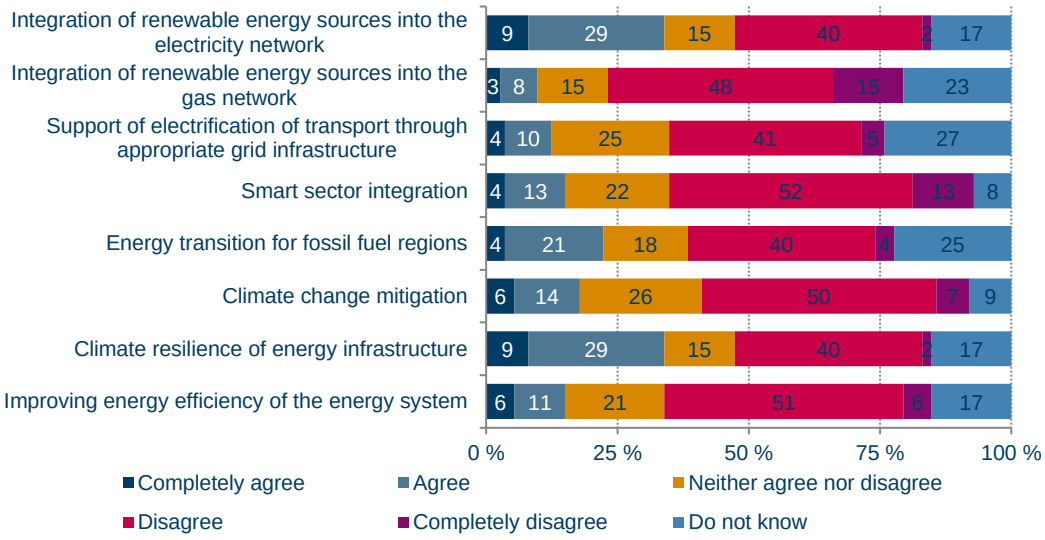
Regarding specific infrastructures, in Figure 4.23, the survey respondents agreed that the following infrastructures were 'relevant' or 'relevant to a large extent' for TEN-E: Electricity infrastructure (98 %), smart electricity grids (90 %), grids for offshore wind farms (94 %), P2G (64 %), H2 network (61 %), RES and carbon-neutral gases integration infrastructure (58 %).

Figure 4.23 Responses to the targeted survey: Which of the following infrastructure categories do you consider relevant for the regulatory framework on trans-European energy networks? (n=112)



The following emerging issues are not well addressed by the TEN-E Regulation according to the results of the targeted survey: (1) 65 % disagree, with only 17 % agreeing that smart sector integration is well addressed; (2) 63 % disagree, with only 11 % agreeing that RES integration in the gas system is well addressed (Figure 4.24).

Figure 4.24 Responses to the targeted survey: To what extent do you agree that the following issues are currently well addressed by the Regulation? (n=112)



Concerning specific technologies, smart grids show the highest level of disagreement (43 % disagree / 16 % agree) regarding the TEN-E being relevant in supporting these types of energy infrastructure.

In the interviews, the following technologies, most of which are currently not part of the TEN-E Regulation, were addressed by stakeholders as necessary for the fulfilment of carbon neutrality in 2050: gas smart grids, hydrogen and green gas infrastructures, power-to-gas, bidirectional gas flow projects, demand-side flexibility measures, hybrid offshore wind projects with meshed grids, retrofitting of gas infrastructures to transport hydrogen or green gases, and carbon storage.

Position papers by different stakeholders suggest the following issues to be addressed by the TEN-E Regulation:

- EU decarbonisation targets;
- Energy system integration and greater integration of the various sectors (energy, transport, buildings);
- RES integration;
- Energy-efficiency-first principle / Demand-side flexibility;
- Decentralisation: shift targeted projects from large-scale, stand-alone projects to decentralised sector integration projects / smaller and smarter projects / Greater importance for DSOs / smart grids / Foster interactions between transmission and distribution networks;
- Digitalisation / smart grids;
- Climate and biodiversity / Natural habitats respect / 'Do no harm' principle / No fossil fuel projects;
- District heating and cooling as sector-coupling enablers;
- Hydrogen, green gases, CO2 transport and storage infrastructures.

The webinar on 'TEN-E Infrastructure categories to ensure full consistency with the climate neutrality objectives of the European Green Deal' pointed at certain emerging technologies within smart grids and gas infrastructure. On 'Scale-up smart grids deployment', the following ideas on emerging issues to be covered by the TEN-E Regulation were discussed: (1) The crucial role of decentralised electricity must be recognised by the revised TEN-E Regulation, with greater cooperation between TSOs and DSOs encouraged; (2) There must be a higher importance given to the gas distribution grid, for growing shares of decentralised gas production, and of bidirectional gas flows between gas TSOs and DSOs; (3) Coordination of smart grid and distributed projects is needed to gain cross-border impact and seize opportunities of synergies to cooperate in digitalisation. On gas infrastructure categories, including hydrogen and CO2, the following points were mentioned: (1) Hydrogen and green gases will be required on a large scale; (2) Hydrogen infrastructure to be deployed around current industrial hydrogen clusters; (3) Green gases blending into the current gas pipelines can only be a transition technology; (4) Higher importance of distribution gas projects; (5) Multimodal network design for CO2 transport; (6) 'Do no harm' principle should guide all projects, so no fossil fuel projects to be eligible for PCI.

Relevance of the issues initially identified by the TEN-E Regulation

The need identified in the TEN-E to develop interconnections in the European network and promote smart grid solutions is still of great relevance, as confirmed by Trinomics et al. (2018), to enable and ensure a higher degree of energy system flexibility and resilience with the integration of growing renewable energy capacity. Interconnection capacity for electricity still falls short of the 2030 target of 15 % of installed capacity for some Member States. The TEN-E should emphasise investing primarily in electricity-related development projects, with less relevance for gas and oil infrastructure development. With renewable energy targets and energy efficiency measures, natural gas demand is also set to drop. Analyses of the European gas system even suggest that SOS is unproblematic under various disruption scenarios indicating that the focus on gas in the PCI list can potentially be reduced ([181]). Nonetheless, there are also diverging views on the decreasing role of gas in light of the potential reconversion of coal and nuclear power to gas.

Rebalancing the TEN-E objectives

The Regulation's objectives are still important in the development of an integrated European energy market, but might need to undergo a process of rebalancing when it comes to long-term planning conditions for electricity-grid infrastructure ([182]).

The relevance of oil and natural gas PCIs may decrease given the foreseen falling demand, and a long infrastructure lifetimes may result in overinvestment (stranded assets) in new oil and natural

[181] Artelys (2020), An updated analysis on gas supply security in the EU energy transition. Retrieved from: https://www.artelys.com/wp-content/uploads/2020/01/Artelys-GasSecurityOfSupply-UpdatedAnalysis.pdf.

[182] European Commission (2018c). Investment needs in trans-European energy infrastructure up to 2030 and beyond. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/431bc842-437c-11e8-a9f4-01aa75ed71a1.

gas PCIs ([183]). Yet, natural gas projects also depend on declining EU oil and natural gas production. Natural gas is currently competitive due to high CO2 quota prices, so it can provide a fast transitional solution for CO2 reductions for some Member States. A stronger emphasis on innovation in the regulatory framework will also be beneficial, together with a long-term view on sustainable PCIs ([184]).

According to the EU Strategy for Energy System Integration ([185]), 'the Commission will ensure that the ongoing revision of the TEN-E Regulation makes it fully consistent with climate neutrality and enables the cost-effective integration of the energy system'. The European Green Deal calls for a revision of the TEN-E Regulation centred around decarbonisation.

In the interviews performed in the stakeholder consultation, various stakeholders pointed that the objectives of the current TEN-E Regulation may have become outdated with respect to current energy sector trends and strategies. All stakeholders indicated the need for the TEN-E Regulation to be compatible with the decarbonisation targets and that sustainability or carbon reduction must be a priority, although there are diverse opinions on the pathways needed to achieve carbon neutrality in 2050. While some stakeholders (NGOs, RES project promoters and RES associations) did not conceive that gas and, especially, oil infrastructure projects could be considered in the revised TEN-E Regulation, others (ENTSOs, TSOs, gas infrastructure project promoters and government authorities) advocated for gas to be a necessary transition infrastructure for some regions in the EU, including central and eastern Europe. Such infrastructures can be refurbished to transport hydrogen and green gases in the future.

The webinar on 'TEN-E Infrastructure categories to ensure full consistency with the climate neutrality objectives of the European Green Deal' drew attention to the following points on how the TEN-E Regulation should rebalance its objectives:

ENTSO-E highlighted the vision of a seamless integration and alignment with all connected assets, as a system of systems in line with the EU Strategy for Energy System Integration. They defended the PCI framework as an enabler of bringing consistency to all elements of the integrated energy system. The ENTSO-E remarked on the importance of the following emerging issues: energy storage, demand-side response, power-to-gas, digitalisation, and integration of offshore wind.

Other stakeholders stressed the following matters: (1) Importance of changing the trend of infrastructure investments under the TEN-E from transmission level to distribution level; (2) The need for equally assessing all technology options with a robust and fair evaluation methodology to ensure the most efficient ways of achieving carbon neutrality are deployed; (3) Offshore wind hybrid projects, including power-to-X, should be covered by the TEN-E Regulation;

ENTSOG stated that the TEN-E should support RES integration and sustainability by including hybrid energy systems coupling the electricity and gas systems. It was remarked on that it is also important to consider regional differences in the EU in the paths towards decarbonisation, which may include transition conventional gas infrastructures that may be refurbished in the future to accommodate hydrogen and green gases.

4.4.2 Evaluation question 7

To what extent are the 12 priority corridors still relevant? Do they address current and arising challenges for TEN-E networks (see EQ9)?

[183] European Commission (2017b), COMMISSION STAFF WORKING DOCUMENT Accompanying the document COMMISSION DELEGATED REGULATION amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/swd_accompanying_pci_list_final_2017_en.pdf.

[184] Ecorys et al. (2019), Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure? Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/6700ba89-713f-11e9-9f05-01aa75ed71a1/language-en/format-PDF/source-96288082.

[185] European Commission (2020d), Powering a climate-neutral economy: An EU Strategy for Energy System Integration. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/energy_system_integration_strategy_.pdf.

Sub-questions:
7.1 Are the current and future needs of the EU addressed via the priority corridors and areas? Should the list of corridors and areas be updated?
7.2 Is there a need to pay more attention to priority thematic areas instead? Is the cross-border criterion still fit for purpose?

Conclusions

As seen in Evaluation question 6, we identified many emerging technologies that are deemed necessary for the future trans-European energy infrastructures in order to achieve carbon neutrality by 2050 and follow the EU energy strategies. The current priority corridors and thematic areas do not entirely cover all those technologies.

Thematic areas and/or fewer and expanded priority corridors may help to harmonise EU-wide solutions, although some specific priority corridors may be needed to allow for regional differentiation in specific cases. Among the possibilities for new thematic areas, we highlight hydrogen and gas decarbonisation infrastructures, smart grids extended to gas infrastructures, cross-sectoral investments and offshore wind network infrastructures. Electricity and gas priority corridors may be maintained where they are considered necessary for tackling specific regional needs for the objectives of the TEN-E Regulation. The oil priority corridor does not seem to be aligned with the European Green Deal, despite its still predominant contribution to the EU's primary energy sources. Although fossil-fuel based, conventional gas infrastructures are still seen as transitional infrastructures needed for certain Member States that still rely heavily on coal and lignite for power and heat production. Some scenarios foresee a potential nuclear-to-gas transition, which would make the role of gas more relevant in future energy infrastructures. Furthermore, those gas infrastructures can be refurbished in the future to transport hydrogen or green gases. Some stakeholders, such as ENTSOG, call for a flexible approach when defining the priority corridors and areas, in view of the high uncertainty that remains upon emerging technologies.

With regard to the cross-border criterion, it is still considered necessary to ensure that all PCIs have a trans-European impact. Nonetheless, the cross-border criterion can be redefined to widen the concept of cross-border impact in view of the potential decentralisation of the system.

Analysis

Priority corridors and areas

ACER suggested specific updates on the current priority corridors and areas in its Position Paper on the revision of the TEN-E Regulation ([186]): create new thematic area for cross-sectoral projects, dismiss the thematic areas on electricity highways and oil priority corridors.

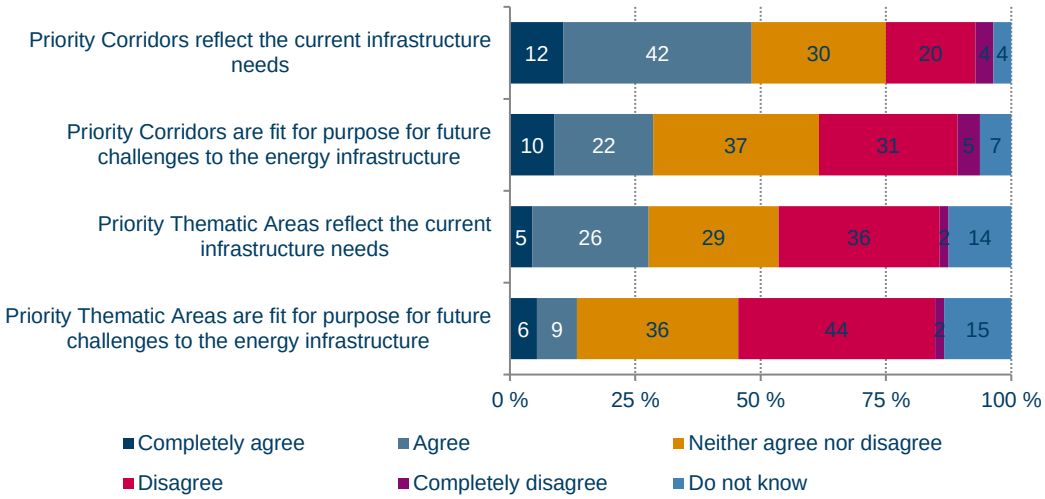
In the targeted survey, ENTSO-E proposed redefining priority corridors based on joint gas-electricity-hydrogen corridors. ENTSOG stressed the importance of maintaining regional differentiation with distinct geographical priority corridors for the gas sector in order to reflect regional aspects/differences in terms of market integration, competition and SOS, and in terms of possible decarbonisation pathways and deployment rates. ENTSOG suggests that priority corridors and thematic areas could be adjusted to further enhance renewable and decarbonised technologies, as well as sector-coupling projects and smart gas grid projects. Nevertheless, they warn that, given the high level of innovation and evolution of such technologies, the new priority corridors and thematic areas should ensure a flexible approach to avoid hampering their penetration. Regarding cross-border impact, ENTSOG is open to contemplating GHG emissions reductions or innovation as the basis for arguing for cross-border effects among Member States.

In the targeted survey, see Figure 4.25 , 54 of the 112 respondents agreed (and 50 disagreed) that the priority corridors reflect the current infrastructure needs. As for future challenges to the energy infrastructure, the targeted survey showed an opposite trend, with higher disagreement than agreement on the fitness of the current priority corridors and thematic areas for the future challenges. For priority corridors, 36 respondents (of 112) disagree and 32 agree that they are fit

[186] ACER (2020), Position on Revision of the Trans-European Energy Networks Regulation (TEN-E) and Infrastructure Governance. Retrieved from: http://www.acer.europa.eu/Official_documents/Position_Papers/Position%20papers/ACER_CEER_paper_on_TEN_E.pdf.

for purpose for future challenges to the energy infrastructure. As for thematic areas, 46 disagree, whereas only 15 respondents agree with the prior statement. Thematic areas are also seen as not reflecting the current needs. It is very likely that view is influenced by the low number of smart grid projects in the PCI list, as was a common claim among interviewed stakeholders.

Figure 4.25 Responses to the targeted survey on priority corridors and thematic areas (n=112)



Some stakeholders pointed out in the interviews that, due to the high uncertainty around the technologies which will be most relevant in the future energy system, a flexible approach is required when defining priority corridors and thematic areas, to allow flexibility in adapting to technological developments. In that sense, thematic areas may be more flexible than priority corridors, e.g. hydrogen or green gas infrastructures can be better addressed by thematic areas that can adapt to the developing market needs. On the other hand, other stakeholders (especially gas project promoters) stressed the importance of keeping regional differentiation when defining priority corridors.

The need for updating priority corridors and thematic areas to adapt to future energy challenges was widely shared among the stakeholders interviewed. Some of them made specific suggestions for how such new priority corridors and thematic areas should be: hydrogen, clean gases, sector coupling, smart gas grids, digitalisation, distribution projects, energy storage, hybrid wind offshore, hybrid solutions, electric priority corridor to south Mediterranean / North Africa, decarbonisation of islands, smart sector integration, electrification of heating and cooling systems, and peripherical countries.

In the first webinar 'TEN-E Infrastructure categories to ensure full consistency with the climate neutrality objectives of the European Green Deal', TenneT suggested including sector coupling and conversion into hydrogen in the current NSOG priority corridor or adding a new thematic area on power-to-gas.

Some stakeholders' position papers pointed at the following developments for priority corridors: (1) Thematic areas should be expanded to include sector integration technologies and solutions; (2) Inclusion of renewable heating and cooling infrastructures as priority corridors or thematic areas in the TEN-E framework; and (3) Gas and oil priority corridors should be dismissed.

Cross-border criterion

Cross-border impact is defined in Annex IV.1 of the TEN-E Regulation. It is differentiated by type of infrastructure (electricity transmission, electricity storage, gas transmission, gas storage or LNG, and smart grids).

ACER points to different issues concerning the cross-border criterion in its position paper. They call attention to ambiguous criteria for electricity and gas projects that remain subject to interpretation: for the 500 MW grid transfer capacity for electricity, no defined calculation method is provided; concerning the 10 % increase in cross-border capacity for gas, it is unclear whether it refers to a daily or longer-term peak. For electricity infrastructure, ACER suggests considering cross-zonal, instead of cross-border, to align to the current electricity market setup, with a specific

capacity increase threshold (200 MW). For gas infrastructure, they suggest considering cross-border impact in terms of both peak and long-term flow capability, and the impact on capacity market products.

The smart grid projects are often decentralised and are, by nature, not necessarily cross-border projects, as they are typically implemented at DSO level. Hence, fulfilling the requirement for cross-border co-operation may be a hindrance. As the need for flexibility and sector coupling will be increasing and since electric interconnection between countries will be highly relevant ([187]), there must also be a recognition that smart grid projects within countries can provide positive results on a larger European scale of renewable energy integration. Of the current six smart grid projects in the 4th PCI list, not all involve physical cross-border infrastructures. The cross-border criterion of those projects primarily relies on systems-, data- or policy-sharing initiatives (see examples below) between Member States:

- 10.6 Smart Border Initiative (Germany, France) - The Smart Border Initiative will connect policies designed by Germany and France in order to support their cities and territories in their energy transition strategies and European market integration;
- 10.7 Danube InGrid (Hungary, Slovakia) – The project enhances cross-border coordination of electricity network management, with a focus on smartening data collection and exchange;
- 10.8 Data Bridge (Denmark, Estonia, France, Latvia, Lithuania and Finland) – Aimed at building a common European Data Bridge Platform, to enable integration of different data types (smart meter data, network operational data and market data), with a view to developing scalable and replicable communication infrastructure solutions for the EU.

The above indicates that the current cross-border criterion for smart grids is open to considering projects with infrastructures in different Member States where the cross-border action is not necessarily a physical infrastructure.

In the targeted survey, ENTSO-E suggested reshaping the current criteria of 500 MW increased cross-border grid capacity for electricity infrastructures.

Some interviewees were open to easing the definition of cross-border impact to shared relevant objectives among Member States, such as significant CO2 reduction or other indirect impacts, in order to foster the implementation of decentralised projects (like smart grids) within the scope of the TEN-E Regulation. Other stakeholders, such as ACER, consider that broadening the definition of the cross-border criterion too much may be a risk to maintaining the number of PCIs at a manageable level, and only contemplate large-scale projects within the scope of the TEN-E Regulation (for facilitating project monitoring and timely implementation). In its position paper, ACER openly states that the TEN-E Regulation is not the most appropriate tool for addressing small-scale projects. Some stakeholders also pointed out that the outermost regions have a disadvantage with regard to the cross-border criterion.

In the first webinar 'TEN-E Infrastructure categories to ensure full consistency with the climate neutrality objectives of the European Green Deal', a smart grid project promoter clarified that some smart grid PCIs already show a degree of flexibility in the interpretation of the cross-border impact, mainly based on data sharing. Other participating stakeholders aim to consider energy efficiency gains, RES integration, and electrification as sufficient cross-border impact for any project. In the second webinar, 'Selection procedure and criteria for Projects of Common Interest', one stakeholder representing local and regional energy companies also encouraged interpreting the cross-border criterion as any relevant shared concepts among Member States with or without physical connection, e.g. transfer of post-project know-how in innovative fields.

4.4.3 Evaluation question 8

To what extent are the provisions of the TEN-E Regulation able to respond to new or emerging issues such as the energy and climate targets for 2030, the EU long-term decarbonisation

[187] European Commission (2017a). Towards a sustainable and integrated Europe. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/report_of_the_commission_expert_group_on_electricity_interconnection_targets.pdf.

commitment towards carbon neutrality, the energy efficiency first principle and EU readiness for the digital age ([188])?

Sub-questions:
8.1 Which provisions[189] are in place to address the new or emerging issues? Has the Regulation addressed the new or emerging issues with relevant provisions?
8.2 To what extent does the cross-border criterion address those issues? Are sector coupling projects sufficiently addressed? If not, what could be changed?
8.3 What are the new or emerging issues that the provisions of the TEN-E Regulation do not cover?

Conclusions

In the analysis of how the current provisions of the TEN-E Regulation can respond to new emerging issues and technologies, the following limitations were found.

The Energy Efficiency First Principle (EEFP) is considered not to be sufficiently developed in the TEN-E Regulation. The EEFP is not mentioned explicitly in the TEN-E Regulation and very limited mention is made of energy efficiency.

The regional approach of the TEN-E in the definition of geographical priority corridors and regional groups may not be aligned to EU-wide solutions that can be better addressed through thematic areas and EU-wide groups.

The current definition of the cross-border criterion may hinder the deployment of decentralised infrastructures.

Some PCI selection criteria may hinder deployment of emerging technologies. In particular, the voltage threshold of 10 kV for smart grid projects in Annex IV.1.e leaves out essential installations of these projects, and the 20 % requirement of RES generation in the network can limit the deployment of smart grids in regions with lower penetration of RES capacity.

The methodologies developed by the ENTSOs - scenario development, modelling and CBA assessment, which are the basis of the PCI selection process, need to be adapted to include all new or emerging technologies and take a holistic view of the energy system.

The permit-granting process, as conceived by the TEN-E is only effective for large transmission infrastructure projects. Concepts such as the one-stop shop and provisions in Chapter III related to environmental impact assessment, duration and implementation of the permit-granting process cannot be adequately applied to smart grid projects, as confirmed by all the smart grid project promoters who took part in the stakeholder consultation.

Public engagement since the early phase of the projects seems to be the most effective way to increase public acceptance of PCIs, including those related to new or emerging technologies.

Regulatory incentives are relevant for new or emerging technologies like offshore wind hybrid projects, where additional regulatory and technical risks are expected compared to the usual transmission projects.

(188) Specifically, the just transition of coal regions, smart grids, energy savings from smart building controls, CO2 network development, hydrogen networks, hydrogen injection into existing gas network, multi-directional and highly-integrated energy systems, integration of various renewables (including gases such as biomethane, and power-to-gas), smart charging of electrical vehicles, carbon capture, storage and utilisation, energy storage, sector integration, infrastructure climate resilience, the interface and interlinkages between transmission and distribution grids.

(189) For instance, regional approach, cross-border criterion, PCI selection process and criteria, permit-granting procedure, public participation, regulatory incentives or cross-border cost allocation.

Analysis

We first present a section on the energy-efficiency-first principle in the TEN-E Regulation, then structure the analysis according to various provisions of the TEN-E Regulation and how they address emerging issues.

Energy Efficiency First Principle

The EEFP is an important principle, as one of the cornerstones of the EU energy policies, which needs to be reflected in the TEN-E Regulation.

According to Article 2 (18) of the Governance Regulation 2018/1999, *'energy efficiency first means taking utmost account in energy planning, and in policy and investment decisions, or alternative cost-efficient energy efficiency measures to make energy demand and energy supply more efficient, in particular by means of cost-effective end-use energy savings, demand response initiatives and more efficient conversion, transmission and distribution of energy, whilst still achieving the objectives of those decisions'*. The European Council endorsed a 2030 Framework for Energy and Climate for the EU with an indicative target of improvement in energy efficiency of at least 27 %, to be reviewed by 2020 with a view to increasing the level to 30 %. Amendments to Directive 2012/27/EU of the European Parliament and of the Council have set the EU-level target for improvements in energy efficiency in 2030 to at least 32.5 %, including a provision for a review with a view to increasing the EU-level targets ([190]). As outlined in the recent EU Strategy for Energy System Integration, applying the energy-efficiency-first principle across sectoral policies is at the core of system integration. It states in its key actions the promotion of the energy-efficiency-first principle in all upcoming relevant methodologies and legislative revisions like the TEN-E Regulation.

The current TEN-E Regulation mentions energy-efficiency mainly in its recitals: (7) achieving a 20 % increase in energy efficiency by 2020 whereby energy efficiency gains may contribute to reducing the need for construction of new infrastructures as part of the Union's energy and climate policy objectives; (8) EU-wide integrated networks and deployment of smart grids are vital for increased energy efficiency, among others; (17) to promote energy efficiency and energy saving as energy policy objectives of the Treaty on the Functioning of the European Union (TFEU). Energy efficiency is only mentioned again in Annex IV, 4 (e), which defines energy efficiency measures, together with others, as a concept to be assessed in order to quantify the PCI criterion efficiency and service quality in electricity supply grid operations for project categories under Annex II.1 (e), i.e. electricity smart grids. The concept of EEFP is not included as such in the TEN-E Regulation.

Article 51.3 of the Electricity Directive ([191]) mandates that the TYNDP fully take into account the potential for the use of demand response, energy storage facilities or other resources as alternatives to system expansion. The most recent TYNDP 2020 is being developed, but the scenarios report has already been published. It includes a central policy scenario, "National Trends", based on the Member States' NECPs, and is compliant with the EU's 2030 Climate and Energy Framework, including the 32.5 % energy efficiency target. Energy efficiency gains are accounted for in the demand levels of the scenarios to be modelled. As for the CBA methodologies, energy efficiency is measured in the indicator grid losses for electricity projects ([192]); whereas for gas projects, no energy efficiency evaluation has been found in the CBA methodology ([193]). Smart grid projects follow a specific CBA methodology developed by the JRC, based on a list of KPIs, among which energy efficiency is evaluated in KPI_{15} - demand-side participation in electricity markets and in energy efficiency measures. Trinomics et al. (2018) stressed that the current setup for selecting PCIs is partially adequate, given the deficiency in accounting for energy efficiency in the evaluation process.

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[190] Regulation (EU) 2018/1999. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1999&from=EN.

[191] Directive (EU) 2019/944. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0944&from=EN.

[192] ENTSO-E (2019a), 3rd ENTSO-E Guideline for Cost Benefit analysis of Grid Development Projects (draft version). Retrieved from: https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/tyndp-documents/Cost%20Benefit%20Analysis/191023_CBA3_Draft%20for%20consultation.pdf.

[193] ENTSOG (2018), 2nd ENTSOG Methodology for Cost-Benefit Analysis of Gas Infrastructure Projects. Retrieved from: https://www.entsog.eu/sites/default/files/2019-03/1.%20ADAPTED_2nd%20CBA%20Methodology_Main%20document_EC%20APPROVED.pdf.

The stakeholder consultation showed different opinions on how the EEFP is not sufficiently reflected in the TEN-E Regulation. Comments on energy efficiency were addressed by 32 stakeholders across 112 respondents to the targeted consultation, including stakeholders from civil society (ten), the industry (nine), NRAs (three), NCAs (two), energy producers (two), DSOs (two), TSOs (two) and others (two). Stakeholders particularly mentioned that the TYNDP scenarios, modelling and CBA methodologies from the ENTSOs do not consider sufficiently energy efficiency in project evaluations. Eligibility criteria and PCI selection are not considered either to reflect adequately energy efficiency when evaluating projects. Some stakeholders suggested creating new thematic areas around the concept of energy efficiency to deploy decentralisation and demand flexibility solutions or retrofitting of current gas infrastructures (gas TSO). Some stakeholders also suggested evaluating PCI candidates compared to alternative energy efficiency solutions (civil society, industry). Lastly, industry stakeholders commented that the TEN-E Regulation should be aligned with the provisions on network infrastructures in the Energy Efficiency Directive ([194]).

Regional approach

From the insights gained through the desk review and, especially, the stakeholder consultation, thematic areas and/or fewer and expanded priority corridors may help to harmonise EU-wide solutions, although some specific priority corridors may be needed to allow regional differentiation in specific cases.

It was suggested that regional groups, aligned with priority corridors and thematic areas, be brought to a European dimension by ACER-CEER, in their position on the revision of the TEN-E Regulation, in view of progressively harmonising criteria across regional groups and sectors, while serving resource efficiency and transparency in the regional groups operation. Cross-regional meetings have been held where regional needs were identified, as were methodologies for the evaluation of project candidates for PCI lists which are common across regional groups, but differentiated between electricity and gas projects.

Regional groups have been effective in discussing regional needs and proposing PCI candidate projects for the PCI lists. However, gaps have been found in terms of communication and transparency of the project candidate evaluation processes to establish the PCI draft lists, as addressed in the *PCI selection process and criteria* section. Restructuring the current regional groups into EU-wide groups may help in terms of transparency or, at least, help to harmonise criteria in the negotiation and final evaluation of projects to define the PCI draft lists.

Cross-border criterion

Cross-border impact, defined in Annex IV.1 of the TEN-E Regulation, is differentiated by type of infrastructure: electricity transmission, electricity storage, gas transmission, gas storage or LNG and smart grids. The latter may need to be revised to foster the full deployment of smart grids and decentralised solutions for the energy infrastructure needs at the DSO level.

The smart grid projects are often decentralised and, by nature, not necessarily cross-border projects, as they are typically implemented at DSO level. Hence, fulfilling the requirement for cross-border co-operation may be a hindrance. As the need for flexibility and sector coupling will be increasing, and since electric interconnection between countries will be highly relevant ([195]), there must also be a recognition that smart grid projects within countries can provide positive results on the larger European scale of renewable energy integration. Of the current six smart grid projects in the 4th PCI list, not all involve physical cross-border infrastructures. The cross-border criterion of these projects primarily relies on systems-, data- or policy-sharing initiatives between Member States. That indicates that the current cross-border criterion interpretation for smart grids is flexible in considering projects with infrastructures in different Member States where the cross-border action is not necessarily a physical infrastructure.

Some stakeholders were open to easing the definition of cross-border impact to shared relevant objectives among Member States, such as significant CO2 reduction or other impacts, like energy efficiency gains, RES integration or electrification of non-electrified energy demand sectors. Such a

[194] Directive 2012/27/EU. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0027&from=EN.

[195] European Commission (2017a). Towards a sustainable and integrated Europe. https://ec.europa.eu/energy/sites/ener/files/documents/report_of_the_commission_expert_group_on_electricity_interconnection_targets.pdf.

broader redefinition of cross-border impact may foster the implementation of decentralised projects and other emerging solutions currently not covered within the TEN-E Regulation. Other stakeholders, such as ACER, consider that opening up the definition of the cross-border criterion too much may be a risk to maintaining the number of PCIsat a manageable level, and only contemplate large-scale projects within the scope of the TEN-E Regulation (so as to facilitate project monitoring and timely implementation). In its position paper, ACER openly states that the TEN-E Regulation is not the most appropriate tool for addressing small-scale projects. Some stakeholders also pointed out that the outermost regions have a disadvantage with regard to the cross-border criterion.

PCI selection process and criteria

PCI selection criteria for smart grids have been found to show limitations in the full deployment of smart grid projects. Specific criteria for smart grid projects may need to be revised, including in view of fostering the inclusion of other decentralised solutions and reinforcement of the grid at a distribution level within the TEN-E Regulation, in line with the grid developments outlined in the EU Strategy for Energy System Integration.

The ACON case study indicated that the selection criteria in current TEN-E Regulation to facilitate the deployment of electricity smart grid projects might be too restrictive. Project promoters complained of the current low voltage threshold of 10 kV, as set in Annex IV.1.e of the Regulation, which excludes essential infrastructures from smart grid projects, such as smart meters connected at low voltage levels that allow demand-side management. The EU vision of the new energy system as an integrated system with decentralised production advocates for facilitating the deployment of energy grids at the distribution level, where most RES are connected.

In the targeted survey, smart grid project promoters also complained about the exclusion of low voltage infrastructures, pointing out that the potential hindrance caused by the 20 % RES generation requirement in the network covered by the project, since it limits the deployment of smart grid projects in regions with a lower penetration of RES.

Methodologies developed by the ENTSOs under Article 11

As provided by Article 11 of the TEN-E Regulation, the ENTSOs are responsible for developing an energy system-wide cost benefit analysis. ENTSOs methodologies – scenario development, modelling, CBA assessment - have been constantly evolving since their first release. ENTSO-E CBA methodology is currently in its third version ([196]), published on 28 January 2020. ENTSOG CBA methodology is in its second version ([197]), published on 23 October 2018. The most recent TYNDP 2020 package, currently under development, has also incorporated major changes to the scenario-building guidelines ([198]).

A Roadmap for an MSPS ([199]) was published in 2020, setting out the path towards a cross-sector energy system integrated modelling and planning exercise, in line with the trends of the future energy system as conceived by the EU Strategy for Energy System Integration ([200]). As stated by the ENTSOs during the stakeholder consultation, continuous effort is put into adapting their methodologies. They acknowledge that further development is needed to accommodate all the new or emerging technologies and develop fully integrated energy system models. Work is currently

[196] ENTSO-E (2020a), 3rd ENTSO-E Guideline for Cost-Benefit Analysis of Grid Development Projects (draft version). Retrieved from: https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/tyndp-documents/Cost%20Benefit%20Analysis/200128_3rd_CBA_Guideline_Draft.pdf.

[197] ENTSOG (2018), 2nd ENTSOG Methodology for Cost-Benefit Analysis of Gas Infrastructure Projects. Retrieved from: https://www.entsog.eu/sites/default/files/2019-03/1.%20ADAPTED_2nd%20CBA%20Methodology_Main%20document_EC%20APPROVED.pdf.

[198] ENTSOs (2020a), TYNDP 2020 Scenario building guidelines. Retrieved from: https://www.entsos-tyndp2020-scenarios.eu/wp-content/uploads/2020/06/TYNDP_2020_Scenario_Building_Guidelines_Final_Report.pdf.

[199] ENTSO-E (2020), Roadmap for a multi-sectorial planning support. Retrieved from: https://eepublicdownloads.azureedge.net/clean-documents/Publications/Position%20papers%20and%20reports/l_entsoe_RM_MSPS_09.pdf.

[200] European Commission (2020d), Powering a climate-neutral economy: An EU Strategy for Energy System Integration. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/energy_system_integration_strategy_.pdf.

being done on the interlinked model under the provisions in Article 11.8 of the TEN-E Regulation that will form part of the CBA methodologies. It will also ensure a better common perspective of electricity and gas projects assessment ([201]).

Permit-granting procedure

According to the survey responses from smart grid project promoters that participated in the stakeholder consultation, the permit-granting process conceived by the TEN-E Regulation does not take into account the specifics of permitting at a DSO level, e.g. large amount of small projects, overlapping implementation times, actions that do not require permits, mandatory local permits, etc.

According to the project promoters, that may lead to a higher burden from the TEN-E Regulation in the permit-granting process. One stakeholder pointed out that the Article 10 provisions, about duration and implementation of the permit-granting process, represent a time-consuming process, especially the pre-application procedure.

Public participation

As stated in the analysis on Effectiveness, in order to ensure transparency and promote public participation, Art. 9 (4) of the TEN-E stipulates that at least one public consultation be carried out by the project promoters or competent authorities in each Member State involved in a given PCI before submission of the final and complete application file. Although that has enabled more public participation, it has not necessarily improved public acceptance. The desk research results show that the public consultation provisions of the Regulation have increased opportunities for the public to be informed about and participate in the PCI permitting process. However, public opposition remains a key challenge to PCIs and have resulted in project delays ([202] [203] [204]). Some recent studies ([205] [206]) see an important connection between the early involvement of the public in energy infrastructure planning and lower opposition to projects due to improved understanding of the infrastructure needs. As such, early public participation with a focus on raising awareness about infrastructure needs during the planning stages could lower opposition to PCIs at later stages. Transparent and accessible information on the need for new energy infrastructure at a European grid level can reduce public opposition ([207]).

New or emerging technologies, aligned with EU energy strategies towards the targets of carbon neutrality, have in general a good degree of public acceptance, yet there is a risk of 'not in my backyard' (NIMBY) reactions, as seen with onshore wind development projects, where the European interest is not shared at a local level ([208]). As stated before, public engagement from

[201] ENTSOG (2019b), Focus study and interlinked model. Retrieved from: https://www.entsog.eu/sites/default/files/2019-05/20190515%20Focus%20Study%20Interlinked%20Model%20-%20Conclusion%20workshop.pdf.

[202] ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

[203] European Commission (2017b), Commission staff working document Accompanying the document commission delegated regulation amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/swd_accompanying_pci_list_final_2017_en.pdf.

[204] Case studies showed that two of the examined PCIs (TAP and Suedlinks) are both subject to significant public opposition.

[205] Ecorys et al. (2019), Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure?

[206] Scope et al. (2020), Innovative actions and strategies to boost public awareness, trust and acceptance of trans-European energy infrastructure projects. Draft Revised Interim Report. Provided by DG ENER.

[207] Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Final Report. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

[208] European Commission (2008), Green Paper: Towards a secure, sustainable and competitive European energy network. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/ba923b2d-4b1d-45db-8b4f-8da13d4ca089/language-en.

early project phases seems to be the most effective way of increasing public acceptance of PCIs and accommodating any public resistance at an early stage.

Regulatory incentives

As stated in Section 4.2.1, risk-based incentives have been used in very few instances (two requests for electricity PCIs, with one granted, and four requests for gas PCIs, with three granted). In the Trinomics et al. (2018) study, reasons for low application rates relate to assumptions by project promoters that NRAs do not see higher risks for PCIs or that the regulatory framework allows for coping with the risks. Project promoters noted receiving negative feedback from NRAs and deciding not to apply as a result. However, according to offshore energy industry stakeholders and project promoters, the instrument can become more relevant in the context of offshore grid infrastructure, where there will be both regulatory and technology challenges in the development of those new types of project ([209]). Such projects will include offshore wind hubs far from the coast with high wind capacities installed, offshore cables and substations, and power-to-gas infrastructures ([210]). The ownership, cost-allocation, market set-up and remuneration of the different assets is still to be defined. Thus, there seems to be greater risks associated with these projects than with the more usual transmission infrastructure projects that have been covered so far by the TEN-E Regulation. In this context, regulatory incentives are considered necessary for mitigating the higher risks associated with future PCIs of emerging technologies.

Stakeholder views differ in respect to risk-based incentives. While some TSOs see an added value in such incentives in adjusting the financial risk, regulators refer to the low number of applications to illustrate the lack of need for additional risk-based incentives. However, due to the limited experience of all stakeholder types, such views remain largely theoretical in nature, rather than providing an indication of the actual effectiveness of the risk-based incentives.

4.5 Coherence

4.5.1 Evaluation question 9

Are the measures set out within the TEN-E Regulation mutually reinforcing or are there any overlaps, inconsistencies or incoherencies (when read in isolation)?

Conclusions

Evidence obtained from the evaluation questions identified limited concerns regarding the *internal* coherence of the TEN-E Regulation, although we have identified several technical points around the implementation of certain elements.

Potential areas where the Regulation can be improved include:

1. Recital 7 states that the Regulation should be able to accommodate possible future EU energy and climate policy objectives. The evidence from evaluation question 10 below suggests that the Regulation has, in fact, not kept pace. Where clear policy directions in relevant areas have been established, they should be formally reflected in the Regulation. Where there is ongoing uncertainty in material areas, the Regulation should be able to adapt to developments;
2. There may be internal conflicts regarding the legal drafting around the assessment of cost allocation between Articles 12(1) and (5), and Article 12(4). That may result in less than optimum CBCA decisions in certain cases, although any substantive issues should be confirmed during the drafting stage of the revised TEN-E;
3. The notion of 'sufficient maturity', as referenced in Articles 10 and 12, and Annex III, appears to be imprecise in application, as it is not a defined term in the TEN-E. There is evidence that this concept has been interpreted differently by different regulatory actors. Upon review, we consider that such issues merit further consideration;
4. The timetable and process is not well defined for the Commission's updates of the TYNDP Guidelines to the ENTSOs under the TEN-E Regulation, Annex III 2(5). The Commission

[209] European Commission (2014a), Study on regulatory incentives for investments in electricity and gas infrastructure projects. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/MJ0614081ENN_002.pdf.

[210] North Sea Wind Power Hub programme (2020). Retrieved from: https://northseawindpowerhub.eu/project/.

regularly updates these Guidelines ([211]) but the process could benefit from more formalisation to improve stakeholder visibility/planning.

Analysis

The desk review of the TEN-E Regulation provisions indicates that the substantive provisions are, broadly, internally coherent as regards the legal drafting, subject to the finding below.

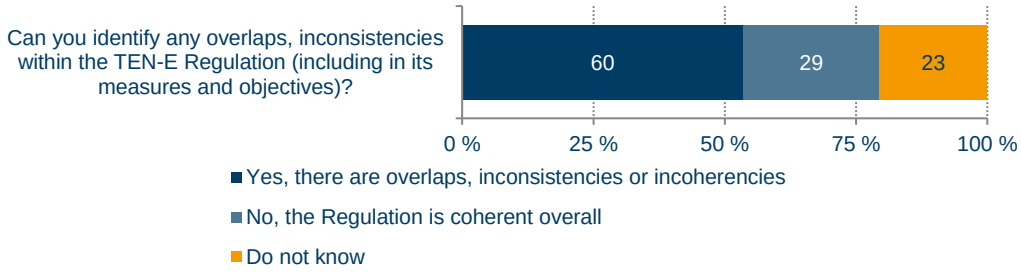
Although the Regulation provisions are broadly coherent, in and of themselves, there are elements of inconsistencies between the objectives/aims set out, particularly in the recitals, when analysed next to the substantive provisions of the Regulation. For example, at recital (7), the following is stated.

> 'At the same time, the Union has to prepare its infrastructure for further decarbonisation of its energy system in the longer term towards 2050. This Regulation should therefore also be able to accommodate possible future Union energy and climate policy objectives.'

Given the emerging conclusions that the TEN-E Regulation will require revision in order to be consistent with the European Green Deal ambitions (further discussed below), we question whether the drafting in the substantive provisions has been able to demonstrate sufficient flexibility to adapt to changing EU policy objectives over time. That is particularly of note in light of the recent considerable and rapid development of EU energy and climate policy – particularly the increased emphasis placed on decarbonisation objectives against others (such as SOS), notwithstanding, for example, the need for PCIs to be analysed in line with the latest available Union-wide 10-year network development plans ([212]).

Stakeholder responses varied in relation to this evaluation question. The majority commented in relation to the Regulation's *external* coherence, as addressed in evaluation questions 10 and 11. Those comments largely focused on the consistency with contemporary EU energy and climate policies. That explains, for example, a significant proportion of the 'yes' responses in the targeted survey results shown in Figure 4.26.

Figure 4.26 Responses to the targeted survey: Can you identify any overlaps, inconsistencies within the TEN-E Regulation (including in its measures and objectives)? (n=112)



Many stakeholders identified no *internal* inconsistencies in the Regulation, but some provided evidence of internal technical inconsistencies in a number of areas. Those include the following.

An academic institution identified a possible inconsistency within the provisions of Article 12 of the Regulation which may have a corresponding impact on the effective execution of CBCA decisions ([213]). The inconsistency identified is an apparent conflict between the principle that efficiently

[211] See for example Commission Recommendation of 24 July 2018 (2018/C 265/01).
[212] Regulation 347/2013 Annex IV, (2).
[213] Florence School of Regulation (2020), Policy Brief: Making the TEN-E Regulation Green Deal compatible – Eligibility, selection and cost allocation for PCIs. Retrieved from: https://fsr.eui.eu/publications/?handle=1814/67673.

incurred costs of PCIs should be covered by tariffs ([214]), but that NRAs may decide (when taking coordinated decisions) to allocate only part of the costs ([215]). As a result, a number of CBCA decisions were incomplete, with the consequence of final decisions being delayed because not all funding requests were granted or a lower grant was awarded. We have recommended that this issue be examined further.

One project promoter indicated a specific issue regarding the application of the 'maturity' concept in the Regulation. A review of the Regulation indicates that this concept is not defined in the Regulation and could, therefore, be open to interpretation. Consequently, the stakeholder indicated that different actors (competent authorities, National Regulatory Authorities and ACER) apply the concept inconsistently. Some competent authorities, for example, apply the concept as a general power to confirm or approve the PCI status of the project. We consider that this comment has some merit and should be explored further in developing the revised TEN-E Regulation.

Finally, a TSO stakeholder indicated that the Commission is required under the TEN-E to issue Guidelines on criteria to be applied by the ENTSOs for developing the TYNDPs by January 2014 ([216]). In reality, the Commission publishes regular updates to the guideline on a periodic basis. The stakeholder suggested that the TEN-E be clarified to formalise that practice, notably to set out timelines for when the Commission will issue revisions and precise dates as to when they will apply.

4.5.2 Evaluation question 10

How does the legislation interact with other EU, national or international initiatives (e.g. actions in the field of environment, single market, climate action and the Clean Energy Package) which have similar objectives?

Sub-questions:
10.1 What, if any, inconsistencies/conflicts exist between the TEN-E Regulation and the relevant provisions of the Third Package and the Clean Energy Package (including electricity and gas)?
10.2 What, if any, inconsistencies/conflicts exist between the TEN-E Regulation and any international-level legal provisions/initiatives (e.g. Paris Agreement, Aarhus Convention, UN Sustainable Development Goals)?
10.3 What, if any, inconsistencies/conflicts exist between the TEN-E Regulation and any national-level legal provisions/initiatives (e.g. planning, permitting)?

Conclusions

No significant inconsistencies have been identified between the TEN-E Regulation and the Third Package or the network codes identified for examination in this evaluation.

The TEN-E Regulation will require formal adaptation to account for the updated legislative and policy environment implemented by the various changes under the Clean Energy Package. Those include 'mechanistic' changes (such as updating to align with renewable energy and interconnector targets), but also more nuanced changes such as altering PCI criteria to better align with the intended policy goals behind the Clean Energy Package (such as greater roles for DNOs).

Inconsistencies with the Paris Agreement and UN Sustainable Development Goals are evident, and were indicated by stakeholders, although any revision to ensure alignment with the European Green Deal principles should ensure that the TEN-E is consistent with the objectives in those frameworks (as discussed in evaluation question 11 below).

Some inconsistencies with national-level legal frameworks were identified by stakeholders, although most did not necessarily flag significant changes to the TEN-E Regulation in order to remedy them. The picture is mixed, however, with stakeholders based in some Member States indicating that TEN-E Regulation principles are well reflected in and consistent with national level legal provisions. That suggests there could be issues with national-level implementation and

([214]) Regulation 347/2013 Articles 12(1) and (5).
([215]) Regulation 347/2013 Article 12(4).
([216]) Regulation 347/2013, Annex III (2) (5).

compliance, although, as a detailed review of TEN-E application at the Member State level is beyond the scope of this evaluation, that could not be formally verified across Member States. Many stakeholders stated that further prescriptive measures in the TEN-E Regulation were not required to remedy that inconsistency. Nevertheless, we highlight some suggestions for potential refinement of the TEN-E in certain areas.

Urgent issues that require attention in the revision of the Regulation include:

1. The current TEN-E Regulation is not consistent with the various targets and objectives as set out in the various elements of the Clean Energy Package. That includes (but is not limited to) the alignment with revised interconnection targets ([217]), the five dimensions of the Energy Union ([218]), and various principles and consumption targets for renewables ([219]). The current TEN-E does not reflect the linkages anticipated between the Market Design Regulation as regards the Regional Coordination Centres established under that Regulation ([220]) and does not directly reference 'energy-efficiency-first' principles, a key aspect of the Energy Union ([221]). On the latter point, the TEN-E currently makes no reference to the 'energy-efficiency-first' principle in the recitals, nor explains how the TEN-E contributes to that objective. References to 'sustainability' in Articles 4 (2) (ii) and 4 (4) (a) could be interpreted as encompassing the principle, but that would require a wide reading of the current provisions;
2. Voltage requirements and conditions in Annex II and Annex IV(1) (a) of the Regulation, the condition for smart grid projects in Annex IV (1) (e) and the criteria under Article 4(c) do not appear to allow the adequate facilitation of such projects. That is not consistent with the intent of Clean Energy Package principles, given the increasing focus on smart grid and DNO level projects. Relaxation of requirements for participation of both DSOs and TSOs should also be considered. That would help enable a greater range of projects, be more consistent with the intentions of the Clean Energy Package and align with European Green Deal objectives.

Potential areas where the Regulation can be improved include:

1. Projects are currently required to report under ACER monitoring each year. Some projects observe that some Member States also have reporting requirements at a national level, some of which duplicate or do not necessarily align (from the timing perspective) with EU-level requirements.

Analysis

Third Package

We have not identified any significant inconsistencies as regards the TEN-E Regulation or the key elements of the Third Package. The overall objectives of the TEN-E around supporting increased interconnection, cross-border trading and network balancing are entirely consistent with the overall objectives of the Third Package. Stakeholder consultation did not identify any significant inconsistencies in this area.

Network codes

Analysis of legal texts on the TEN-E Regulation, including existing network codes in electricity ([222]) and gas ([223]), did not identify any material conflicts or incoherence between the instruments. Stakeholder consultation did not identify any significant inconsistencies in this area.

[217] In particular, reference to the 15 % 2030 interconnection target at Regulation (EU) No 2018/1999, Article 4 (the Governance Regulation).
[218] Regulation (EU) No 2018/1999, Article 4 (the Governance Regulation).
[219] Directive (EU) No 2018/2001 (the Renewable Energy Directive), Article 3 (5) (a) – (d) and Article 3 (1) (1).
[220] Directive (EU) 2019/944: Article 37 (1) (p) and Annex I (14).
[221] Directive (EU) 2018/2002 (Energy Efficiency Directive) recital (3) and Governance Regulation Article 2(18) and Article 3 (3) (b).
[222] Commission Regulation (EU) 1222/2015 (Capacity Allocation and Congestion Management).
[223] Commission Regulation (EU) No 2017/459 (Capacity Allocation Mechanism Network Code), EC Decision of 24 August 2012 on amending Annex I to Regulation (EC) No 715/2009 (The CMP Guidelines), Regulation (EU) 2017/460 (Transmission tariff structures for gas).

Clean Energy Package – Market Design Directive ([224])

The Clean Energy Package, in particular the Market Design Directive, envisages enhanced roles for distribution system operators. That reflects an increasing propensity for the potential of localised solutions ([225]) and increased embedded generation at the DNO level, particularly with the increased deployment of renewable energy sources.

As such, the current provisions of the TEN-E Regulation, in particular the requirements for smart grids, could be more aligned with the direction of travel within the Clean Energy Package in this regard. For example, the rules and indicators for PCIs for smart grids ([226]) may be seen as inflexible, particularly the requirements around participation of both TSO and DSO in a particular project, or the voltage requirements.

Stakeholder consultation did not identify any significant inconsistencies in this area. Many DSO stakeholder representatives emphasised the above in the context of the DSO role as *neutral market facilitators*.

Clean Energy Package – Market Design Regulation ([227])

Many of the provisions in the Market Design Regulation relate to operational aspects of market trading/rules and set out rules in areas such as the design principles for capacity mechanisms in Member States. As such, many aspects are not directly relevant in the context of the TEN-E Regulation.

Interfaces are, however, already anticipated between institutions established in the Regulation, for example between the Regional Coordination Centres ([228]), regional groups established under the TEN-E Regulation ([229]) and the Union-wide TYNDP ([230])

Other potential procedures/requirements are set out under the Market Design Regulation, such as the European Resource Adequacy Assessment and National Resource Adequacy Assessments ([231]).

Those observations were generally reflected in the stakeholder consultations, although one project promoter noted that the definition of 'interconnector' in Article 2 of the Market Design Regulation could be overly restrictive if applied in the context of the TEN-E Regulation's objectives.

Clean Energy Package – Governance Regulation ([232])

The Governance Regulation sets out a framework for the governance of the Energy Union and Climate Action (governance mechanism), designed to help secure the achievement of long-term climate objectives at the EU and international levels. As a preliminary point, the TEN-E Regulation may require alignment with updated targets on electricity interconnection in Member States ([233]).

We have identified two other key aspects of the current TEN-E Regulation that could be considered: notably (a) specific reference to and alignment with the five dimensions of the Energy Union ([234]), and (b) consideration within the TEN-E Regulation of Member States' Integrated NECPs. Regarding the former, although the TEN-E Regulation makes reference within the PCI evaluation framework to many aspects of the Energy Union – in that it seeks to support SOS, sustainability and competitiveness – the TEN-E Regulation does not make specific reference to the 'energy-efficiency-first' principle ([235]). Articles 4 (2) (ii) and 4 (4) (a) do refer to requirements to take account of 'sustainability' in PCI criteria, so the principle could logically be inferred, given the over-riding

[224] Directive (EU) 2019/944 (The Market Design Directive).
[225] Directive (EU) 2019/944 (The Market Design Directive), Article 16.
[226] Under Annex IV (1) (e) and the requirements placed on smart grids under the criteria for PCIs under Article 4(4) of the TEN-E Regulation.
[227] Regulation (EU) No 2019/943 (Market Design Regulation).
[228] Established under Article 35 of the Market Design Regulation.
[229] Article 37 (1) (p) and Annex I (14) of the Market Design Regulation.
[230] Article 48 of the Market Design Regulation.
[231] Article 23 and 24 of the Market Design Regulation.
[232] Regulation (EU) No 2018/1999 (The Governance Regulation).
[233] In particular, reference to the 15% 2030 interconnection target at Article 4 of Regulation (EU) No 2018/1999.
[234] See Article 4 of the Governance Regulation.
[235] See article 2(18) and Article 3 (3) (b) of the Governance Regulation.

importance of the principle under the Governance Regulation, the TEN-E would benefit from being more specific on that point. As such, any future development of the assessment framework for potential PCIs should better reflect the principle of energy efficiency first, to be consistent with the requirements of the Governance Regulation. Those observations were generally reflected in the stakeholder consultations, with various stakeholder groups in the targeted survey, OPC and interviews observing that the TEN-E should more directly reflect that principle.

Clean Energy Package – Renewable Energy Directive [236])

The overall principles of the TEN-E Regulation would appear to align to an extent with the high-level objectives of the Renewable Energy Directive, particularly around Article 3 of the Directive. It sets out the Commission's commitment to using enhanced levels of Union funds for a range of purposes including: deployment and integration of RES; system flexibility; developing interconnectors; enhancing regional cooperation; achieving the high-level energy consumption targets for 2030 ([237]).

The requirements placed on Member States to streamline national-level rules for authorisation procedures for plants and transmission/distribution networks in support of RES under Article 15 would also appear to be complimentary to the overall objectives of the TEN-E Regulation to streamline national-level planning and consenting procedures. However, we would suggest that that aspect of any future TEN-E Regulation be developed with consideration of the requirements under Article 15 of the Directive, particularly given the reference there to ensuring that national rules on authorisation contribute to the implementation of the energy-efficiency-first principle ([238]).

Although the principles of the TEN-E Regulation and the Renewable Energy Directive would appear to align (at least at a high level), there could be further consideration given to whether the specific implementation of the existing TEN-E is in fact optimised to deliver on the ambitions in the Renewable Energy Directive. Further discussion on that topic can be found below, where consistency with wider EU energy policy is considered.

Those observations were generally reflected in the stakeholder consultations.

Clean Energy Package – Energy Efficiency Directive ([239])

There does not appear to be any direct incoherence between the TEN-E Regulation and the specific measures in the Energy Efficiency Directive, noting that many of the requirements relate primarily to operational objectives on Member States regarding energy saving obligations, metering and billing, etc. However, recital 3 of the Energy Efficiency Directive states:

> 'Energy efficiency should be recognised as a crucial element **and a priority consideration** in future investment decisions on the Union's energy infrastructure.'

That would suggest that any recasting of the TEN-E Regulation could review the weight placed on energy efficiency under any rules/criteria for projects, so as to be consistent with current EU policy priorities. That is largely consistent with the wider conclusions of the literature review.

These observations were generally reflected in the stakeholder consultations.

Article 107 and State aid

There is no reference to EU State aid rules in the TEN-E Regulation. Obligations by Member States to secure the implementation of PCIs are without prejudice to other obligations stemming from EU law, including requirements under the TFEU regarding State aid ([240]). While it may be implicit that a project's inclusion on the EU list of PCIs would indicate positive treatment for the project under a State aid perspective, the processes, nevertheless, remain separate, with some degrees of overlap

[236] Directive (EU) 2018/2001 (The Renewable Energy Directive).
[237] See the Renewable Energy Directive, Article 3 (5) (a) – (d) and Article 3 (1) (1).
[238] See Article 15 (1) of the Renewable Energy Directive.
[239] Directive (EU) 2018/2002 (Energy Efficiency Directive).
[240] Article 7 (7) of the TEN-E Regulation.

([241]). Coherence would be improved if any recasting of the TEN-E Regulation made any direct reference to and complemented the EU State aid regime to ensure that project assessment and treatment is consistent under each framework.

Stakeholder consultation did not identify any inconsistencies in that area.

National level legal instruments

Some inconsistencies with national-level legal frameworks were identified by stakeholders, although most did not necessarily flag significant changes to the TEN-E Regulation in order to remedy them. However, the picture is mixed, with stakeholders based in some Member States indicating that the TEN-E Regulation principles are well reflected and consistent with national-level legal provisions. That suggests an issue with national-level implementation and is not a surprising finding. Many stakeholders stated that further prescriptive measures in the TEN-E Regulation were, therefore, not required.

For instance, material differences were noted during the stakeholder interviews, with regulatory stakeholders in Denmark, for instance, noting no specific views on this point and confirming that permit-granting procedures worked well in their jurisdiction in relation to PCIs. On the other hand, difficulties were noted by TSO and DSO stakeholders in Czechia.

One observation from the *Suedlink* project case study is that there were some issues regarding the reporting/monitoring requirements for ACER under Article 5 of the TEN-E Regulation and their interaction with similar reporting requirements at the national level. National level requirements in this jurisdiction are extensive and do not necessarily align with ACER requirements (as least with regards to timing). As such, there may be opportunities to better streamline reporting requirements to reduce administrative burdens on projects.

Further observations

Analysis of the case studies supports the conclusion that the current TEN-E Regulation does not adequately support smart grid project development, which is an area identified as a key focus area for current EU energy and climate policy.

4.5.3 Evaluation question 11

How well does the legislation fit with and complement other EU policies (e.g. Regional Policy, Research and Innovation, and Environment) but also other elements of EU energy policy (e.g. internal market design, renewable energy framework, energy efficiency first principle, Union energy and climate targets for 2030, the EU long-term decarbonisation commitment and the European Green Deal)?

Sub-questions:

11.1 Does the operation of EU funding mechanisms and programmes (such as CEF, Cohesion Fund, European Regional Development Fund and Horizon 2020) interact effectively with the implementation of the TEN-E Regulation, or are there overlaps/inconsistencies?

11.2 What, if any, inconsistencies/conflicts exist between the TEN-E Regulation and EU initiatives for decarbonisation/sustainability (such as the European Green Deal, Sustainable Finance, habitats, water environment and Long-Term Strategy for Decarbonisation)?

11.3 Does the TEN-E Regulation contribute to implementing article 349 of the TFUE and the October 2017 Commission strategy for the outermost regions and how?

11.4 Does the TEN-E Regulation adequately and coherently support EU policy initiatives in the field of digitalisation (in particular relevant policy strands within 'Europe Fit for the Digital Age' such as security, standardisation and development of smart networks)?

11.5 Does the TEN-E Regulation adequately and coherently support the objectives of the Trans-European Transport Network (TEN-T) policy?

([241]) For example, between the criteria set out at Article 4 of TEN-E and assessment of aid under Article 107 (3) of the TFEU.

Conclusions

The TEN-E Regulation is largely consistent with the legislative and policy environment that was in place at the time of its implementation. However, since the introduction of the TEN-E Regulation, EU energy and climate policy has evolved considerably. The TEN-E Regulation requires substantive revision to bring the Regulation into line with the priorities in the European Green Deal and to bring greater synergies with other sectoral instruments, such as the TEN-T Regulation and EU Digital Strategy, to drive decarbonisation by fostering a more cross-sectoral approach.

Urgent issues that require attention in any revision of the Regulation include:

1. The current TEN-E Regulation, including recitals and related references do not currently take account of the post-2013 energy and climate policy environment, in particular the principles set out in the European Green Deal and those of sustainable investment, as set out in the EU's Sustainable Finance Framework;
2. Oil-related infrastructure projects are currently within the scope of the TEN-E Regulation, including priority oil corridors. Support for such infrastructure would appear to be inconsistent with the European Green Deal principles;
3. The PCI status for 'new build' gas infrastructure would appear to be inconsistent with the European Green Deal principles, except where such infrastructure can demonstrate tangible decarbonisation benefits or help in the transition towards 2050 objectives;
4. The establishment of a new thematic area on clean hydrogen networks would be consistent with the European Green Deal objectives to support the development of clean hydrogen infrastructure in Europe and may provide an incentive to unlocking investment in this new emerging area;
5. There are inadequate co-ordination mechanisms within the current TEN-E Regulation to facilitate the visibility of emerging projects which may have cross-sectoral impact, particularly in the areas of Transport and Digital, and there are no requirements in the TEN-E Regulation which might promote the discovery of such synergies – such as a requirement on project promoters to examine and identify potential cross-sectoral opportunities. Examples of cross-sectoral opportunities that are not currently reflected in the TEN-E include infrastructure for Electric Vehicle (EV) charging, aspects of clean energy with maritime transport and road-haulage synergies, and opportunities to align deployment of transmission and distribution infrastructure with telecommunications;
6. The PCI criteria under Article 4 of the TEN-E does not adequately reflect the emphasis on decarbonisation objectives as set out in the European Green Deal, as well as wider EU climate and energy policy;
7. The development of the future energy system will necessarily involve approaches and technologies which differ from traditional large-scale transmission network infrastructure, such as more development at DNO level, local infrastructure and smart grid projects, which may not usually meet the criteria of having a 'significant cross-border impact' (SCBI) ([242]). As a result, the SCBI concept may need to be re-envisaged in a more holistic way, so that there is less reliance on the existence of traditional 'geographic' notions of cross-border impact, and to better reflect how current EU energy policy envisages the development of European networks.

Potential areas where the Regulation can be improved include:

1. Evidence from stakeholders suggests that the latest scenarios in 2020 are varied considerably from scenarios as set out in the Commission's 2018 Long Term Strategy. Scenarios were also not consistent with NECPs. There was limited evidence suggesting support for the removal of CO2 networks from the TEN-E Regulation;
2. Evidence suggested that the criteria for storage technologies to be eligible as PCIs under Annex IV of the TEN-E Regulation does not provide sufficient flexibility for the support of different and emerging storage technologies which might have a significant cross-border impact and facilitate the deployment of renewable energy.

[242] Under Annex IV of Regulation 347/2013.

Analysis

European Green Deal ([243])

Launched in 2019, the European Green Deal is a new growth strategy for the EU which aims to:

> 'transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resources.' ([244])

The strategy is central to the EU's overall strategic direction and will influence almost every area of EU policy in the coming years. It is vital that the TEN-E Regulation aligns with and fully supports the European Green Deal objectives.

Given the considerable movement in European climate policy in recent years, particularly the launch of the European Green Deal, it is perhaps unsurprising that many aspects of the Regulation are inconsistent with the European Green Deal objectives and will require alignment in many aspects of the legal drafting ([245]). Indeed, that is specifically recognised by the Commission:

> 'The regulatory framework for energy infrastructure, including the TEN-E Regulation, will need to be reviewed to ensure consistency with the climate neutrality objective. This framework should foster the deployment of innovative technologies and infrastructure, such as smart grids, hydrogen networks or carbon capture, storage and utilisation, energy storage, also enabling sector integration. Some existing infrastructure and assets will require upgrading to remain fit for purpose and climate resilient.' ([246])

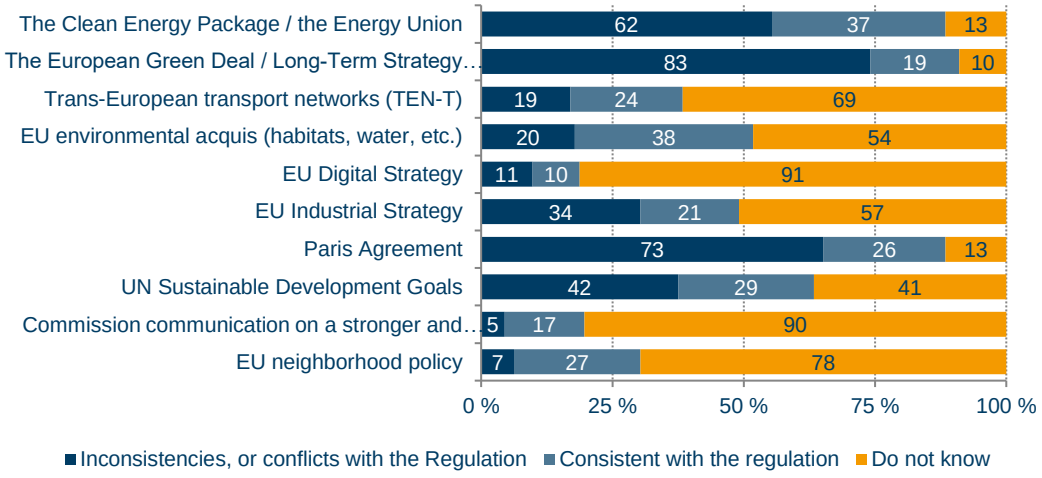
Key issues to consider in this context include:

1. To what extent and context is the continued support under TEN-E of fossil fuel projects consistent with the European Green Deal objectives, particularly the 2050 net-zero objective, or whether conditions of support for such projects should include requirements to support the development of, for example, alternative fuels such as hydrogen, include elements of carbon capture technology, or otherwise support the phase-out of more polluting technologies deployment of low carbon technologies. Under the current TEN-E Regulation, such projects have been assessed with a focus on SOS objectives and market development, as opposed to wider decarbonisation objectives. Evidence from this evaluation suggests that the scope for participation for any fossil-fuel based infrastructure will need to be significantly limited, if not eliminated, under the revised TEN-E;
2. The revision and future development of the criteria for PCIs under Article 4 of the TEN-E Regulation. Both the European Green Deal and recent developments in the EU energy market framework, including the Clean Energy Package, suggest significant prominence should be given to contributions to decarbonisation;
3. To what extent the rules and indicators under Annex IV of the TEN-E Regulation, and criteria under Article 4 (4), should be revamped to, for example, remove inflexibilities or barriers for more localised projects and smart grids ([247]). The European Green Deal objectives clearly set out an ambition to support a wide range of alternative approaches to developing networks and the energy system as a whole, including the need to support emerging technologies such as hydrogen networks and explore synergies with the 'wider' system on a cross-sectoral basis.

([243]) European Commission (2019), The European Green Deal. Retrieved from: https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf.
([244]) European Commission (2019), The European Green Deal: Section 1. Retrieved from: https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf.
([245]) For example, under Recital (7) of TEN-E for consistency with the 2050 carbon neutrality objective, alignment with greenhouse gas reduction targets, renewable energy deployment targets.
([246]) European Commission (2019), The European Green Deal: Section 2.1.2, page 6. Retrieved from: https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf.
([247]) See, for example, discussion above regarding the Market Design elements of the Clean Energy Package.

Evidence from stakeholder engagement shows overwhelming support for the need of the TEN-E Regulation to be adapted to align with the European Green Deal principles, as well as wider contemporary climate and energy policies. This is clearly shown in the high-level results of the targeted survey, outlined in the table below.

Figure 4.27 Response to Targeted Survey: Please state your opinion on the following statements regarding the consistency between the TEN-E Regulation and other policies/initiatives at EU, international and national levels. (n=112)



Analysis from across all stakeholder engagements, including interviews, the targeted survey and OPC, all show strong support for the removal of eligibility for new oil infrastructure under the TEN-E Regulation. Further, a significant number of stakeholders supported significant limitations on the eligibility of gas infrastructure for PCI status, essentially limiting the scope of eligibility to retrofitting projects to repurpose such infrastructure to utilise clean gases. Overall, our findings suggest the focus should instead be on electrification, optimisation of energy networks, development of clean hydrogen networks and the integration of renewables, primarily through the development of more and better storage technologies. Stakeholders also recognised the significant opportunities for cross-sectoral synergies (which are explored further below), which will also contribute to the objectives and approach set out in the European Green Deal.

A key enabling element for the adoption of alternative technologies under the TEN-E Regulation is a re-envisaging of the concept of 'cross-border' impacts. Several stakeholders, including academic institutions and industry participants, provided views on this and made a range of suggestions. Overall, the evidence supports the need to take a more holistic approach to the notion of 'significant cross-border impact' so that projects more closely aligned with the European Green Deal (and other) principles are appropriately enabled. We have set out several proposed approaches for that in our above conclusions.

2050 Long-Term Strategy (LTS) ([248])

The LTS presents a strategy/vision which could lead to the overall achievement of net-zero greenhouse gas emissions in the EU by 2050. It is intended to set the direction of travel for EU climate and energy policy. The LTS emphasises, as one of the seven main building blocks, the need to develop smart electricity, data/information grids and inter-connectors, and, '*where needed'*, hydrogen pipelines. Existing infrastructure and assets should be replaced with carefully designed options '*are compatible with the deep decarbonisation objective*.'

([248]) European Commission (2018a), A clean planet for all. A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0773&from=EN.

EU energy policy has developed considerably since the commencement of the TEN-E Regulation.

As suggested above, references to the role of natural gas and LNG, etc. (not decarbonised) is flagged in the Commission's long-term strategy infrequently and noted as having a short-term role, e.g. for road haulage. Europe's energy import dependence, notably as oil and gas imports are expected to fall significantly by 2050, with the primary energy supply largely coming from renewable energy sources ([249]). The policy statements in the LTS also emphasise the need to develop alternative fuels. In that regard, the TEN-E Regulation, has, for example, no direct link to the assessment criteria on requirements for fossil fuel investment to be decarbonised.

The LTS appears to signal a clear direction for the EU towards reducing dependency on traditional energy imports, notably of oil and gas, and to discourage the development of major fossil-fuel supporting infrastructure. As with the wider climate objectives set out in the European Green Deal, the TEN-E Regulation as currently drafted does not appear to align consistently with the LTS objectives.

As outlined above, analysis from across all stakeholder engagements, including interviews, the targeted survey and OPC, show strong support for the removal of eligibility for new oil infrastructure under the TEN-E Regulation. Further, a significant number of stakeholders supported significant limitations on the eligibility of gas infrastructure for PCI status, essentially limiting the scope of eligibility to retrofitting projects to repurpose such infrastructure to utilise clean gases. Several specific comments from stakeholders, during interviews, surveys and across the stakeholder engagement webinars, noted that there should be a greater element of oversight/independent scrutiny of TYNDPs at an EU level. In that regard, one industry stakeholder specifically noted that recent TYNDPs had been inconsistent with the scenarios as set out in the Commission's 2018 LTS.

Data ([250])

As part of the EU digital strategy, the Commission has launched a European Strategy for Data, with notable aspirations to further develop the sharing and utilisation of energy data, particularly at the end-user level, through development of a common European energy data space ([251]).

While the development of smart grids is a notable feature of the TEN-E Regulation, as discussed above, the effectiveness of the current framework in promoting those projects has been questioned. To be consistent with the objectives in the EU's data strategy and the wider direction of travel for the development of electricity networks in Europe, the Commission would need to consider a substantive revision of the TEN-E Regulation to ensure alignment.

In particular, the Commission could consider the need to require that PCIs align with EU work on developing interoperability of smart grid infrastructure, including alignment/complementarity with requirements for interoperability in smart metering and transmission networks under the new Electricity Directive.

Evidence from stakeholder engagement generally supported the need to improve synergies between sectoral areas, including data and transport. One TSO stakeholder noted several such projects being developed, including the deployment of fibre-optic cables together with electricity transmission lines. Stakeholders generally commented on the increasing interconnectedness of

[249] See Long-Term Strategy, Section 2, Paragraph 2: '*The clean energy transition would result in an energy system where primary energy supply would largely come from renewable energy sources, thereby significantly improving security of supply and fostering domestic jobs. Europe's energy import dependence, notably as regards imports of oil and gas, standing today at ca. 55% will fall in 2050 to 20 %. This would positively impact the EU's trade and geopolitical position as it would result in a sharp reduction of fossil fuel import expenditures (currently EUR 266 billion), with imports falling by over 70 % in some scenarios. The cumulative savings from a reduced import bill will amount to EUR 2–3 trillion from 2031 to 2050, freeing resources for further potential investments into the modernisation of the EU economy*.'

[250] European Commission (2020g), A European strategy for data. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0066&from=EN.

[251] European Commission (2020g), A European strategy for data, page 31. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0066&from=EN.

sectors and the efficiencies that can be obtained by thinking in a holistic, 'whole systems' way – that approach would bring the revised TEN-E into better alignment with the EU Digital Strategy.

CEF ([252])

Trinomics (2018) notes that the CEF is largely complementary to the TEN-E Regulation and is regarded as a logical package in terms of the administration of funding ([253]). There are some overlaps in the reporting requirements, as discussed in more detail in the Effectiveness analysis of this evaluation.

One emerging issue, as identified during stakeholder interviews (particularly a number of industry representative bodies) and in the targeted survey, suggests there is a need to look into 'bridging the gap' between wider EU funding mechanisms focused on innovation (such as H2020) and the TEN-E Regulation, particularly as many emerging technologies begin to develop commercially in the coming years. Those stakeholders did, for the most part, recognise the need to delineate clearly funding mechanisms to ensure that the TEN-E Regulation remained in place to support 'operational' projects as opposed to innovation and research. In that sense, stakeholders did appreciate that the TEN-E Regulation and CEF perform a specific role in supporting the development of infrastructure which is necessarily different to other support regimes, such as innovation, and it is important to maintain this distinction. However, refocusing the TEN-E Regulation to allow a wider variety of 'non-traditional' projects to achieve PCI status may assist in 'bridging the gap' in this area, while also supporting the wider European Green Deal objectives and the Clean Energy Package approaches.

Sustainable finance

As regards the proposals to establish an EU-level framework for sustainable finance, we note that the Taxonomy Regulation ([254]) entered into force on 12 July 2020. Under that Regulation, the Commission is required to develop a range of delegated Acts specifying the technical criteria for assessing whether an economic activity is sustainable under the framework.

Some preparatory work has already been undertaken. The Technical Expert Group, set up by the Commission in order to inform the development of the overarching design of the taxonomy, delivered its final report to the Commission in March 2020 ([255]). Broadly speaking, however, the Regulation will require institutional investors to consider/identify environmentally sustainable economic activities. It will apply to financial market participants who offer financial products, as well as companies to which the Non-Financial Reporting Directive applies (generally, large public-interest listed companies across the EU), and for an economic activity to be an ***'environmentally sustainable economic activity,'*** the activity must make a ***'substantial contribution'*** to at least one of six ***'environmental objectives.'***

Evidence from stakeholder engagement, including the targeted survey and interviews, suggested it is important for the TEN-E Regulation to be aligned and coherent with the taxonomy established under the sustainable finance framework. That is particularly important for infrastructure investors, who will also seek to align with the EU principles of sustainable finance as part of their portfolio strategies.

In reality, a revised TEN-E Regulation which takes fossil fuel projects outside the scope, fostering support for networks and technologies with a focus on decarbonisation, will likely be in alignment with the principles for sustainable finance. In that regard, it could be useful to view the EU sustainable finance principles and taxonomy as a 'baseline' standard rather than a benchmark to be achieved. We have noted the Commission's ongoing work in developing the delegated Acts

[252] Regulation (EU) No 1316/2013 (The Connecting Europe Facility).
[253] Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios, page 218, 219. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.
[254] Regulation (EU) 2020/852. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0852&from=EN.
[255] European Commission (2020h), Taxonomy: Final report of the Technical Expert Group on Sustainable Finance. Retrieved from: https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf.

mentioned above. Once these have been finalised, any revised TEN-E Regulation proposals should be assessed in line with those provisions.

Outermost regions ([256])

The TEN-E Regulation does not appear to have any direct inconsistencies with the Commission Strategy for the Outermost Regions or Article 349 of the TFEU, although no PCIs appear to have been promoted in such regions to date.

There was limited feedback from stakeholders on that issue, with 80 % of respondents to the targeted survey expressing no view and 15 % viewing the TEN-E Regulation as consistent with regional policy. Those stakeholders that did engage at this point noted that relaxation of certain criteria to allow a wider range of projects to achieve PCI status would allow the TEN-E to better contribute to the outermost regions policy. Our conclusions regarding 'holistic' views of cross-border impact are relevant in that regard. The cross-border criterion can be redefined to expand the concept of cross-border impact with the aim of facilitating the deployment of decentralised infrastructures in single Member States. A potential definition of 'cross-border impact' is a quantifiable positive impact on the TEN-E objectives. To maintain a manageable number of projects, we recommend considering setting sufficiently large impact thresholds that can only be attained by large projects.

Finally, we note the ongoing work on the development of the CEF2 Regulation – any revised TEN-E Regulation should ensure appropriate alignment with relevant principles as regards the outermost regions in the final version of the CEF2 (while noting the specific scope and objectives of the TEN-E).

Environmental policy impacts

Trinomics (2018) analysed the coherence of the TEN-E Regulation in line with wider EU environmental objectives and across a range of EU and international environmental instruments. Only a limited number of PCIs were noted as having specific issues related to environmental impacts ([257]).

Naturally, PCIs, in common with large infrastructure projects of a similar nature, will often have material impacts on local environmental receptors and, as such, must still be assessed by application of appropriate requirements across the relevant EU environmental frameworks ([258]).

Appropriate application of these frameworks should ensure that such environmental factors are assessed and addressed, although Trinomics et al. (2018) identify a specific concern on the *'application of Article 7(8) of the TEN-E Regulation and Article 6(4) of the Habitat Directive, which enable authorisation of environmentally adverse projects for reasons of overriding public interest.'* The same concern could also potentially be identified regarding similar provisions under the Water Framework Directive, although our review did not identify any similar specific project examples ([259]). Again, however, appropriate application of the wider EU environmental frameworks should help mitigate such concerns.

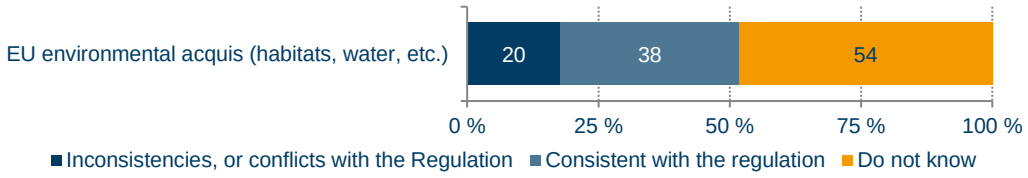
Those observations were generally reflected in the stakeholder consultations – particularly during the stakeholder interviews, where stakeholders generally observed that the proper operation of the various EU environmental frameworks should help mitigate issues regarding environmental and biodiversity impact.

Generally, a limited number of stakeholders in the targeted survey identified inconsistencies between the TEN-E Regulation and EU environmental *acquis*, as noted in Figure 4.28. The 20

[256] European Commission (2017), A stronger and renewed strategic partnership with the EU's outermost regions. Retrieved from: https://ec.europa.eu/regional_policy/sources/policy/themes/outermost-regions/pdf/rup_2017/com_rup_partner_en.pdf.
[257] Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios, pages 227 – 230.
[258] For example, Directive 2011/92/EU, Directive 2001/42/EC, Directive 2009/72/EC, Directive 2000/60/EC.
[259] Directive 2000/60/EC, Article 4 (7) (c).

respondents who expressed a view that there were inconsistencies provided limited specific comments in relation to that policy area in the targeted survey response returns.

Figure 4.28 Response to Targeted Survey: Please state your opinion on the following statements regarding the consistency between the TEN-E Regulation and other policies/initiatives at EU, international and national levels. (n=112)



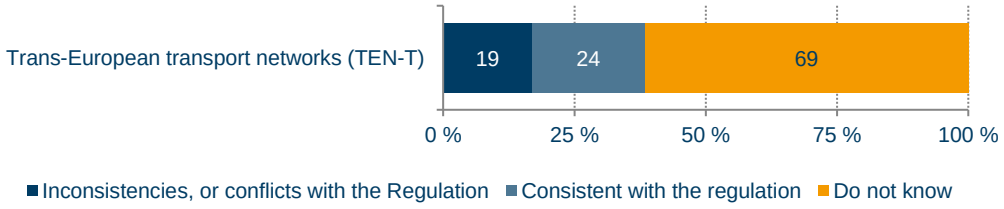
However, one area for future consideration should be the Commission's recently published Biodiversity Strategy for 2030 ([260]). We would note, however, that the key strands of the strategy include enhancing the EU-wide network of protected areas, restoration plan and additional governance, and that any proposed infrastructure project would be subject to any future requirements resulting from that strategy.

Trans-European Transport Network Regulation (TEN-T) ([261])

Broadly speaking, many of the objectives within the TEN-T Regulation can be seen as complementary to those contained within the TEN-E Regulation, particularly, for example, those around sustainability in Article 4 (c) of the TEN-T and in terms of implementation, including planning/permitting requirements. However, given the potential for overlap in the development of transport infrastructure and the increased deployment of smart grid technologies, and other electricity network developments that could facilitate, e.g. electrification of vehicles under TEN-E, the literature review suggested that more specific linkages between the TEN-E Regulation and the TEN-T Regulation in those areas could be considered as part of any revised TEN-E Regulation.

Stakeholder feedback from the targeted survey suggested a large proportion of stakeholders did not hold a view on the alignment of the TEN-E as it relates to the TEN-T, as can be seen in Figure 4.29.

Figure 4.29 Response to Targeted Survey: Please state your opinion on the following statements regarding the consistency between the TEN-E Regulation and other policies/initiatives at EU, international and national levels. (n=112)



However, individual feedback, from the targeted survey, interviews and webinars, revealed interesting insights into the opportunities for synergies across the TEN-E Regulation and the TEN-T Regulation, particularly amongst industry stakeholders, TSOs and academic institutions. A number of stakeholders, particularly in academic and industry sectors, strongly supported extension of the TEN-E Regulation scope to cover infrastructure to support the development of electric vehicle charging stations and the wider network to support their development, which would dovetail with elements of the TEN-T Regulation. Other stakeholders, including industry representative groups,

([260]) European Commission (2020i), EU Biodiversity Strategy for 2030. Retrieved from: https://eur-lex.europa.eu/resource.html?uri=cellar:a3c806a6-9ab3-11ea-9d2d-01aa75ed71a1.0001.02/DOC_1&format=PDF.

([261]) Regulation (EU) No 1315/2013 (The TEN-T Regulation).

emphasised a need for synergies with hydrogen infrastructure to support decarbonisation of maritime transport.

4.6 EU added value

4.6.1 Evaluation question 12

What has been the EU added value of the TEN-E Regulation (e.g. regional cooperation)? Would the same results have been achieved with legislating at national and/or regional levels?

Conclusions

The TEN-E Regulation has provided additional value compared to what could have been achieved at national or regional levels. The EU added value was achieved through access to financing, improved information and transparency, and improved processes, as mentioned most frequently by stakeholders. There are, however, differences in the magnitude of added value across the thematic areas. The evidence from the ACON Smart grid case study showed that the Regulation is less suited for smart grid projects, thereby suggesting somewhat lower potential added value for them. In addition, there are differences in how the TEN-E Regulation is applied across Member States, suggesting some differences in the magnitude of added value. Specifically, some Member States do not have a one-stop shop, so national legislation has to be applied and, in some cases, results in delays in permitting procedures.

Analysis

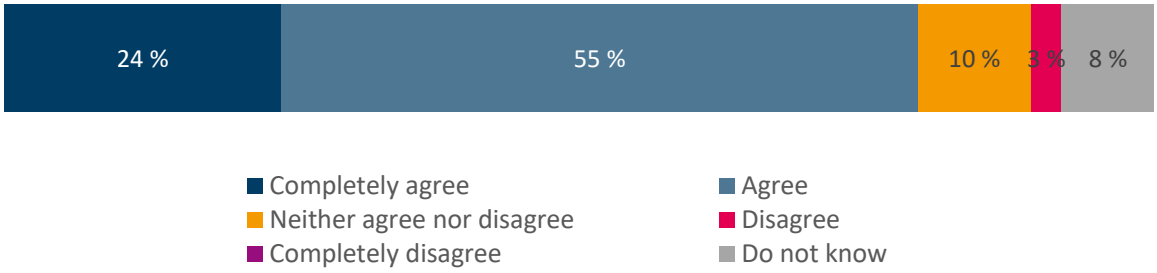
The TEN-E Regulation has provided additional value compared to what could have been achieved at national or regional levels. This notion is supported by the majority of stakeholders participating in the targeted survey and the OPC. Various stakeholders mentioned that the TEN-E Regulation allows the possibility of comparing and benchmarking infrastructure projects across Member States. As such, many Member States have benefited from increased SOS, more competitive markets and more interconnected energy networks.

Figure 4.30 shows the level of agreement of respondents to the targeted survey to the statement that the TEN-E Regulation has achieved more results than what could have been achieved legislating at national and/or regional levels. Almost 80 % of respondents (n=89) agree or strongly agree with the statement. A small share of respondents (3 %, n=3), however, disagreed that the TEN-E Regulation has achieved more results.

Several stakeholders explained their response on the EU added value of the TEN-E Regulation. A common notion between various types of stakeholders is that the TEN-E Regulation fosters the development of cross-border energy infrastructure in the EU. Thus, it promoted cooperation among Member States which might not have occurred without the coordinated action at the EU level. The common approach of benchmarking projects to one another were instrumental in enabling cooperation and transparency. In addition, according to some stakeholders, national- and regional-level legislation covers cross-border cooperation in the EU only to a certain extent, and does not necessarily financially assist projects that have cross-border relevance.

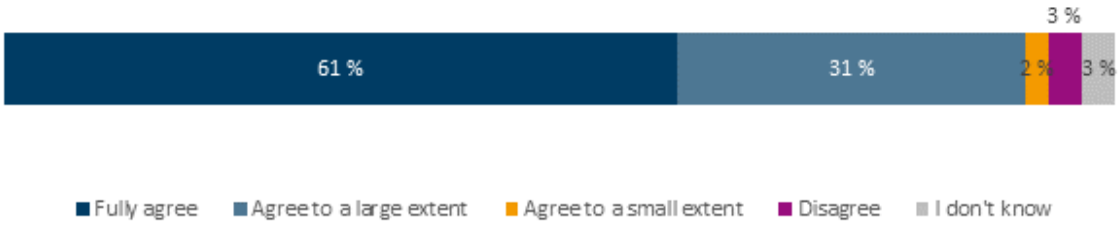
Supporting that, a number of the transmission system operators mentioned that the trans-European network requires action at a supranational level, and the EU actions so far through the TEN-E Regulation have mostly complemented, but not supplemented, national actions. Those that disagreed did not provide an explanation of their reasons.

Figure 4.30 The level of agreement with the statement in the targeted survey: The TEN-E Regulation has achieved more results than what could have been achieved legislating at national and/or regional levels (n=112)



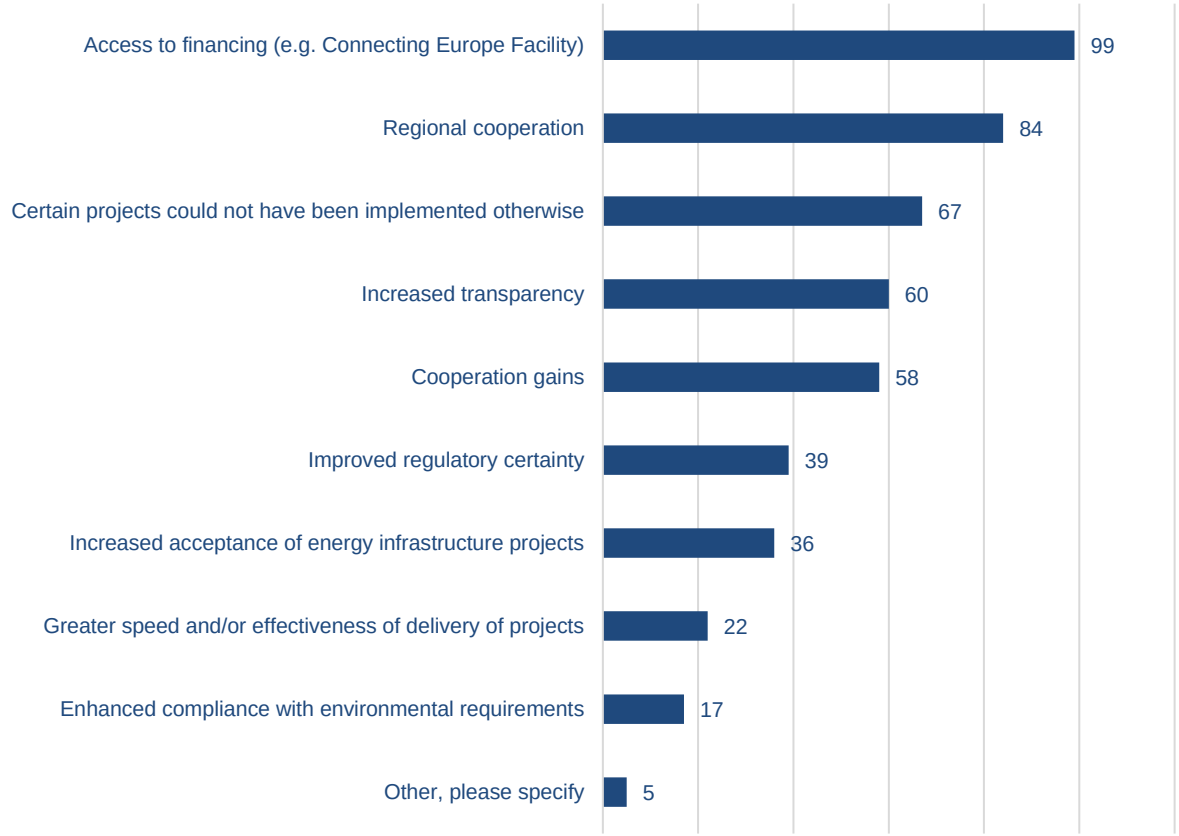
The majority of respondents to the OPC (94 %, n=93) support the statement that the development of TEN-E networks cannot be sufficiently achieved by the Member States alone and can, therefore, be better achieved through coordination at the EU level. Figure 4.31 presents the level of agreement with that statement. A small share of respondents (3 %, n=3) disagreed with it.

Figure 4.31 The level of agreement to the statement asked during OPC: The development of trans-European energy networks cannot be sufficiently achieved by the Member States alone and can, therefore, be better achieved through coordination at EU level (n=99)



The TEN-E Regulation provided EU value added compared to what could have been achieved at national or regional levels through various channels. The EU value was delivered through two streams following the typology of benefits introduced in Section 4.3.1 (Figure 4.18): improved information and transparency, and improved processes. Specifically, the stakeholders were asked in the targeted survey what the EU added value of the TEN-E Regulation is compared to what could have been achieved by Member States alone at national and/or regional levels. Figure 4.32 provides the distribution of answers.

Figure 4.32 The EU added value of the TEN-E Regulation provided as part of the targeted survey



Total number of respondents is 112.

The most commonly chosen EU added value was access to financing, according to 88 % (n=99) of respondents. Regional cooperation and cooperation gains were mentioned by 75 % (n=84) and 52 % (n=58) of respondents, respectively. A large share of respondents (60 %, n=67) specified that certain projects could not have been implemented otherwise. A slightly lower share of respondents (54 %, n=60) indicated increased transparency. About a third of respondents indicated improved regulatory certainty (35 %) and increased acceptance of energy infrastructure projects (32 %). Enhanced compliance with environmental requirements were mentioned by 15 % of the respondents. Five respondents (4 %) chose 'other' category of EU added value. Two of those respondents mentioned the EU added value of improved SOS.

According to 20 % of the respondents, the EU added value of the TEN-E Regulation is greater speed and/or effectiveness of delivery of projects. That is in line with the findings that permit-granting procedures have shortened since the entry into force of the TEN-E Regulation, leading to an EU average of 4.0 and 3.1 years for electricity and gas PCIs, respectively ([262]). That is much shorter than the average time the permitting procedures took at the national level - up to 10 years in 2011.

The EU added value of the TEN-E Regulation is generally acknowledged by stakeholders. There are, however, some differences across Member States in how the TEN-E Regulation is implemented, and, thus, the EU added value might be different across Member States. The one-stop shop permitting procedure has not been implemented in Poland, Slovakia or and Czechia. Project promoters there must apply their national regulation, which entails involvement of numerous local

[262] See Section 4.2.1 for details on the permitting procedure length.

authorities for permits. In the case of the ACON Smart Grid project, that meant the TEN-E Regulation added additional work in terms of permitting.[263]

Differences might also exist in terms of the magnitude of the EU added value across thematic areas. The analysis of the ACON Smart Grid project case study showed that the TEN-E Regulation provisions are less suited for smart grid projects ([263]). Smart grids are limited in applications for PCI status, as low voltage level infrastructures are not contemplated and they are required to operate with at least 20 % of their electricity originating from renewable resources. Reporting requirements obey the characteristics of TSO project permitting and implementation, which may not be entirely suited to smart grid projects. Smart grids involve a multiple number of projects, overlapping timings for permitting and construction, and some works that do not require permitting, like software development. In such cases, the EU added value might not be at the same level as for the projects in other thematic areas.

Furthermore, there are some regions that established cooperation at a regional level prior to the TEN-E Regulation, so somewhat similar results could have been achieved with legislation at a regional level in those regions ([264]). For example, the North Sea region countries established the NSCOGI ([265]), which later evolved into a political declaration on energy cooperation between the North Sea Countries. Another example is the Pentalateral Energy Forum (PLEF) ([266]), the regional cooperation in Central Western Europe towards improved electricity market integration and SOS. Similar results to those achieved by the TEN-E Regulation might have been achieved, to some extent, without the Regulation at the EU level in those regions. It is not clear, however, to what extent the results of the TEN-E Regulation could have been achieved with legislation at national and/or regional levels only.

4.6.2 Evaluation question 13

To what extent do the issues addressed (i.e. market integration, SOS, competitiveness, climate and energy targets for 2020) by the TEN-E Regulation continue to require action at EU level?

Conclusions

The TEN-E Regulation has provided value and contributed to achieving results regarding EU energy market integration, competition and SOS. The issues addressed by the TEN-E Regulation continue to require action at the EU level. A number of adjustments were proposed by the stakeholders for aligning the Regulation with the climate targets and related commitments.

Analysis

The TEN-E Regulation has provided value and contributed to achieving results regarding the EU energy market integration, competition and SOS. The ENTSO-E's TYNDP states that EUR 114 billion of investments by 2030 are needed for electricity transmission ([267]). From those projects, about EUR 50 billion was leveraged through projects with PCI status. Given that, not only the EU's trans-European networks (TEN-E) policy has been instrumental in upgrading the EU's infrastructure([268]) and the TEN-E Regulation could continue to contribute to such investments.

Stakeholders in general acknowledge that the issues addressed by the TEN-E Regulation continue to require action at the EU level. Figure 4.33 shows the level of agreement of stakeholders regarding the need to continue actions at the EU level.

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[263] See Annex II, Section on case study of ACON Smart Grid project for more details.

[264] Trinomics et al. (2018). Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Final Report, p.231. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

[265] Council of the European Union (2009), Signature of « The North Seas Countries »Offshore Grid Initiative, retrieved from https://web.archive.org/web/20110720155255/http://storage001.blastmedia.eu/consilium/15286/31428/consilium_15286_31428_8250.pdf.

[266] More information about PEF could be found on https://www.benelux.int/nl/kernthemas/holder/energie/pentalateral-energy-forum/.

[267] Trinomics et al. (2018). Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Final Report. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

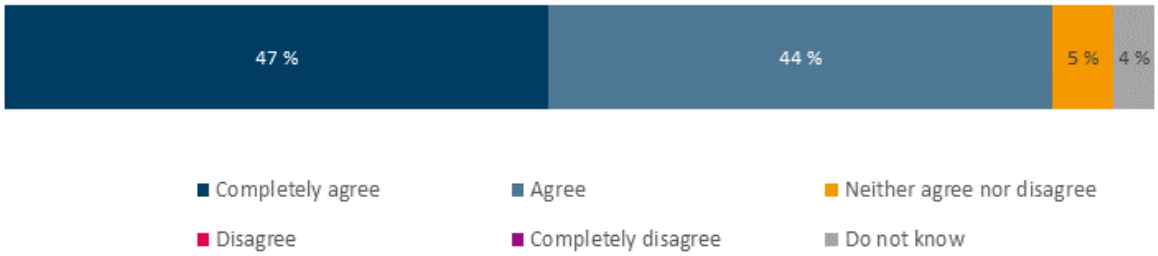
[268] ENTSOs (2019) TYNDP 2018 Scenario Report, retrieved from https://eepublicdownloads.entsoe.eu/clean-documents/tyndp-documents/14475_ENTSO_ScenarioReport_Main.pdf.

A large share of respondents, 91 % (n=102) of respondents, agree or completely agree that the issues addressed by the TEN-E Regulation continue to require action at the EU level. 5 % of the respondents neither agreed nor disagreed. From those respondents, one person indicated that 'it seems that SOS has become a much lesser concern than in 2013. That should be reflected in the revised TEN-E Regulation'.

Several stakeholders suggested that to achieve the decarbonisation targets and other climate related targets, cross-border cooperation and integration of all energy systems is needed. According to them, that need has only intensified since the launch of the Regulation in 2013, so the issues addressed by the TEN-E Regulation will not only continue, but will magnify, in the future. Thus, the need for action at the EU level continues ([269]).

Several stakeholders mentioned that the legislation at national and/or regional levels are somewhat fragmented and covers cross-border cooperation in the EU only to a certain extent. In addition, it does not necessarily financially assist projects that have cross-border relevance. Such stakeholders argue for continuation of actions.

Figure 4.33 The level of agreement with the statement in the targeted survey: The issues addressed by the TEN-E Regulation continue to require action at the EU level.



Total number of respondents is 112.

While there is a recognised need for action at the EU level to address the issues in the energy sector, there might be differences across thematic areas on the magnitude of the EU action. For example, a study by Artelys ([270]) suggests that existing EU gas infrastructure is sufficiently capable of meeting a variety of future gas demand scenarios in the EU28, even in the event of extreme supply disruption cases. That would imply that there is less need for investments in gas infrastructure projects on a SOS basis. From the findings on the relevance of the Regulation (Section 4.4), it follows that EU action might be needed in new thematic areas to integrate networks and to facilitate the integration of renewable energy in the market. Potential projects within possible new thematic areas have different characteristics from those of current PCIs and the cross-border impact is not always obvious.

While the need for continued action is recognised among stakeholders, they suggest a number of adjustments to the Regulation. To be able to deliver and contribute to the climate targets and related commitments, the TEN-E Regulation should take into account the changing needs of the energy system and support integrated planning. One stakeholder argued that 'geological storage sites are not evenly distributed amongst Member States, and the development and large-scale deployment of cross-border European CO2 transport and storage infrastructure is crucial to reaching the set target of climate neutrality by 2050'. This study highlighted several suggestions throughout answers to the evaluation questions on effectiveness, efficiency, relevance and coherence.

[269] Trinomics (2018) pointed out that similar challenges exist across borders, so there is a need to coordinate network planning and large investment project at a supranational level. Thus, the need for action at the EU level was still present at the time the report was finalised in 2018.

[270] Artelys (2020). An updated analysis on gas supply security in the EU energy transition Final report. Retrieved from: https://www.artelys.com/wp-content/uploads/2020/01/Artelys-GasSecurityOfSupply-UpdatedAnalysis.pdf.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 Effectiveness

Goals and objectives

In terms of contributing towards its overall goals, the TEN-E Regulation has effectively improved market integration and competitiveness, as shown in the evidence on interconnection targets and energy prices and their convergence across the EU. A main contextual driver in the design of the TEN-E Regulation, SOS has also been improved. PCIs in electricity and gas have contributed strongly to this. For gas, the infrastructure and supply resilience has improved substantially since 2013. Member States are almost exclusively compliant with the N-1 rule, and the infrastructure is resilient to disruption scenarios. The focus on cross-border projects that increase interconnection capacity is found to have made an effective contribution to these goals. In this respect, the organisation of PCI selection in regional groups, under the coordination of the Commission, is an important factor, as is the approach of sharing costs between Member States to enable projects with benefits across borders. The financing support provided by the CEF also contributed to this, mainly by supporting electricity projects but also through providing targeted support to gas interconnectors in Central and Eastern European Member States, that helped end energy isolation and successfully decreased dependence on dominant external suppliers. The grants for studies helped projects to reduce risks in their early stages, while grants for works supported projects addressing key bottlenecks.

The impact of the TEN-E Regulation on the energy and climate targets of energy efficiency and reduction of GHG emissions is less clear, and quantitative data on the effect of the Regulation is lacking. Opinions on the effectiveness of its contribution to climate targets differ among groups of stakeholders; in particular the support of gas projects is debated between TSOs of gas networks (who emphasise the continuous need for investments in gas networks), NGOs and the power industry (which points to the lock-in for fossil fuel infrastructure). On the other hand, electricity interconnection PCIs are key elements for the integration of renewable energy sources into the European market. For both electricity and gas projects, the selection of PCIs is mainly oriented around the other three overall objectives (market integration, competitiveness, SOS) because of the market situation and policy priorities at the time of the inception. The sustainability criterion in the selection of PCIs has played a lower-priority role and, therefore, has not always been effective in the pursuit of the 2020 energy and climate targets.

Work towards the specific objectives that the TEN-E Regulation aims to address, including reducing permit duration and complexity, advancing the regulatory framework and improving the financing conditions of energy infrastructure projects in cross-border contexts, has been effective overall since the Regulation entered into force in 2013. However, the positive picture at the level of overall improvement also faces challenges in the specific implementation of the main provisions.

Provisions

Permit-granting procedures have shortened since the entry into force of the TEN-E Regulation, leading to an EU average of 4 and 3.1 years for electricity and gas projects, respectively, compared to national averages of up to 10 years in 2011. The establishment of one-stop shops – a central element of the TEN-E Regulation – is welcomed as an instrument to reduce the complexity and duration of permitting procedures. However, the effectiveness of permit-granting procedures strongly depends on national implementation; experiences of project promoters vary substantially because of national differences, such as the responsibilities of authorities in the permit-granting process. Thus, long permitting durations are still found under the current framework. However, the underlying reasons fall outside the direct scope of the current TEN-E Regulation. While complex national procedures are one cause of extended permitting times, other reasons include environmental procedures in the early stages of PCIs (e.g. following changes to the project design) as well as public opposition with lengthy court cases against the projects. These challenges cannot be addressed by the Regulation alone. At the same time, the procedural delays that arise from addressing public opposition underline the potential benefits of increased public acceptance. However, while the provisions on public participation are valuable and have ensured and increased opportunities for the public to be involved in the permitting stages of a project, they have not been effective in reducing public opposition to many PCIs, and there is no clear mechanism for ensuring that the input collected in the consultations is taken into account. Note that compliance of projects with the environmental acquis can also contribute to a reduction of the permitting duration. .

The CBCA mechanism aims to address regulatory challenges for cross-border infrastructure projects. This mechanism has also been effective to varying extents. While the approach of sharing costs between Member States in relation to benefits is largely praised, the details of the mechanism (like time and data requirements) as well as its complexity reduce its attractiveness. Therefore, CBCAs prove to be effective in some cases, but a question remains as to the value of the mechanism, as it is a step to application for CEF grants. The complexity of obtaining data, the additional time until an investment decision can be made and the lack of unambiguous results on which to base the decision are factors that reduce stakeholder satisfaction with the process. At the same time, CBCA is appreciated, as it provides an understanding of the benefits of a project.

The availability of CEF funding has had the most significant influence on the financing of energy infrastructure projects. By providing support in the early stages of a project, the grants offered for studies contribute to de-risking project development. According to project promoters and national authorities, this helped to improve project realisation and also contributed to attracting investors. The visibility of the projects due to the PCI label and the political support that has been experienced by many project promoters also makes PCIs attractive to investors. CEF grants for works can also support projects that would not otherwise be economically viable, preventing high increases in tariffs. The additional mechanism of risk-based incentives is rarely used, and so far it has not improved the financing situation of PCIs.

Selection of PCIs

PCIs have demonstrated progress toward fulfilling the current objectives of the TEN-E Regulation, as it was conceived in 2013. However, the transformation needed for the energy sector to comply with the decarbonisation targets of the Paris Agreement and the European Green Deal will challenge the achievement of sustainability in the future. Focus should be put on sustainability, as currently this is not being fully assessed, especially for gas projects. Procedures and techniques for the proper assessment of the projects' contribution to sustainability need to be further developed. Priority corridors and thematic areas need to be updated to address future challenges and incorporate new types of projects (see also the conclusions below for the evaluation criterion of relevance).

Some of the current selection criteria might be too restrictive for the inclusion of projects at DSO level, particularly the cross-border impact criteria, the 10 kV threshold and possibly also the 20 % RES origin for smart grids. With regards to the objectives of the TEN-E Regulation, a more flexible definition of cross-border impact may allow for inclusion of relevant projects in one Member State with significant and quantifiable benefits in other Member States.

In the network planning process, the models of the electricity and gas systems are currently independent and so do not allow for consideration of interdependencies between systems. However, the ENTSOs are developing an interlinked model with a view to developing the network planning process into a 'system of systems' approach, including all energy vectors and demand sectors, in the future. This approach is welcomed and aligned with the EU Strategy for Energy System Integration but needs to be pursued further.

CBA methodologies are not aligned between electricity and gas, so a fair comparison between electricity and gas projects is not possible, since they can potentially compete to address system needs. Additionally, ACER found some specific limitations (regarding indicator calculations, etc.) of the current methodologies, which shall be addressed by the ENTSOs.

The role of the ENTSOs in the PCI selection process is seen by some stakeholders as not independent and conflicting with their interests as project promoters. The ENTSOs, as TSOs, are seen as being the right actors to evaluate system needs and, hence, the projects that may address those more effectively. Although a higher degree of stakeholder consultation as well as validation of assumptions made by ENTSOs (in scenarios and modelling) and in CBA methodologies may be needed to ensure trust in the process.

Although issues are raised concerning lack of transparency and high administrative costs of participation, the regional groups' role in project monitoring is considered to be adequate and successful and perceived as sufficiently enabling regional cooperation. According to ACER's opinion on the 4th PCI list, the documentation reviewed at regional group meetings and the impressions received via stakeholder consultation, the assessment of the projects by regional groups lacks some degree of transparency and traceability in relation to the process of inclusion of projects on the draft list. Stakeholders consider the high level groups to provide added value through strategic steering and political guidance in their corresponding priority regions.

The biennial periodicity of the PCI lists is found by some stakeholders to be unnecessarily burdensome. Some stakeholders have suggested that full reassessments should not be performed every 2 years; rather, only relevant changes in project development should be reported in order to update PCI status. Additionally, some project promoters pointed out that the risk of losing the PCI label every 2 years carries a risk for investors. A longer time span for PCI status would reduce the risk as perceived by investors.

As for reporting and monitoring, it has been suggested that ACER's annual monitoring report be completed biennially, with every PCI list, focusing only on relevant changes and following up on inefficiencies or problems detected. According to some stakeholders, this would help to increase the usefulness of the report. The transparency platform and the PCI interactive map are valued positively; however, there is room for improvement in terms of search options, selection and downloading of information and availability of information about previously commissioned projects.

5.1.2 Efficiency

Quantification of all the benefits and costs is not possible. Based on an analysis of the cost drivers, we conclude that benefits of the TEN-E Regulation outweigh the costs of the Regulation, even if benefits are estimated conservatively. Benefits include socio-economic net benefits and market efficiency. The analysis of effectiveness shows that socio-economic net benefits were realised through an increase in SOS, competition and integration of markets and, to a lesser extent, sustainability. Modelling shows that net benefits of commissioned gas PCIs are highly positive and that they have substantially increased market integration and SOS for the EU. Results also underpin the need for limited investment into the gas network in the future. Net benefits of electricity PCIs increase in scenarios with a higher CO2 price, which in turn shows that these projects have benefits in the context of the European Green Deal. The market efficiency benefits refer to benefits that improve information availability, increase cost savings and ensure that a wider range of products or services are provided. The Regulation has resulted in improved transparency. Evidence on the extent to which the Regulation has resulted in improved processes and timely completion of projects is, however, mixed.

The main cost drivers are the PCI selection process and monitoring, the permitting process, stakeholder consultation and costs associated with decisions on CBCA and regulatory incentives. In general, stakeholders view the costs associated with the Regulation to be justified. Opportunities to improve the efficiency of the Regulation are limited, but there is potential to reduce the administrative burden for project promoters in the PCI application process and in monitoring. The costs of reapplication for new PCI lists and of monitoring are considered too high by some stakeholders, mainly because data requests are considered inefficient. The total impact on costs of any changes to the application/monitoring processes is limited compared to the total benefits and costs of the Regulation, and changes can have a negative impact on other objectives of the Regulation (see recommendations below).

5.1.3 Relevance

The Paris Agreement and the European Green Deal involve a significant transformation of the current energy infrastructures into a fully carbon-neutral energy integrated system by 2050. While the initial objectives of the TEN-E Regulation – SOS, market integration, competition and sustainability – are still relevant, the changes needed in the energy infrastructures require a rebalancing of the objectives in order to fulfil the decarbonisation targets and to be aligned with the European Commission's energy strategies. Along the pathway towards a decarbonised economy in 2050, energy infrastructure needs will gradually evolve as emerging technologies are deployed and the sectors gradually switch to sustainable sources. There must be realistic planning of the network from its current state in order to reach the targets in 2050. In the desk review and the stakeholder consultation, many emerging technologies were identified as necessary in the future energy infrastructure. We highlight the following technologies that are currently not specifically addressed by the TEN-E Regulation: decarbonisation of gas – hydrogen, green gas infrastructures, retrofitting of existing gas networks, bidirectional gas flow projects; energy system integration – power-to-gas, smart system integration, gas smart grids, digitalisation, electric vehicle charging infrastructures, decarbonisation; and carbon storage, RES deployment and integration – hybrid offshore wind and meshed wind hubs. Not all of these would benefit in the same way from inclusion on the scope of TEN-E.

In terms of objectives of the TEN-E Regulation, sustainability/decarbonisation may need to be given higher priority. In view of the necessary growing shares of variable renewable energy generation, RES integration and SOS are becoming increasingly more relevant. The flexibility needs of the system can also be addressed by energy system integration, potentially an additional objective per se in the Regulation. On the other hand, although market integration and competition

are still relevant, these have been addressed already to a significant extent, as shown in the results of the targeted survey. Lastly, it is worth noting that innovation as an objective addressed by many stakeholders is indeed necessary at this transforming stage of the energy sector.

The current priority corridors and thematic areas do not entirely cover all emerging technologies identified. From the insights gained through the desk research and, especially, the consultation with stakeholders (who provided with diverse proposals), a stronger focus on thematic areas can facilitate EU-wide solutions, although some priority corridors may be needed to allow for regional differentiation in specific cases. Among the possibilities for new thematic areas, we highlight hydrogen and gas decarbonisation infrastructures, smart grids extended to gas infrastructures, cross-sectoral investments and offshore wind network infrastructures. Electricity and gas priority corridors may be maintained where they are considered necessary to tackle specific regional needs in relation to the objectives of the TEN-E Regulation. The oil priority corridor does not seem to be aligned with the European Green Deal. Although based on fossil fuel, conventional gas infrastructures are still seen as necessary transitional infrastructures for certain Member States that still rely heavily on coal and lignite for power and heat production. Furthermore, gas infrastructure can be refurbished in the future to transport hydrogen or green gases. But according to our modelling the European network infrastructure (including the PCI projects for which an investment decision has been taken) is already adequate to serve the demand and building all the projects on 4th PCI list would only help with the better utilisation of the grid. Some stakeholders, like ENTSOG, call for a flexible approach when defining the priority corridors and areas in view of the high uncertainty that remains around emerging technologies.

The EEFP is not considered sufficiently developed in the TEN-E Regulation. The EEFP is not mentioned explicitly in the TEN-E Regulation, and reference to energy efficiency is limited.

Some TEN-E provisions do not facilitate the deployment of emerging technologies that are necessary in the context of the European Green Deal and which will inevitably gain predominance in energy infrastructure investments in Europe in the next decades.

- The regional approach of the TEN-E Regulation in the definition of geographical priority corridors and regional groups may not be aligned to EU-wide solutions, that can be better addressed through thematic areas and EU-wide groups;
- The cross-border criterion could be redefined to expand the concept of cross-border impact, with the aim of facilitating the deployment of (large-scale) decentralised infrastructures;
- Some PCI selection criteria may hinder deployment of emerging technologies. In particular, smart grid projects, according to Annex IV.1.e of the Regulation, have a voltage threshold of 10 kV, which leaves out essential installations of these projects.;
- The methodologies developed by the ENTSOs, including scenario development, modelling and CBA assessment, as the basis of the PCI selection process, are currently undergoing major changes towards coordinated multi-sectorial planning and a smart sector coordination approach. The methodologies need to be adapted to include all new emerging technologies and to have a holistic view of the energy system;
- The permit-granting process, as conceived by the TEN-E Regulation, seems to be effective only for large transmission infrastructure projects. Concepts such as the one-stop shop and provisions in Article 10 related to the duration and implementation of the permit-granting process cannot be adequately applied to smart grid projects, as confirmed by all smart grid project promoters who took part in the stakeholder consultation;
- Public engagement from the early phase of the projects seems to be the most effective way to increase public acceptance of PCIs, including for those related to new emerging technologies;
- Regulatory incentives are relevant for new emerging technologies like offshore wind hybrid projects, where additional regulatory and technical risks are expected compared to usual transmission projects.

5.1.4 Coherence

Evidence obtained during the evaluation process identified limited concerns around the *internal* coherence of the TEN-E Regulation, although we have identified a number of points around the implementation of certain elements, such as insufficient flexibility to adapt to rapidly evolving policy areas, potential conflicts on legal drafting around cost allocation, insufficient precision in the definition of 'maturity' and limited clarity in the process for the Commission's publication of TYNDP Guideline updates. More details are set out at Section 4.5.1.

The TEN-E Regulation is largely consistent with the legislative and policy environment that was in place at the time of its introduction. However, we note that since its implementation, EU energy and climate policy has evolved considerably.

No significant inconsistencies have been identified between the TEN-E Regulation and the Third Package or the network codes identified for examination in this evaluation.

The TEN-E Regulation is not consistent with the current legislative and policy environment which has been instigated by the various changes under the CEP. Inconsistencies include 'mechanistic' examples, such as alignment with specified renewable energy and interconnector targets, but also more nuanced examples such as PCI selection which is not currently aligned with the intended policy goals behind the CEP (such as greater roles for DNOs).

The TEN-E Regulation requires substantial revision to bring the Regulation into line with the priorities of the European Green Deal and to bring greater synergies with other sectoral instruments such as the TEN-T Regulation to drive decarbonisation by fostering a more cross-sectoral approach. We anticipate substantive requirements for revision of the TEN-E Regulation in order to align with the EU's over-arching decarbonisation ambitions. Stakeholder evidence strongly supports an ambitious, long-term approach when redefining the scope of the TEN-E Regulation. It will also be important for the TEN-E Regulation to align with future relevant provisions being developed by the Commission under the Sustainable Finance Framework.

Some inconsistencies with national-level legal frameworks were identified by stakeholders, although most did not flag significant necessary changes to the TEN-E Regulation in order to remedy these. However, the picture is mixed, with stakeholders based in some Member States (such as Denmark and France) indicating that the TEN-E Regulation principles are well reflected in and consistent with their national-level legal provisions. This suggests an issue with national-level implementation and compliance in the limited number of Member States which have reported difficulties in their national-level legal frameworks as opposed to a systemic issue with the TEN-E Regulation. Firm conclusions in this area would require a detailed assessment of individual Member State compliance with the TEN-E, which is not within the scope of this evaluation. However, there is opportunity for a revised TEN-E Regulation to have some alignment of national-level reporting requirements with EU-level requirements to realise administration efficiencies.

5.1.5 EU added value

The TEN-E Regulation has provided added value compared to what could have been achieved at national or regional level. This notion is supported by the majority of stakeholders who participated in the targeted survey and the OPC. Various stakeholders mentioned that the TEN-E Regulation allows the possibility of comparing and benchmarking infrastructure projects across Member States. Many Member States have benefitted from an increase in SOS, more competitive markets and more interconnected energy networks.

A common notion between various types of stakeholder is that the TEN-E Regulation fosters the development of cross-border energy infrastructure in the EU. Thus, it promoted cooperation among Member States, which might not have occurred without the coordinated action at the EU level. The common approach of benchmarking projects to one another was instrumental in enabling cooperation and transparency. In addition, according to some stakeholders, national and regional legislation covers cross-border cooperation in the EU only to a certain extent and does not necessarily financially assist projects that have cross-border relevance.

5.2 Recommendations

We make the following recommendations for revision of the Regulation, based on the issues identified.

5.2.1 Recommendations regarding the scope of the Regulation and the PCI selection process

A general recommendation is to align the TEN-E Regulation with the EU's climate neutrality objective and other regulatory frameworks introduced since the Regulation entered into force in 2013. This requires changes to the scope of the Regulation, including the selection criteria and the PCI selection process.

Revision of priority corridors and thematic areas

Priority corridors and thematic areas may need to be updated in view of future challenges for the network infrastructure that may be addressed by new types of projects. This revision may involve adding, modifying or dismissing priority corridors and thematic areas. In view of the uncertainty around the development of emerging technologies, it might be necessary to have some flexibility in the definition of priority corridors and thematic areas, i.e. more open definitions or periodic revisions. The following modifications can be considered:

- New thematic areas can include cross-sectoral projects (infrastructures that add flexibility to the system by coupling energy vectors), gas decarbonisation infrastructures (hydrogen, clean gases, smart gas grids) and meshed offshore grids;
- Some priority corridors and thematic areas can be considered as having been dismissed; for instance, electricity highways (these projects are covered by electricity priority corridors) and the oil priority corridor (not aligned with the required sustainability focus); Some priority corridors may need to be modified. In light of the inclusion of new priority corridors and thematic areas to incorporate new types of infrastructure, the number of electricity and especially gas corridors might need to be reduced. Modelling results show there are limited benefits of additional gas infrastructure.

Revision of selection criteria

Selection criteria form the basis of the selection of PCIs. The following modifications can be considered to focus the Regulation on sustainability goals and to facilitate the deployment of more flexibility and decentralised infrastructures, deemed necessary to better incorporate storage, demand-side flexibility and a more efficient operation of the network.

A positive contribution to sustainability should be a prerequisite for all projects ('sustainability first'). As for gas infrastructures, sustainability roadmaps can ensure they can be refurbished to transport hydrogen or other decarbonised gases.

The cross-border criterion could be redefined to expand the concept of cross-border impact, with the aim of facilitating the deployment of decentralised infrastructures in single Member States. A potential definition of 'cross-border impact' is a quantifiable positive impact on the TEN-E objectives. If this definition would be used, more projects would fulfil the cross-border criterion which could make the number of PCIs unmanageable. For this reason, we recommend setting impact thresholds that can only be attained by relatively large projects.

Given the importance of the EEFP in the current EU energy policies, the inclusion of this principle should be explicitly considered in the TEN-E Regulation. Energy efficiency could be explicitly included among the specific criteria in Article 4 and/or Annexes II and IV in order to ensure that the most efficient conversion, transmission and distribution of energy infrastructures are deployed, in line with the Governance Regulation 2018/1999. Another alternative to account for the EEFP, and in line with Article 51.3 of the Electricity Directive, could be to enforce evaluation of grid infrastructure projects against energy efficiency / demand response solutions as alternatives to system expansion.

The specific selection criteria for smart grids in Annex IV.1.e (10 kV threshold, 20 % RES origin) might be hindering the full deployment of smart grid projects. These criteria may need to be reconsidered if projects at lower voltage levels are seen as necessary for the fulfilment of the TEN-E objectives.

Enhancement of sustainability assessment in the PCI selection process

It is recommended to develop procedures and techniques for the proper assessment of the projects' contribution to sustainability, especially for gas infrastructures. The TEN-E Regulation could seek further alignment with principles set out in the sustainable finance framework, once adopted.

Revision of the roles of ENTSOs and ACER in the PCI selection process

In view of the potential conflicting role of the ENTSOs, as project promoters and developers of the scenarios and CBA methodology by which projects are evaluated, and given the shared perception among stakeholders that ENTSOs have a predominant role that is not seen as fully independent, some mitigation measures must be taken to ensure that all stakeholders trust in the PCI selection process. Two different approaches can be taken: (1) enhance stakeholder engagement in all relevant steps of the PCI selection process, particularly scenario development and CBA methodology revisions; or (2) consider providing ACER or another independent entity with the

power to approve and amend scenarios and CBA guidelines. A drawback of the first approach is that there is still a (perceived) risk that ENTSOs do not act in the best interests of all stakeholders. But However, it is acknowledged that the ENTSOs do have the required expertise and their members are also involved in development of national development plans in Member States. Regardless of the approach taken, the PCI selection process should continue to be transparent and based on a solid CBA methodology.

5.2.2 Recommendations regarding CBCA

CBCAs are beneficial in some cases but less effective in others. Ineffectiveness of the CBCA process can result in projects that are not realised due to a lack of funding or may lead to the 'unnecessary' use of EU funding where projects could also be funded from tariffs in Member States. Due to its ineffectiveness, project promoters, NRAs and ACER consider CBCAs to be an administrative burden with, in many cases, little to no direct benefits.

The effectiveness of the CBCA process can be improved by including stricter guidelines in the TEN-E Regulation on the steps to be taken in the process. The objective of the guidelines would be to have a harmonised approach considering all costs and benefits to identify the financing gap for which European funding may be needed. The guidelines should, at the least, refer to the CBA methodology, the input data to be used, the interpretation of CBA results and the allocation of investment costs (it should be clear if and when EU funding can be assumed). If the benefits of a project in other Member States are below a certain threshold (and there is a clear reason to assume that there are limited opportunities to allocate costs across borders) the process should be as short and efficient as possible.

5.2.3 Recommendations regarding the permitting process

The findings in this report show that differences in national implementation cause different degrees of effectiveness of the permitting process. This relates to national permit-granting legislation as well as the provisions of the TEN-E Regulation on the creation of one-stop shops for permit granting. With such diverging national contexts and rules that are beyond the scope of the TEN-E Regulation, it is not possible to base recommendations to change provisions of the Regulation on sound evidence. However, as project promoters describe varying experiences with the permitting process, there seems to be potential for introducing mechanisms to improve European performance, especially as cross-border projects are the focus of the Regulation. As project set-ups and contexts differ for each PCI, the experiences of other Member States can be of value to national authorities both at a general level concerning the organisation of responsibilities and obligations and at a specific project level regarding the implications on the permitting process.

With this in mind, we recommend improving the monitoring of implementation of permitting schemes in the Member States and developing further incentives and guidance to national authorities on how to achieve streamlined and shortened permitting durations. This can be achieved by promoting platforms to share best practices between NCAs, with a view to shortening the permitting processes also in countries that have not yet been able to do so.

5.2.4 Recommendations to reduce administrative costs of specific provisions

The following three recommendations aim mainly to reduce the administrative burden for project promoters. In general, the costs of the Regulation are justified and the potential impact of the recommendations below on net benefits is much lower than the potential impact of recommendations mentioned above.

Reapplication for PCI lists

Project promoters consider it too burdensome that all projects go through the full application process for every PCI list. The renewal process also creates uncertainty for the projects.

The rationale for assessing all projects (including existing PCIs) for a new PCI list is that all projects can be assessed on an equal basis and changes in (market) circumstances can be taken into account. In our view, the benefits of renewal are clearer for some projects than others. For example, the business case for most smart grid projects and CO2 networks will not change fundamentally in 2 years' time when they depend only to a limited extent on market prices. We recommend reducing the burden of reapplication for all projects and infrastructure categories by using data from previous applications and monitoring results as much as possible.

Monitoring costs

In general, stakeholders consider the costs of the Regulation to be justified, but some inefficiencies have been identified. Monitoring costs were most frequently mentioned as an administrative

burden. The annual frequency of the monitoring is also considered too burdensome. Project promoters also indicate that the data request is wide in scope and difficult to use.

Monitoring costs can be reduced by decreasing the frequency of reporting, by reducing the scope of the monitoring or by making it easier and more user-friendly to submit data. We recommend reviewing, on a continuous basis, whether data requirements are still fit for purpose and seeking opportunities to make the submission process easier (including alignment with other monitoring requests – for example, from the CEF). That does not require revision of the Regulation. Monitoring on a biennial basis (once per PCI list) instead of a yearly basis would reduce the administrative burden for project promoters and ACER, but it would also result in a loss of transparency as data will not always be up to date.

Regulatory incentives

Provisions on regulatory incentives are rarely used. For this reason, we recommend not including regulatory incentives in the current form in a revised version of the Regulation. The benefits of removing those provisions are limited, as the administrative burden for project promoters and NRAs is low. Some stakeholders, especially project promoters, think that regulatory incentives might be effective for specific projects. If provisions on regulatory incentives are part of a revised version of the Regulation, we recommend that they are more prescriptive about when (e.g. for specific infrastructure categories such as offshore electricity networks or if the regulatory framework in a Member State provides a disincentive to allocate costs to other Member States or to use CEF funding) and how they have to be used.

ANNEX I EVALUATION QUESTION MATRIX

Introduction

Our approach builds on the use of an evaluation matrix to guide the evaluation process and define the manner in which the evaluation questions are to be answered and presented. The matrix outlines our interpretation of the evaluation questions by proposing indicators based on the intervention logic. It is important to mention that the evaluation matrices are usually 'live' documents and as the evaluation process unfolds, they receive updates.

In this annex, the evaluation matrix is split into the five evaluation criteria. For each of the criteria we first list the main evaluation questions and explain on what basis the criteria will be assessed and what the sources for the assessment will be.

As agreed during the inception phase, the EQM was revised to accommodate the change in scope of the project. Evaluation questions were combined and streamlined under all criteria to avoid unnecessary repetition; however, we ensured that the questions was not "lost", but rather reformulated questions to ensure that the information would be captured elsewhere. The questions under Relevance and Coherence were revised to reflect the current policy context. The indicators, data sources, data collection, and data analysis approaches were revised and made more specific.

A separate section with the detailed question on the effectiveness of the main provisions under the TEN-E Regulation (i.e. the sub-questions in the ToR) is included. These questions have a strong focus on how the 'activities' (see the intervention logic) function and how they contribute to the output and objectives. Almost all of the detailed questions fall under the effectiveness criteria; thus, the implementation questions will be input for the effectiveness questions and analysed when answering the effectiveness questions. The questions under Evaluation question E were merged with the sub questions under Relevance and thus Evaluation question E was removed; however, we ensured that the questions are adequately covered by the Relevance sub questions. The evaluation matrix includes a table for each of the evaluation questions. The table breaks down the question into various sub-questions and includes the following information per evaluation question:

- Assessment criteria;
- Indicators to be used to inform the assessment;
- Data sources;
- Data collection methods;
- Data analysis approaches;
- Ability to answer the evaluation question and limitations.

The data sources, data collection methods, and data analysis approaches are often similar for the sub-questions of one evaluation questions. However, the assessment criteria and indicators are more specific for each sub-question, thus we include a reference after each assessment criteria and indicator to the linked sub-question.

Effectiveness questions

1. To what extent has the Regulation' main provisions addressed the needs identified in the Impact Assessment accompanying the Commission proposal in 2011?
2. How effective has the regulatory approach of the TEN-E Regulation been both in terms of scope and main provisions in contributing to the goals of market integration, security of supply, competitiveness and the climate and energy targets for 2020?
3. What unintended or unexpected positive and negative effects, if any, have been produced by the TEN-E Regulation? (e.g. in terms of human health, use of resources, and natural ecosystems)?

Evaluation criterion: Effectiveness	
Evaluation question 1: To what extent has the Regulation' **main provisions**([271]) addressed the needs identified in the Impact Assessment accompanying the Commission proposal in 2011?	
Sub-questions: 1. 1.1 To what extent has the Regulation tackled the lengthy and ineffective **permit-granting procedures([272])**? 2. 1.2. To what extent has the Regulation tackled problems related to the **regulatory framework for energy infrastructure investments([273])**? 3. 1.3 To what extent has the Regulation tackled the problems related to **financing of energy infrastructure projects([274])**?	
Assessment criteria	**Relevant indicators**
• Streamlined permit granting procedures (in line with Articles 7, 8 and 10 of the Regulation) (EQ1.1); • Time for most PCIs to receive permits is below the target of 3 ½ years and has decreased over time (EQ1.1); • Appropriate cross-border allocation of costs and benefits for PCI (in line with Article 12) (EQ 1.2); • Appropriate allocation of incentives for energy infrastructure investments based on risks (in line with Article 13) (EQ1.2); • Ensured coordination for cross-border investment approval (in line with Article 8(b)) (EQ 1.2); • Financing instruments available to finance PCIs (EQ 1.3); • Increased financing capacities of TSOs (ability to raise debt at a reasonable cost, ability to attract new institutional investors) (EQ1.3).	• Time for PCIs to receive permits (compared to previous evaluations) (EQ1.1); • % of stakeholders who perceive that permitting procedures have been streamlined (EQ1.1); • % of stakeholders who perceive the distribution of costs and benefits is appropriately distributed based on risks (EQ1.2); • Process observed for the cross-border allocation of costs and risk-related incentives for PCI (EQ1.2 & EQ1.3); • Answers to implementation questions Block B (EQ1.1); • Answers to implementation questions Block D (EQ1.2); • Answers to implementation questions Block D (EQ1.2); • Answers to EQ9, EQ10, EQ11 (EQ1.2); • Answers to D.7,D.6, and D.3 (EQ1.2 & EQ1.3); • % of stakeholders who perceive that the regulatory framework is appropriate for energy infrastructure investments (EQ1.2); • List of existing financing instruments for PCIs (EQ1.3); • % of stakeholders who perceive that there are increased financing capacities of TSOs and financing instruments available to TSOs (EQ1.3).
Data sources	**Data collection methods**
• PCI lists; • Sector market reports and databases; • TSO/Project promoter; • NRAs; • Environment permitting authorities; • EU policy-makers; • Implementation questions; • Previous evaluations; • 2011 Impact assessment.	• Desk research; • Case studies; • Interviews with regulators and TSO/project promoters; • Targeted survey.
Data analysis approaches • Case studies; • Analysis of interview results; • Portfolio analysis.	
Ability to respond to the evaluation question and limitations.	

([271]) Including the regional approach with regional lists and regional groups, PCI selection process and criteria including qualitative criteria laid down in Article 4(4) of the Regulation, methodology for assessing benefits and contribution to the Regulation's objectives, permit granting procedure, public participation including during regional group meetings, regulatory incentives/cross-border cost allocation.

([272]) Due to fragmented permit granting processes, differences across involved countries, lack of time limits on permitting decisions, unclear documentation, lack of up-front planning and coordination.

([273]) Due to asymmetric distribution of costs and benefits, lack of appropriate regulatory incentives and long-term signals to meet EU priorities, lack of coordination for cross-border investment approval process.

([274]) Due to lack of adapted funding instrument available to promote PCIs, limited financing capacities of TSOs.

Evaluation criterion: Effectiveness
As a first line of assessment the implementation questions will be used to provide an understanding of the functioning/implementation of the elements of the Regulation and set the scene. The assessment criteria will need to be revised to set an appropriate level for the Regulation to be judged as effective. The responses to this evaluation question will also rely on the analysis of the views and information provided by stakeholders for which we will rely on two main tools: surveys and interviews. Additional research and studies might complement the analysis.

Evaluation criterion: Effectiveness	
Evaluation question 2: How effective has the regulatory approach of the TEN-E Regulation been both in terms of **scope** and **main provisions** in contributing to the goals of market integration, security of supply, competitiveness and the climate and energy targets for 2020([275])? *Sub-questions:* 2.1 To what extent has the **scope**([276]) ensured or hampered the achievement of the **goals**? 2.2 To what extent have the **main provisions**([277]) ensured or hampered the achievement of the **specific objectives**([278])? What have been their contribution to the **main objectives**? 2.3 Should the scope or the main provisions of the Regulation be changed to meet the current objectives? 2.4 To what extent have external factors([279]) influenced the achievements observed, how and which external factors?	
Assessment criteria	**Relevant indicators**
• Increased number of interconnector projects in markets lacking integration, especially integrating Eastern Europe with Central Europe(EQ2.1 & EQ2.2); • Increased competitiveness resulting in a decrease in the wholesale price (EQ2.1 & EQ2.2); • Increased number of projects which help lower greenhouse gas emissions (EQ2.1 & EQ2.2); • Increased number of projects which refurbish existing energy infrastructure to increase energy efficiency (EQ2.1 & EQ2.2); • Increased number of projects which deploy new energy infrastructure supporting renewable energy generation and distribution (EQ2.1 & EQ2.2); • Increased number of projects which deploy new energy infrastructure supporting carbon capture, utilisation and storage (EQ2.1 & EQ2.2); • Increased number of projects which deploy new energy infrastructure supporting smart grids (EQ2.1 & EQ2.2); • **Conclusive criterion:** The scope was sufficient to ensure achievement of objectives (EQ2.3); • **Conclusive criterion:** The scope should be narrowed or widened to	• Market integration (EQ2.1): - Interconnector projects selected; - Installed capacity; - Aggregate change in the socio-economic welfare of the modelled countries as consequence of the wholesale price change (modelling)Stakeholders' views on the degree to which the Regulation has contributed to market integration. • Security of supply (EQ2.2): - Findings based on monitoring under security of supply regulation; - Stakeholders' views on the degree to which the Regulation has contributed to security of supply, including as regards infrastructure resilience to climate-related extreme events and climate change; - Difference between the economic welfare under disturbance conditions with and without the project (modelling). • Competitiveness (EQ2.3); - Electricity: ratio between import capacity and installed generation capacity & price differentials observed between international interconnectors; - Gas: price monitoring by Energy Market Observatory; - Stakeholders' views on the degree to which the Regulation has contributed to competitiveness; - Price change due to decreasing congestion between countries (modelling). • Climate and energy targets (EQ2.4):

([275]) Specifically achieving a 20% cut in greenhouse gas emissions (from 1990 levels); producing 20% of EU energy from renewables; and achieving a 20% improvement in energy efficiency through the refurbishment of existing energy infrastructure and/or the deployment of new energy infrastructure.
([276]) Electricity, gas, oil, CO2, smart grids as well as the role of third countries.
([277]) Including the regional approach with regional lists and regional groups, PCI selection process and criteria including qualitative criteria laid down in Article 4(4) of the Regulation, methodology for assessing benefits and contribution to the Regulation's objectives, permit granting procedure, public participation including during regional group meetings, regulatory incentives/cross-border cost allocation.
([278]) The specific objectives being: reduction of time for permitting procedures; increase in public acceptance and involvement in PCIs; allocation of costs and benefits in line with risks; provision of market based and direct EU support.
([279]) External factors are factors other than stemming from the Regulation itself, but including the way in which it has been implemented (e.g. implementation by Member States and their relevant authorities including the permitting one stop shops).

Evaluation criterion: Effectiveness	
ensure achievement of objectives (EQ2.3); • **Conclusive criterion:** The main provisions were sufficient to ensure achievement of the objectives (EQ2.3); • **Conclusive criterion:** Additional provisions were needed to ensure achievement of the objectives (EQ2.3); • Identification of factors other than the Regulation (i.e. 'external' factors) which explain achievements observed (EQ3); • External factors have a larger influence on the achievements observed than the Regulation itself (EQ3).	- Installed capacities for electricity generation from renewable sources- monitored through biennial reports MS art. 22 of renewables directive; - Number of PCI projects that support (1) new types of gas infrastructure projects, (2) renewable energy sources, (3) carbon capture, storage and utilisation, (4) smart grids; - Stakeholders' views on the degree to which the Regulation has contributed to the climate and energy targets; - Greenhouse gas emissions reduction (partly can be estimated by modelling). • Stakeholders' perception of the influence of external factors in enabling/inhibiting the achievements observed, compared to the Regulation itself (EQ2); • Answers to implementation questions- Block A, B, C & D (EQ2.2).
Data sources	**Data collection methods**
• TSO/Project promoter; • NRAs; • Representatives of ministries; • EU policy-makers; • Participants of regional groups; • The in-depth analysis supporting the Commission Communication COM(2018) 773 "A Clean Planet for All"; • Report on "Do current regulatory frameworks incentivise innovative and security of supply projects? • PCI list (status); • Implementation questions; • Previous evaluations; • 2011 Impact assessment.	• Desk research; • Case studies; • Interviews with regulators and TSO/project promoters; • Modelling.
Data analysis approaches • Case studies; • Portfolio analysis; • Analysis of interviews and survey results; • Modelling.	
Ability to respond to the evaluation question and limitations. As with the other effectiveness question, the implementation questions form the basis of the analysis. The response to this evaluation question will rely on the modelling outputs/indicators as well as the analysis of the views and information provided by stakeholders for which we will rely on two main tools: surveys and interviews. A baseline will need to be drawn for comparison. Additional research and studies might complement the analysis.	

Evaluation criterion: Effectiveness	
Evaluation question 3: What unintended or unexpected positive and negative effects, if any, have been produced by the TEN-E Regulation (e.g. in terms of human health, use of resources, and natural ecosystems)?	
Assessment criteria	**Relevant indicators**
• Effects identified that are not included in the intervention logic/impact assessments (EQ3); • Extent to which effects other than those anticipated have materialised (EQ3).	• Stakeholders perception of existence of unintended or unexpected effects (EQ3); • Difference between effects observed and expected effects (see intervention logic) (EQ3); • Quantitative and qualitative evidence of unexpected positive or negative impacts from PCIs e.g. on human health, use of resources, natural ecosystems.
Data sources	**Data collection methods**
• TSO/Project promoters; • EU policy-makers; • NRAs; • Implementation questions.	• Case studies; • Interviews with regulators and TSO/project promoters.
Data analysis approaches • Case studies; • Analysis of interview results.	
Ability to respond to the evaluation question and limitations As with the other effectiveness question, the implementation question forms the base of the analysis. We are searching for unintended or unexpected positive or negative effects thus this analysis will mainly be limited to a qualitative analysis as these effects will not be monitored. The response to this evaluation question will rely on the analysis of the views and information provided by stakeholders for which we will rely on two main tools: surveys, interviews, and case studies. The case studies and portfolio analysis as well as the analysis of the implementation questions will provide information on unintended effects.	

Efficiency questions

1. To what extent are the costs resulting from the implementation of the TEN-E Regulation proportionate to the benefits that have been achieved? What are the major sources of inefficiencies?
2. To what extent do the different types of costs resulting from the implementation of the TEN-E Regulation vary based on the approach taken to implement the legislation (while achieving the same results)? Which approach was most efficient?

Evaluation criterion: Efficiency	
Evaluation question 4: To what extent are the costs resulting from the implementation of the TEN-E Regulation proportionate to the benefits that have been achieved? What are the major sources of inefficiencies?	
Assessment criteria	**Relevant indicators**
• Ratio between benefits and costs of the f the Regulation > 1 (following from answers to evaluation questions regarding the effectiveness of the Regulation).	• Costs: - Overview of cost categories including: Administrative costs; - Substantive compliance costs (implementation costs, direct labour costs, overheads, equipment costs, material costs, cost of external services); - Costs related to applying for incentives granted by NRAs. • Benefits: See effectiveness questions- mostly EQ 1; • Perception of stakeholders on major sources of inefficiencies.
Data sources	**Data collection methods**
• TSOs/Project promoters; • NRAs; • Representatives of ministries; • Impact Assessment; • Previous evaluation; • 2011 EU policy-makers.	• Targeted survey; • Interviews; • Desk research.
Data analysis approaches • Case studies; • Administrative cost analysis; • Analysis of interviews and survey results; • Energy market modelling / cost benefit analysis.	
Ability to respond to the evaluation question and limitations. Answers to the implementation questions can also be useful for the assessment of costs of the Regulation. It is unlikely that we will be able to identify and quantify all costs and benefits. For this reason, we will report bandwidths or a qualitative assessment of how the costs of the Regulation compare to the benefits. As outlined in the methodology, receiving input on the cost figures from stakeholders may be difficult thus we will engage the following mitigating measures to ensure that there is enough time for stakeholders to respond, the right stakeholders are contacted, as well as utilising available data where possible and using the energy market modelling to receive estimates. We will use the energy market modelling to supplement the cost and benefit analysis.	

Evaluation criterion: Efficiency	
Evaluation question 5: To what extent do the different types of costs resulting from the implementation of the TEN-E Regulation vary based on the approach taken to implement the legislation (while achieving the same results)? Which approach was most efficient?	
Assessment criteria	**Relevant indicators**
• Existence of different implementation approaches in MS (i.e. permit processes, public consultation); • Differences in costs of the different approaches.	• Typology of different approaches (); • Ratio between costs and benefits ().
Data sources	**Data collection methods**
• TSOs/ Project promoters; • NRAs; • Representatives of ministries; • 2011 Impact Assessment; • Previous Evaluation.	• Targeted survey; • Interviews; • Desk research.
Data analysis approaches • Case studies; • Analysis of interviews and survey results.	
Ability to respond to the evaluation question and limitations Implementation approach in one country cannot always be implemented in another country due to institutional differences. Before answering this evaluation question the detailed implementation questions need to be answered. Furthermore, as quantifying cost and benefits may be difficult if respondents do not provide sufficient cost estimates, the indicators as well as the data analysis may largely focus on qualitative data and analysis.	

Relevance questions

1. To what extent do the objectives of the TEN-E Regulation still respond to the needs of the EU in relation to energy infrastructure?
2. To what extent are the 12 priority corridors still relevant? Do they address current and arising challenges for TEN-E networks (e.g. sector coupling, hydrogen)?
3. To what extent are the provisions of the TEN-E Regulation able to respond to new or emerging issues such as the energy and climate targets for 2030, the EU long-term decarbonisation commitment towards carbon neutrality, the energy efficiency first principle, and EU readiness for the digital age?

Evaluation criterion: Relevance	
Evaluation question 6: To what extent do the objectives([280]) of the TEN-E Regulation still respond to the needs of the EU in relation to energy infrastructure?	
Sub-questions: 6.1 What are the relevant **new/emerging issues**([281]) within the field of energy infrastructure? 6.2 To what extent are the **needs**([282]) initially identified by the TEN-E Regulation **still relevant**? 6.3 In light of this, are the **objectives** of market integration, security of supply, and competitiveness **still relevant**? Should the objectives or the balance between objectives be changed?	
Assessment criteria	**Relevant indicators**
• Stakeholders are of the opinion that their needs and new developments are addressed (EQ6.1 & EQ6.2); • Stakeholders are not of the opinion that their needs and new developments are addressed (EQ6.1 & EQ6.2); • Stakeholders are of the opinion that the Regulation has the ability to address current needs of the EU (EQ6.3); • Evidence found in different types of documents confirming whether the Regulation supports/contradicts new developments (EQ6.1, EQ6.2, EQ6.3); • Evidence found in different types of documents indicating new developments in the field of energy infrastructure (EQ6.3, EQ6.2); • Stakeholders refer to the fact that original objectives are (in)sufficient to meet the needs of key target groups and the new developments are addressed, and propose possible amendments (EQ6.3).	• Stakeholder's opinions on whether original objectives are (in)sufficient to meet needs of key target groups (EQ9.2); • Description of environmental, technical, economic and social trends in the EU and their impact on energy infrastructure (e.g. decarbonisation, development of new gases, etc.) (EQ6.3, EQ6.4, EQ6.5); • Correspondence (lack of gaps and contradictions) between the objectives and the current needs (EQ6.6); • Stakeholder's judgement on the suitability of the Regulation to address current

([280]) Market integration, security of supply, competitiveness and the climate and energy targets for 2020.

([281]) Such as resource depletion, climate change mitigation, just transition of coal regions, smart grids, energy savings from smart building controls, CO2 network development, hydrogen networks, hydrogen injection into existing gas network, multi directional and highly integrated energy systems, integration of various renewables (including gases such as biomethane, and power-to-gas), smart charging of electrical vehicles, carbon capture, storage and utilisation, energy storage, sector integration, infrastructure climate resilience, the interface and interlinkages between transmission and distribution grids.

([282]) As regards challenges/barriers previously identified with different types of energy infrastructure within the scope of the Regulation (electricity, gas, oil, CO2, smart grids) as regards permit-granting procedures, public opposition to projects, regulatory cross-border challenges, energy infrastructure investments, commercial viability, energy financing capacity, market fragmentation, security of supply, competitiveness, social and environmental impacts of energy infrastructure.

	needs (EQ6.1, 6.2, EQ6.6); • Stakeholder's judgement on the suitability of the Regulation to address new developments (EQ6.6); • Stakeholder's judgement on how to amend the Regulation's objectives (EQ6.6); • Assessment of EQ7 (EQ6.1 &6.2).
Data sources	**Data collection methods**
• Previous evaluations and IAs; • Other EU legislation outlining current needs; • Academic literature; • TSOs/Project promoters; • NRAs and competent authorities; • General Public.	• Desk research; • Case studies; • Interviews with regulators and TSO/project promoters; • Online public consultation; • Targeted survey.
Data analysis approaches • Stakeholder consultation result analysis; • Analysis of interviews and survey results; • Intervention logic analysis; • Portfolio analysis.	
Ability to respond to the evaluation question and limitations The starting point of answering these questions will be reconstruction of the intervention logic. Answering this question will require information from the EC and gathering inputs from other stakeholders. A possible limitation is that the judgement will be mostly based on qualitative information. Stakeholders' opinions will help to triangulate the results to make them more robust. In addition, the analysis will be supported by portfolio analysis and documentary review.	

Evaluation criterion: Relevance	
Evaluation question 7: To what extent are the 12 priority corridors still relevant? Do they address current and arising challenges for TEN-E networks (see EQ9)?	
Sub-questions: 7.1 Are current needs of the EU addressed via the priority corridors and areas? Should the list of corridors and areas be updated? 7.2 Do priority corridors and areas sufficiently address the current and arising challenges for TEN-E networks? What challenges are not addressed, if any? 7.3 Is there a need to pay more attention to priority thematic areas([283]) instead? (Is the cross-border criterion still fit for purpose?)	
Assessment criteria	**Relevant indicators**
• Suitability of the corridor/areas approach with each of the identified current needs (EQ7.1); • Suitability of each priority corridors and areas to new needs and challenges (EQ7.2); • Identified current and arising challenges for TEN-E networks that are not addressed by the priority corridors and areas (EQ7.2); • Identified needs and challenges for which an approach focused on priority thematic areas rather than corridors is better suited (EQ7.3).	• Correspondence (lack of gaps and contradictions) between the priority corridors/ areas and the current needs (EQ7.1); • The extent to which the current needs are addressed via the priority corridors (EQ7.1); • The extent to which the current needs are addressed via the priority corridors (EQ7.1); • Perceived suitability by stakeholders that the priority corridors and areas to address the current and emerging challenges for TEN-E networks by stakeholders (EQ 7.2); • % of opinions expressed by stakeholders on the arising challenges for TEN-E networks that are not addressed by the priority corridors and areas (EQ 7.2); • Assessment of EQ7 (EQ7.1 & 7.2).
Data sources	**Data collection methods**
• Previous evaluations and IAs; • Energy scenarios, sector market reports and databases; • Academic literature; • TSO/Project promoter; • NRAs and competent authorities; • General Public.	• Desk research; • Case studies; • Interviews with regulators and TSO/project promoters; • Online public consultation; • Targeted survey.
Data analysis approaches • Stakeholder consultation result analysis; • Analysis of interviews and survey results; • Intervention logic analysis; • Portfolio analysis.	
Ability to respond to the evaluation question and limitations Answering this question will require information from the EC and gathering inputs from other stakeholders. A possible limitation is that the judgement will be mostly based on qualitative information. Other stakeholders' opinions will help to triangulate the results to make them more robust. In addition, the analysis will be supported by portfolio analysis and documentary review.	

([283]) Priority thematic areas include Smart grids deployment, Electricity highways, Cross-border carbon dioxide network (see annex I (4) of the Regulation 347/2013).

Evaluation criterion: Relevance	
Evaluation question 8: To what extent are the provisions of the TEN-E Regulation able to respond to new or emerging issues such as the energy and climate targets for 2030, the EU long-term decarbonisation commitment towards carbon neutrality, the energy efficiency first principle, and EU readiness for the digital age([284])?	
Sub-questions: 8.1 Which **provisions**([285]) are in place to address the new or emerging issues? (e.g. the cross-border criterion with regard to the need for smart grids and sector coupling projects) 8.2 Has the Regulations addressed the new or emerging issues with relevant provisions? 8.3 What are the new or emerging issues that the provisions of the TEN-E Regulation do not cover?	
Assessment criteria	**Relevant indicators**
• Identification of emerging issues that influence the landscape of TEN-E Regulation (see EQ6.1); • Identified new or emerging issues that the Regulation does not cover (EQ8.3); • Stakeholders perceive that provisions of the TEN-E Regulation sufficiently address the changing needs (EQ8.2 and 8.3); • High degree of flexibility provided by the TEN-E Regulation to adjust to new or emerging issues (EQ8.2).	• % of opinions expressed by stakeholders and views expressed through interviews on the possibility and/or flexibility provided by the Regulation to adapt to new or emerging issues (EQ8.2); • Score on relevance expressed by stakeholders on the measures adopted by the Regulation to address changing needs (EQ8.2); • % of opinions expressed by stakeholders on the emerging needs or challenges that the Regulation does not cover (EQ8.3).
Data sources	**Data collection methods**
• Previous evaluations and IAs; • Energy scenarios, sector market reports and databases; • Academic literature; • TSO/Project promoter; • NRAs and competent authorities; • General Public.	• Desk research; • Case studies; • Interviews with regulators and TSO/project promoters; • Online public consultation; • Targeted survey.
Data analysis approaches • Stakeholder consultation result analysis; • Analysis of interviews and survey results; • Intervention logic analysis.	
Ability to respond to the evaluation question and limitations This question resembles EQ9 but differs in its focus on specific provisions rather than the Regulation's objectives. Answering this question will require information from the EC, NRA's and gathering inputs from different stakeholders. A possible limitation is that the judgement will be mostly based on qualitative information and expert analysis (workshop). Results of the OPC and publications can help to overcome limited data availability and subjectivity, as will comprehensive desk research and case studies on MS level. Views and opinions of different types of stakeholders will allow to triangulate the results to make them more robust.	

([284]) Also more specifically the just transition of coal regions, smart grids, energy savings from smart building controls, CO2 network development, hydrogen networks, hydrogen injection into existing gas network, multi directional and highly integrated energy systems, integration of various renewables (including gases such as biomethane, and power-to-gas), smart charging of electrical vehicles, carbon capture, storage and utilisation, energy storage, sector integration, infrastructure climate resilience, the interface and interlinkages between transmission and distribution grids.

([285]) For instance: regional approach, cross-border criterion, PCI selection process and criteria, permit granting procedure, public participation, regulatory incentives/cross-border cost allocation.

Coherence questions

1. Are the measures set out within the TEN-E Regulation mutually reinforcing or are there any overlaps, inconsistencies, or incoherencies (when read in isolation)?
2. How does the legislation interact with other EU/ national/ international initiatives (e.g. actions in the field of environment, single market, climate action) which have similar objectives?
3. How well does the legislation fit with and complement other EU policies (e.g. Regional Policy, Research and Innovation, Environment) but also other elements of EU energy policy (e.g. internal market design, renewable energy framework, energy efficiency first principle, Union energy and climate targets for 2030, the EU long-term decarbonisation commitment, European Green Deal)?

Evaluation criterion: Coherence	
Evaluation Question 9: Are the measures set out within the TEN-E Regulation mutually reinforcing or are there any overlaps, inconsistencies, or incoherencies (when read in isolation)?	
Assessment criteria	**Relevant indicators**
• Clearly distinct objectives and expected effects between the articles of the TEN-E Regulation with limited overlap and no conflicts. (EQ9.1).	• % of opinions expressed by stakeholders that objectives/effects are distinct with limited overlaps and conflicts. (EQ9.1).
Data sources	**Data collection methods**
• Academic literature; • Policy instruments and documents; • EU stakeholders; • NRAs.	• Targeted survey; • Interviews with EU stakeholders and NRAs; • Webinars.
Data analysis approaches • Stakeholder consultation results analysis; • Analysis of interviews and survey results; • Analysis of literature.	
Ability to respond to the evaluation question and limitations Responses to this evaluation question from stakeholders will rely on interview evidence and therefore could be necessarily qualitative/subjective but will be complemented by other data sources/analysis.	

Evaluation criterion: Coherence	
Evaluation Question 10: How does the legislation interact with other EU/ national/ international initiatives (e.g. actions in the field of environment, single market, climate action, Clean Energy Package) which have similar objectives?	
Sub-questions: 10.1 What, if any, inconsistencies/conflicts exist between the TEN-E Regulation and the relevant provisions of the Third Package and the Clean Energy Package (including electricity and gas)? 10.2 What, if any, inconsistencies/conflicts exist between the TEN-E Regulation and any international-level legal provisions/initiatives (e.g. Paris Agreement, Aarhus Convention, UN Sustainable Development Goals)? 10.3 What, if any, inconsistencies/conflicts exist between the TEN-E Regulation and any national-level legal provisions/initiatives (e.g. planning, permitting)?	
Assessment criteria	**Relevant indicators**
• Clearly distinct objectives between the instruments with limited overlap and no conflicts (instruments should be complementary and reinforce each other). (EQ10.1 - 10.2); • National laws do not frustrate the implementation of TEN-E Regulation objectives. (EQ10.3).	• % of opinions expressed by stakeholders that objectives are distinct with limited overlaps and conflicts. (EQ10.1 - 10.2); • Number of national legal instruments identified by stakeholders, together with explanations. (EQ10.3).
Data sources	**Data collection methods**
• Academic literature; • Legislative instruments; • Policy instruments and documents; • EU stakeholders; • NRAs.	• Targeted survey; • Interviews with EU stakeholders and NRAs; • Webinars; • Desk research utilising at least the following: - Legislative instruments (both Third Package and CEP); - Relevant legal analysis literature and evaluation studies; - Impact assessments; - EU working documents.
Data analysis approaches • Stakeholder consultation results analysis; • Analysis of interviews and survey results; • Analysis of literature.	
Ability to respond to the evaluation question and limitations – Project team reliant completely on respondents regarding the flagging of national law issues and critical analysis thereof; – Depth and scope of EU instruments across these areas may limit ability of all selected stakeholders to provide comprehensive commentary across all instruments; – Responses to this evaluation question will rely on interview evidence and therefore could be necessarily qualitative/subjective.	

Evaluation criterion: Coherence	
Evaluation Question 11: How well does the legislation fit with and complement other EU policies (e.g. Regional Policy, Research and Innovation, Environment) but also other elements of EU energy policy (e.g. internal market design, renewable energy framework, energy efficiency first principle, Union energy and climate targets for 2030, the EU long-term decarbonisation commitment, European Green Deal)?	
Sub-questions: 11.1 Does the operation of EU funding mechanisms and programmes (such as CEF, Cohesion Fund, European Regional Development Fund, Horizon 2020) interact effectively with the implementation of the TEN-E Regulation, or are there overlaps/inconsistencies? 11.2 What, if any, inconsistencies/conflicts exist between the TEN-E Regulation and EU initiatives for decarbonisation/sustainability (such as the European Green Deal, Sustainable Finance, habitats, water environment and Long-Term Strategy for Decarbonisation)? 11.3 Does the TEN-E Regulation contribute to implementing article 349 of the TFUE and the October 2017 Commission strategy for the outermost regions and how? 11.4 Does the TEN-E Regulation adequately and coherently support EU policy initiatives in the field of digitalisation (in particular relevant policy strands within "Europe Fit for the Digital Age" such as security, standardisation and development of smart networks)? 11.5 Does the TEN-E Regulation adequately and coherently support the objectives of the Trans-European Transport Network (TEN-T) policy?	
Assessment criteria	**Relevant indicators**
• TEN-E Regulation objectives clearly defined in their scope and do not create confusion/overlap with wider EU funding mechanisms. (EQ 11.1); • TEN-E Regulation complements and reinforces, rather than conflicts with wider EU policy initiatives. (EQ11.2 - EQ11.5).	• % of opinions expressed by stakeholders that objectives are distinct with limited overlaps and conflicts. (EQ 11.1 - EQ11.5).
Data sources	**Data collection methods**
• Academic literature; • Legislative instruments; • Policy instruments and documents; • EU stakeholders; • NRAs.	• Targeted survey; • Interviews with EU stakeholders and NRAs; • Webinars; • Desk research utilising at least the following: - - Legislative instruments (both Third Package and CEP); - Relevant legal analysis literature and evaluation studies; - Impact assessments; - EU working documents.
Data analysis approaches • Stakeholder consultation results analysis; • Analysis of interviews and survey results; • Analysis of literature.	
Ability to respond to the evaluation question and limitations – The project team reliant completely on respondents regarding the flagging of national law issues and critical analysis thereof; – Depth and scope of EU instruments across these areas may limit ability of all selected stakeholders to provide comprehensive commentary across all instruments; – Responses to this evaluation question will rely on interview evidence and therefore could be necessarily qualitative/subjective.	

EU Added value questions

1. What has been the EU added value of the TEN-E Regulation (e.g. regional cooperation)? Would the same results have been achieved with legislation at national and/or regional level only?
2. To what extent do the issues addressed by the TEN-E Regulation continue to require action at EU level?

Evaluation criterion: EU added value	
Evaluation questions 12. What has been the EU added value of the TEN-E Regulation (e.g. regional cooperation)? Would the same results have been achieved with legislating at national and/or regional level?	
Assessment criteria	**Relevant indicators**
• The generated EU added value over legislation at national and/or regional level; • Benefits such as coordination gains, improved legal certainty, greater speed of the delivery of the greater effectiveness due to legislating at EU level, volume effects (TEN-E contributed to existing actions, and supporting additional individuals which would otherwise not have been helped), scope effects (development of new services), role effects (development of support which came to act as a model for other local provision or were subsequently mainstreamed), process effects (the establishment of successful partnerships).	• Costs induced by additional requirements of the TEN-E Regulation compared to the combination of previously existing national regimes and EU-level legislation; • Generated benefits and effects of the Regulation; • (Perceived) added value of the TEN-E Regulation over national and/or regional level regulation based on responses on effectiveness and efficiency questions (including implementation questions A.7, B.6, C.4, D.3); • (Perceived) added value of the TEN-E Regulation in terms of improved coordination among MS, legal certainty, effectiveness in the absence of the TEN-E Regulation per type of benefit/effect; • Perception of participants of the likelihood that the benefits would have been implemented in absence of the Regulation; • Stakeholders are of the opinion that the benefits outweigh the costs generated by the Regulation.
Data sources	**Data collection methods**
• TSO/Project promoter; • NRAs and competent authorities; • Impact assessment; • Previous evaluation.	• Case studies; • (Scoping) Interviews with regulators, TSO/project promoters; • Targeted survey.
Data analysis approaches • Stakeholder consultation result analysis; • Analysis of interviews and survey results.	
Ability to respond to the evaluation question and limitations To answer these evaluation questions the analysis of the implementation questions will be needed as well as the analysis of the efficiency and effectiveness criteria. The response to this evaluation question will primarily rely on the analysis of the views and information provided by stakeholders for which we will rely on the following tools: targeted survey and interviews. Answering these evaluation questions relies mainly on anecdotal evidence provided by stakeholders. We have to carefully evaluate whether efficiencies are the result of the Regulation or the implementation process in a particular MS or by a specific stakeholder. Additional research and studies might complement the analysis.	

Evaluation criterion: EU added value	
Evaluation questions 13. To what extent do the issues addressed (i.e. market integration, security of supply, competitiveness and the climate and energy targets for 2020) by the TEN-E Regulation continue to require action at EU level?	
Assessment criteria	**Relevant indicators**
• Stakeholders are of the opinion that the currently addressed issues will continue to require action at the EU level; • Stakeholders are of the opinion that the benefits due to the Regulation are future proof and will be generated only if the actions are taken at the EU level; • A majority of stakeholders expects the positive effects to disappear in case of interruption of the Regulation.	• % of opinions expressed by stakeholders that currently addressed issues will continue to require action at the EU level; • % of opinions expressed by stakeholders that the generated benefits in the future outweigh the cost due to involvement at the EU level; • Answers to effectiveness/efficiency questions (EQ6, 7, 8, 10).
Data sources	**Data collection methods**
• TSO/Project promoter; • NRAs and competent authorities; • Impact assessment; • Previous evaluation.	• Case studies; • (Scoping) Interviews with regulators, TSO/project promoters; • Targeted survey.
Data analysis approaches • Stakeholder consultation result analysis; • Analysis of interviews and survey results.	
Ability to respond to the evaluation question and limitations To answer these evaluation questions the analysis of the implementation questions will be needed as well as the analysis of the efficiency and effectiveness criteria. The response to this evaluation question will rely on the analysis of the views and information provided by stakeholders for which we will rely on the following tools: targeted survey and interviews. Answering these evaluation questions relies mainly on anecdotal evidence provided by stakeholders. We have to carefully evaluate whether efficiencies are the result of the Regulation or the implementation process in a particular MS or by a specific stakeholder. Additional research and studies might complement the analysis.	

Detailed questions on the effectiveness of the main provisions under the TEN-E Regulation

The implementation questions including their sub-questions, assessment criteria, relevant indicators, data sources, data collection methods, and data analysis approaches are outlined below. The implementation questions were also revised and condensed to reflect the new scope. As previously mentioned almost all of the implementation questions (Block A- D) fall under the effectiveness criteria; thus, the analysis of these questions will be done along with the analysis of the effectiveness questions. The questions in Block E were merged with the sub-questions under Relevance and thus Block E was removed; however, we ensured that the questions are adequately covered by the Relevance sub questions.

ANNEX II CASE STUDY REPORTS

Case study – Interconnection between Latvia and Estonia

Main messages of the case study

PCI 4.2.1 *"Interconnection between Kilingi-Nõmme (EE) and Riga CHP2 substation (LV)"* or *"Estonia-Latvia 3rd Interconnection"* has appeared on all four PCI lists as one of three 4.2 cluster projects that is now in its final stage of construction and expected to be operational by the end of 2020, serving as the backbone of cross-border capacity expansion between Latvia and Estonia.

The following three main messages are to be highlighted:

1. The interconnector was drawn up in the form of multiple feasibility studies years before the permit granting process and first PCI list. The national regulator responded to the initial investment asserting the project would not have been economically feasible without EU funds and while the CBCA did not reallocate costs, the benefits were distributed on territorial basis;
2. Overall public acceptance was fairly straight forward due to positive messaging about the project ensuring energy independence from Russia by increasing connectivity with Nordic and Central Europe power grids;
3. The Environmental Impact Assessment was an arduous process involving nearly one hundred consultations with affected parties mostly over the location of the line. The stakeholder opposition pushed for a joint implementation with the Rail Baltica project which further complicated the coordination process between the groups of project promoters, yet nonetheless the project is expected to be finalised by the end of 2020 as planned.

Description of the project

PCI 4.2.1, PCI 4.2.2 *"Internal line between Harku and Sindi (EE)" 2,* and PCI 4.2.3 *"Internal line between Riga CHP2 and RIGA HPP (LV)"* form the 4.2 cluster.

Project goals: The Estonian-Latvian cross-border interconnector is the most congested in the Baltics responsible for significant price discrepancies in NordPool trading between of Estonia, Latvia and Lithuania. The new corridor and connection points will reduce network vulnerabilities and accelerate the renewal and reconstruction of existing Latvian-Estonian interconnection lines. This will not only increase regional security of supply and market integration, but help complete a capacity corridor from the Nordic to Central European electricity grids that will serve as an alternative route for Nordic electricity flows. ([286])

Sector: *Electricity*
Name of case study: *Interconnection between Kilingi-Nõmme (EE) and Riga CHP2 substation (LV)*
PCI Code: *4.2.1*
Project promoters: *Augstsprieguma tikls (LV) /Latvian TSO/, Elering (EE) /Estonian TSO/, Latvijas elektriskie tikli (LV) /Latvian transmission network management/.*
Geographical area: *Baltic Energy Market Interconnection Plan (BEMIP), Kilingi-Nõmme (EE) to Riga (LV).*
Implementation phase: *Under construction (to be commissioned in 2020).*
Hosting countries: *Estonia, Latvia.*

([286]) Source: AST (2018), 3rd 330 kV Estonia-Latvia Interconnection. Retrieved from: http://www.ast.lv/sites/default/files/editor/LV-starpsavienojums-a5-screen-mar12-EN.pdf ; http://www.ast.lv/en/transmission-network-projects/latvia-estonia-third-interconnection ; https://www.sprk.gov.lv/sites/default/files/editor/Enerģētikas%20tarifi/Elektroenerģija/LemumsN090D23042014.pdf.

	Date of first initiation: 23 April 2014 (National Regulatory Authority Council Decision)	1st PCI list	2nd PCI list	3rd PCI list [287]	4th PCI list [288]
Expected date of commissioning		2020	2020	2020	2020
Planned capacity	1143MVA (600 MW)	1143MVA (600 MW)	1143MVA (600 MW)	1143MVA (600 MW)	1143MVA (600 MW)
Planned route	Kilingi-Nõmme (EE) and Riga CHP2 substation (LV)	Kilingi-Nõmme (EE) and Riga CHP2 substation (LV)	Kilingi-Nõmme (EE) and Riga CHP2 substation (LV)	Kilingi-Nõmme (EE) and Riga CHP2 substation (LV)	Kilingi-Nõmme (EE) and Riga CHP2 substation (LV)
Estimated investment cost *	€113,52 million/ €177,52 million([289])	€176 million (2016)([290])	€176 million (2017)([291])	€176 million (2018)([292])	€176 million (2019)([293])

*Estimated investment cost includes the joint costs of PCI 4.2.1 and PCI 4.2.2 as they are published together in ACER report, except for the first initiation, where costs have been divided between the two projects.

Permit granting

According to the implementation plan, the feasibility and design studies were executed between 1 September 2006 and 1 September 2008 and 1 January 2016 and 30 March 2019([294]). The preliminary study on the selection of high-voltage line routes, the electricity market, and economic and technical research was finalized in 2009 and 2013, as the necessity of the project has been proved in 2009([295]). From 2012 the project was included in the ENTSO-E's TYNDP as a part of the project set No. 62. Shortly after its inclusion on the first PCI list (approved on 14 October 2013) the National Regulatory Authority of Latvia received an investment request from the Latvian and Estonian TSOs and the Latvian Electricity system owner on 31 October 2013, which was accepted

(287) European Commission (2018), Technical information of Projects of Common Interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/technical_document_3rd_list_with_subheadings.pdf.

(288) European Commission (2020a), Technical information on Projects of Common Interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/technical_document_4th_pci_list.pdf.

(289) https://www.sprk.gov.lv/sites/default/files/editor/Enerģētikas%20tarifi/Elektroenerģija/LemumsN090D23042014.pdf.

(290) ACER (2016), Consolidated report on the progress of electricity and gas projects of common interest for the year 2015. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20PROJECTS%20OF%20COMMON%20INTEREST%20for%20the%20year%202015.pdf.

(291) ACER (2017a), Consolidated Report on the progress of electricity and gas Projects of Common Interest for the year 2016. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20for%20the%20year%202016.pdf.

(292) ACER (2018b), Consolidated Report on the progress of electricity and gas Projects of Common Interest for the year 2017. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20for%20the%20year%202017.pdf.

(293) ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest – 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

(294) European Commission (2020j), Project of Common Interest 4.2.1 PCI Implementation Plan. Retrieved from: https://ec.europa.eu/energy/maps/pci_fiches/PciImplementationPlan_4.2.1.pdf.

(295) Based on interview with the Latvian TSO, Augstsprieguma tikls.

by 23 April 2014, including approval of the CBA and CBCA studies ([296]) The actual period for permit granting process was scheduled between 1 June 2016 and 1 December 2019.

The environmental impact assessment proved to be a challenging process. It was submitted to the State Environmental Bureau on 26 September 2012, and 29 initial public consultations were held involving municipalities and landowners between 11 November 2012 and 17 April 2013. State Environmental Bureau approved the programme on 4 July 2013 triggering the route research a year later, after an additional 10 initial public consultation. From this, the first draft of the EIA report([297]) emerged with two alternative routes, then discussed in 19 subsequent public consultations. Mainly, Latvian municipalities complained that the lines were no longer crossing territories originally proposed([298]). Thus, an alternative routing was included in the revised EIA submitted to State Environmental Bureau on 16 February 2016, which was then extended and re-submitted with additional information and clarification on 22 April 2016. The Cabinet of Ministers of the Republic of Latvia approved this EIA document and granted the project the status of national importance ([299]).

Public participation

The project was included in targeted consultation for candidate PCIs in the 2018-2019 electricity infrastructure survey([300]). The significance of the project and other Baltic Energy Market Interconnection Plan (BEMIP) projects were part of the *integration* and in the *synchronization* of Baltic, European and the Nordic markets. 12 of the overall 19 responses were local (Latvia, Lithuania and Finland), and all 19 responses were positive.

As referred to above, during EIA deliberations in 2013 and 2014 municipalities expressed dissatisfaction about the planned route of the 330 kV line planned following the 110kV lines in place through their territory. In turn, the project developers discussed the possibility of revising the route and aligning it with the planned Rail Baltica line([301]). The Ministry of Economics, responsible for national energy investments in Latvia, agreed with the Ministry of Transport, project promoter of the Rail Baltic project, to joint implementation in 2015.([302])

As a result of the revised EIA document and further public discussion, two alternative routes were identified to avoid forested and highly populated areas.([303]) In the end, the interconnector's path was decided to be the following: joined route with Rail Baltica railway line path between Riga and Saulkrasti, while it is aligned with the already existing 110 kV connector's pathway between Saulkrasti to Rūjiena. From Rūjiena to the Latvian-Estonian border a new pathway is to be established ([304]).

(296) https://www.sprk.gov.lv/sites/default/files/editor/Enerģētikas%20tarifi/Elektroenerģija/LemumsN090D23042014.pdf.

(297) http://www.ast.lv/sites/default/files/editor/att-projekti/EE_LV_Iesniegums_1B.pdf.

(298) Please see a detailed discussion on how the EIA drafting process has been extended due to the municipalities' „not in my backyard" (NIMBY) opinion in the 1.3 and 1.4 sections.

(299) http://www.ast.lv/en/transmission-network-projects/latvia-estonia-third-interconnection , http://www.vpvb.gov.lv/lv/ivn/projekti/?status=3&id=1404.

(300) European Commission (2019e), Targeted consultation on candidate Projects of Common Interest (PCIs) in electricity infrastructure PCI process 2018-2019 – summary. Retrieved from: https://ec.europa.eu/info/sites/info/files/energy_climate_change_environment/electricity_candidate_pcis_consultation_summary.pdf.

(301) Rail Baltica is a greenfield rail transport infrastructure project, which aims to support the direct connection of the Baltic countries and Finland to the „continental" Europe, through Poland. (https://www.railbaltica.org/about-rail-baltica/) This project appears on the TEN-T project list (2014-EU-TMC-0560-M) and has also gained CEF fund.

(302) Based on Antons Kutjuns's (Head of International Development Projects division, AST) presentation at the PCI Energy Day Conference, 4 December 2019, Brussels, Belgium, https://www.youtube.com/watch?v=uk84QPpEUyY&feature=youtu.be , https://ec.europa.eu/info/events/pci-energy-days-2019-dec-03_en.

(303) https://likumi.lv/ta/id/284481-par-elektrotiklu-parvades-savienojuma-igaunijaslatvijas-tresais-330-kv-starpsavienojums-parbuvei-un-jaunbuvei-paredzetas.

(304) http://www.ast.lv/en/events/first-pylons-new-transmission-line-third-latviaestonia-interconnection-are-installed.

Aside from opposition about the initial planned location of the interconnector line, no other major public disapproval occurred. The press opinion was neutral and informative about the construction process[305] and with a direct line to the Bureau where people can acquire for further information.[306]

Administrative burdens – joint implementation of PCI 4.2.1 and Rail Baltica

The EIA agreement between project promoters of PCI 4.2.1 and Rail Baltica promoters faced *complicated coordination process between different sectors* and *different commission dates*. At the Ministerial level, finding a common solution to different project interests and processes (e.g. different requirement for EIAs or way of designing routes, acquiring land). Furthermore, the administrative burden of joint implementation was considerable with different commission dates and project timelines. The interconnector is expected to be commissioned by the end of 2020, while only the design phase of Rail Baltica is expected by 2022 with construction completed in 2026[307]. The main issue was that the acquisition of the land for the railway line, which is already slow and legally complex, happened later, causing uncertainty in the design and construction process of the interconnector line([308]).

Regulatory incentives

No regulatory incentives apply to the project([309]).

CBA: Benefits and costs of the projects

Both CBA and CBCA analyses were approved in 2014. While no detailed information about the CBA analysis is available, a summary published as an investment request for the NRA includes some information about the project benefits and costs. ([310])

According to this document, the investment requirement of PCI 4.2.1 was jointly submitted with PCI 4.2.2 by the project promoters with a total cost of EUR 177.52 million, and EUR 113.52 million to the former. EU funding covered 75% of the total project cost with own costs and funding distributed according to the length of the lines in Estonia (11%) and Latvia (89%).

According to the ENTSO-E TYNDP 2012 project package No. 62, the total benefits of the projects for the entire Baltic Sea region are estimated at over EUR 100 million per year, with no further details. Logically, benefits are concentrated in Latvia and Estonia and, furthermore, the other littoral Baltic Sea States do not exceed the material 10% threshold prescribed by ACER.

An estimated benefit-cost ratio (B/C) can be calculated based on the total costs and annual benefits for Latvia. By considering some general assumptions([311]), the annualized benefit-cost ratio is **1.88**. This figure indicates that **the net benefit of the project is positive** even without consideration of Estonia and third countries.

([305]) https://www.valmieraszinas.lv/mazsalacas-novada-sak-buvet-jaunas-augstsprieguma-elektrolinijas-igaunijas-latvijas-3-starpsavienojums-posmu/ , http://www.beverinasnovads.lv/index.php/8-pasvaldiba/23-tresais-latvijas-igaunijas-parvades-tikla-starpsav.

([306]) https://ropazi.lv/lv/novads/jaunumi/o/pazinojums-par-elektrotiklu-parvades-savienojum-4862.

([307]) https://www.railbaltica.org/about-rail-baltica/project-timeline/.

([308]) Based on Antons Kutjuns's (Head of International Development Projects division, AST) presentation at the PCI Energy Day Conference, 4 December 2019, Brussels, Belgium, https://www.youtube.com/watch?v=uk84QPpEUyY&feature=youtu.be.

([309]) European Commission (2014a), Study on regulatory incentives for investments in electricity and gas infrastructure projects. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/MJ0614081ENN_002.pdf.

([310]) https://www.sprk.gov.lv/sites/default/files/editor/Enerģētikas%20tarifi/Elektroenerģija/Lemums N090D23042014.pdf.

([311]) In the above described annualized benefit-cost ratio estimation the following assumptions have been considered: the annualized cost of the total project cost (EUR 177.52 million) is calculated as the WACC is 4%, while the lifetime of the project is 25 years. Furthermore, on the benefit side only the annual benefits for Latvia (EUR 21.4 million) are considered, therefore the estimated 1,88 B/C ratio is a very conservative result.

Latvia's total annual benefits are estimated at EUR 21.4 million between: socio-economic benefits (EUR 12.2 million), reduction of restrictions for electricity producers (EUR 2.95 million), and reduction of CO2 emissions (estimated EUR 6.25 million).

CBCA

Referring to the same summary published at the request of the NRA, project promoters signed a letter of intent including distribution of costs according to the length of the lines in Estonia and Latvia,11% and 89% respectively. Cost savings are distributed in proportion to the distribution of costs between Latvia and Estonia.

In this case, CEF funding was less than initially submitted, meaning the Latvian Regulator and the Estonian Competition Council mutually agreed on the revision of the cost allocation.([312])

Financing of the projects

The PCI 4.2.1 and PCI 4.2.2 projects were jointly granted CEF funds in the call year 2014 for the maximum of EUR 112.301 million or **65% of the total estimated eligible costs** (EUR 172.771 million). This figure is slightly lower than costs published by the National Regulatory Authority (EUR 177.52 million) and ACER's Consolidation Report (EUR 176 million)([313]).

CEF funding was invaluable to the project's success. Assuming the standard CEF regulation of up to 75% financing, the unit price of electricity transmission service increases at 2.3%. Without it, the unit price of electricity transmission service increases by 13%. It is worth repeating that although the initial CBA estimated the project related costs and benefits with 75% of CEF funding, the final rate was set at 65%.([314])

Lessons learned for the future

- The timing of the feasibility studies, well in advance of submission to the National Regulatory Authority, show that PCI status and CEF funding were indispensable;
- The overall public acceptance of the project followed a simple storyline: independence from Russia's transmission network and further integration with the Nordic and the Central European Transmission;
- Targeted opposition and the ensuing EIA compromise caused project delays. Following resistance to the initial EIA, the project promoters were forced to consider an alternative route in conjunction with Rail Baltica. This, in turn, resulted in conflicts of interest, a clash in project timelines and additional bureaucracy complicating coordination process between promoters;
- Despite all these challenges, the cooperation between the Ministry of Transport, the Ministry of Economics and the Innovation and Networks Executive Agency (INEA) contributed to the ultimate success of PCI 4.2.1. Although combining the permitting process for two different projects worked, it cannot be advised in future scenarios projects.

Case study - SuedLink

Main messages of the case study

SuedLink is a major German internal transmission line project which aims to link the large northern wind production portfolio with the southern territories. In these southern territories electricity demand is concentrated and is dependent on conventional power plants. Suedlink will also bring

([312]) https://www.sprk.gov.lv/sites/default/files/editor/Enerģētikas%20tarifi/Elektroenerģija/LemumsN090D23042014.pdf.

([313]) ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest – 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

([314]) https://www.sprk.gov.lv/sites/default/files/editor/Enerģētikas%20tarifi/Elektroenerģija/LemumsN090D23042014.pdf.

electricity from the offshore wind farms of Denmark and from Norway via Nordlink to the Western European electricity system. The lines will also improve grid resiliency and reliability by reducing the chances of power outages in the German system. The project has EU support making the first PCI list, but this has only partly helped the implementation of the project.

Since its introduction in 2012 the project has faced intense public opposition and criticism that has a general negative attitude toward long-range electricity transmission lines. The main aim of the project is to integrate renewables, while opposition argues that local grid development can support Germany's decarbonisation goals better. As a result, in 2015 a new regulation was introduced forcing the promoters of SuedLink to change the original plans and implement the project with underground cables. This initially delayed the targeted commissioning date from 2022 to 2025, then in 2019 further to 2026.

To increase public acceptance several consultations and information campaigns were organised in association with SuedLink. Its standing as a PCI helped with the organisation of these events, with more than EUR 40 million of funding for the completion of Federal Sectoral Planning documents, including organisation of workshops and consultations. As a result, promoters were able to organise several events to increase transparency and help public acceptance. Nonetheless, several protests were organised against the project with the latest in 2019.

Based on the accumulated delay one can argue that TEN-E Regulation in general is not able to accelerate the implementation of SuedLink. The very strict permit granting procedure in Germany is the same for PCI and non-PCI projects, meaning PCI benefits are essentially the funding and some awareness raising for the importance of the project.

Introduction

Decarbonization is a top priority of the EU with the mass deployment of new renewable energy capacities as key means to this end. The integration of these intermittent power sources into the electricity network carries significant challenges, which is why TEN-E Regulation targets electricity transmission projects that support their integration into the European Power Grid. The challenge in Germany is even more pronounced due to the electricity production profile across its regions and the physical bottlenecks hindering efficient operation. Therefore, there are several domestic German projects included in the latest PCI([315]) and one among them is SuedLink.

Description of the project

The project consists of two HVDC underground cables with a capacity of 2 GW each connecting North and South Germany. The length of the cables is approximately 700 and 550 km with an expected commissioning date of 2026. As Germany is moving towards a more decentralised power system, the role of conventional power plants is declining. The aim of the SuedLink project is to link the surplus wind energy from northern regions (Schleswig-Holstein and Lower Saxony) to the southern region (Bavaria and Baden-Wuerttemberg) where conventional power plants (especially nuclear) dominate the energy production landscape. These southern regions face long term supply problems with planned retirement of nuclear power in 2022 and coal in 2038. On top of that the southern region is the heart of German industry and thus a major electricity demand centre.

Although Suedlink is an internal German line, it also has a cross border impact, as it will transport renewable electricity originating from Danish offshore wind farms and energy from Norway via NordLink. Based on the latest ENTSO-E TYNDP([316]), the completion of the Suedlink project is associated with a symmetric cross border impact of 1800 MW between Germany/Denmark and Norway. The line will also help to better integrate renewables into the power grid and reduce the probability of line overloads in Germany. In order to minimise transmission losses in long-distance electricity transport the cable is planned as a DC line, which under the 2015 legal decision must be an underground cable.

([315]) ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest – 2019. Retrieved from:https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

([316]) https://tyndp.entsoe.eu/tyndp2018/projects/projects/235.

Sector: Electricity
Name of case study: SuedLink - German internal underground HVDC cables, between Brunsbüttel - Großgartach and Wilster - Grafenrheinfeld
PCI Code: 2.10
Project promoters: Tennet Germany & Transnet BW (two TSOs of Germany)
Regional group: NSI West
Project status: In route selecting process, FID was made in 2018
Hosting countries: Germany

Source: 4th PCI fiche, 2.10.

	Date of first initiation (German National Network Development Plan (NNDP) 2012)([317])	3rd PCI list([318])	ENTSO-E TYNDP 2018([319])	Latest German NNDP (2019)([320])	4th PCI list([321])
Expected date of commissioning	2022	2025	2025	2026	2026
Planned capacity	N/A	4 GW	4 GW	4 GW	4 GW
Planned route	529 km + 442 km	700 km + 550 km	700 km + N/A	702 km + 558 km	700 km + 550 km
Type of lines	HVDC OHL (Partly underground)	HVDC underground	HVDC underground	HVDC underground	HVDC underground
Estimated investment cost (million EUR)	N/A	N/A	6500	N/A	6500

Permit granting (& implementation status)([322])

The project was first introduced in Germany's 2012 Network Development plan requesting approval to start the route selection process by the NRA in March, which was granted in November 2015([323]). The feasibility study began in November 2012 and was completed June 2018. Originally, SuedLink was planned as an overhead line but in response to the 2015 regulation plans were updated in 2016 with underground cables([324]). After the completion of the feasibility study a final investment decision was made in 2018. The project was already included in the 1st PCI list in 2013 and since then has been part of all subsequent PCI lists.

Currently the project is in the route selecting process, before the permitting phase. The preparation of the FEED study started in June 2017 and is expected to be completed in 2022. The first part of the route selection process is under the Federal Sectoral Planning, which started in 2017. It aims to find a 1000 m wide corridor, in which the two lines will be located. The project promotors submitted a final document for federal planning in early 2019 with a proposed route and alternatives. The Federal Network Agency already made a binding decision about the corridor for some sections in early 2020, but not for the entire project, so the first phase of federal planning is not yet concluded([325]). In the second part of the planning process the exact location of the lines will be determined within the predefined 1000 m wide corridor. In parallel, the permit granting procedure should commence in 2020 with an expected completion in 2023. The construction of the lines is scheduled between 2023 and 2026 based on the latest German NDP and 4th PCI technical data.

Interviewed stakeholders all agreed that the TEN-E Regulation cannot speed up the permit granting procedure in Germany. It was argued by some stakeholders, that the deadlines of the TEN-E

([317]) https://data.netzausbau.de/2022/NEP/NEP2022_Bestaetigung.pdf.
([318]) European Commission (2018), Technical information on Projects of Common Interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/technical_document_3rd_list_with_subheadings.pdf.
([319]) https://tyndp.entsoe.eu/tyndp2018/projects/projects/235.
([320]) https://data.netzausbau.de/2030-2019/NEP/NEP2019-2030_Bestaetigung.pdf.
([321]) European Commission (2020a), Technical information on Projects of Common Interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/technical_document_4th_pci_list.pdf.
([322]) European Commission (2020k), Project of Common Interest 2.10 PCI Implementation Plan. Retrieved from: https://ec.europa.eu/energy/maps/pci_fiches/PciImplementationPlan_2.10.pdf.
([323]) https://data.netzausbau.de/2022/NEP/NEP2022_Bestaetigung.pdf.
([324]) https://www.tscnet.eu/SuedLink-and-suedostlink-go-underground/.
([325]) https://www.transnetbw.de/de/netzentwicklung/projekte/SuedLink/projektueberblick-SuedLink.

Regulation are too strict relative to German processes. This regulatory system applies for all new electricity transmission lines, irrespective of its PCI status in the country.

On the other hand, the TEN-E one stop shop provision was beneficial to some degree. One stakeholder believes it helps the implementation enormously, while another was less outspoken saying that it does not accelerate the permit granting procedure significantly. Some stakeholders also made the point that in the German system there is no difference between PCI projects and other important electricity lines. Those projects that are part of the NNDPs (both PCI and non-PCIs) have to be constructed by law through the same legal procedure. These rules and procedures apply for SuedLink as well.

Public participation

As part of the 4th PCI in 2019 the project received no feedback according to the related consultation summary([326]).

Also, a consultation was organised for stakeholders around the German Network Development Plan([327]). According to this summary, critics openly questioned the very rationale for the project itself, asserting that the expansion of DC network in Germany is oversized and the Federal Network Agency did not provide sufficient explanation as to why SuedLink is necessary. Some participants also alluded to high network losses associated with long distance transmission arguing that small local extensions would be more beneficial.

Furthermore, some said that the new lines would not only transport wind energy as they would be located near the largest coal power plant of Europe with has an expected decommission date of 2038. At a more technical level, critics of the project found that redispatch costs were not considered adequately and found the assumed utilisation rate of the line too high. As a final point, participants praised the decision for SuedLink to be completed as an underground cable.

The Federal Network Agency offered a written response to critics, arguing that modelling results proved the necessity of the project for significantly reducing overloads, adding that network losses would be minimized with the two HVDC lines relative to the AC lines. According to the modelling, the project proves its value even in the scenario where coal is phased out.

Additionally, SuedLink is one of the Bestgrid's pilot projects([328]). The aim of the Bestgrid initiative is to create a space for public participation and transparent decision making in relation to European transmission line projects through multiple consultations. With strong local opposition, several public consultations were organised by the project promoters. The first consultations were held between March and June 2014, at 22 communal info-marts in 5 federal states, with approximately 300 visitors per event([329]). This was followed by the second round of consultation in October and November building on the initial feedback([330]). In 2016 a new round was initiated taking into consideration updated plans for underground cables. On top of the info markets, an online consultation platform was initiated by the project promoters garnering feedback from more than 9000 concerned citizens. The latest public consultation was held in the summer of 2019 allowing public authorities and citizens to submit their comments and objections to the Federal Network Agency about route selection.([331])

The SuedLink project still faces very strong opposition by locals. In recent years, several protests against the project were held. During the last major one in April 2019 over 2000 people protested against the lines([332]). The protesters wanted to stop the implementation of the project on environmental, healthcare, and agricultural grounds. Additionally, many found the project too

[326] European Commission (2019e), Targeted consultation on candidate Projects of Common Interest (PCIs) in electricity infrastructure PCI process 2018-2019 – summary. Retrieved from: https://ec.europa.eu/info/sites/info/files/energy_climate_change_environment/electricity_candidate_pcis_consultation_summary.pdf.

[327] https://data.netzausbau.de/2030-2019/NEP/NEP2019-2030_Bestaetigung.pdf.

[328] http://www.bestgrid.eu/pilot-projects/project-c-SuedLink.html.

[329] http://www.bestgrid.eu/pilot-projects/project-c-SuedLink/community-dialogue-for-SuedLink-22-local-info-marts-in-5-german-federal-states.html.

[330] http://www.bestgrid.eu/pilot-projects/project-c-SuedLink/tennet-continues-public-dialogue.html.

[331] https://www.tennet.eu/de/unser-netz/onshore-projekte-deutschland/SuedLink/ueber-SuedLink/projektportrait-und-verfahren/.

[332] https://www.dw.com/en/germany-protesters-oppose-SuedLink-wind-energy-cable/a-48437451.

expensive. The opposition formed a citizens' initiative called "The Federal Association of Citizens' Initiatives Against SuedLink". According to their webpage they support an energy system with decentralised power generation, where electricity is consumed close to its generation([333]). On top of general public opposition, some federal states including Hessen, Bavaria and Thuringia heavily opposed the completion of the project.

There is a general agreement between stakeholders that public consultations are necessary because these forums provide a great opportunity for the public to gain information about the proposed project. The consultations in association with SuedLink were very extensive. On the other hand, there was no shared consensus between the opinions with regards to the effectiveness of the public consultations, and the contribution of PCI status itself toward the acceptance of the project. One stakeholder argued that bringing the cable underground was a good compromise, which made the project more publicly acceptable, but noted opposition towards the project remained strong. Another stakeholder agreed that the PCI label itself helps a lot in the early stages of project implementation, making it the highest possible priority. It was also noted that the PCI label itself helps to raise public awareness. On the other hand, several stakeholders do not think that the PCI label makes a positive contribution towards public acceptance because many citizens are not aware or familiar with PCIs. For this reason, one stakeholder suggested the announcement of the new PCI list could be taken in a way that is more accessible and interesting to the general public, so they would receive more information about the concept of PCI and the selected projects therein.

Regulatory incentives

In 2015 a regulation based on a law of the Bundesrat insisted that DC lines should be generally converted to underground cables. This resulted in strong local opposition against OHL transmission projects. An underground cable can reduce the environmental harm and civil resistance against a given project even though it is significantly more expensive. According to the legal requirements, the project will be located underground. This regulation is not directly linked to the TEN-E; however, it must be emphasized as having a very important effect on the final plans of the project.

The project received no legal exemptions. The official position of the Federal Network Agency is not to give regulatory incentives, which are defined in the TEN-E Regulation. One of the project promoters also argued that approval and refinancing of network expansion projects such as SuedLink are adequately governed by the German regulatory framework and have been implemented in close cooperation with the regulatory authority for several years, which diminishes the importance of the potential exemptions. Therefore, the effectiveness of these regulatory incentives is not possible to evaluate, as they are not applicable to SuedLink.

Administrative burdens

According to the project promoters, the PCI application every two years carries some administrative burden. A stakeholder suggested that a simplified application process should be introduced to reappearing projects in a more mature state. The regular update of the TYNDP project work was also highlighted as a source of administrative burden, with the regular update of project information due to the CEF funding and ACER Annual Monitoring also requiring resources. In relation with ACER's annual monitoring, one stakeholder highlighted that in accordance with the current German regulation, the Federal Network Agency monitors the implementation of the projects 4 times a year, so a parallel yearly monitoring by ACER brings less benefit. It was also argued that the timing of ACER monitoring is not ideal, as in those years, when a new PCI list is published, there is no sufficient time between the announcement of the list and the monitoring for the project to significantly develop, so it would be beneficial to change the timing of the monitoring.

CBA: Benefits and costs of the projects([334])

The latest CBA values in accordance with the project can be found in the ENTSO-E TYNDP 2018 project description. Based on the CBA, the socioeconomic welfare of the project is between EUR 548 and 752 million a year in 2030 depending on the scenario, out of which EUR 286-468 million is associated with fuel savings due to integration of renewables, and EUR 87-254 million with avoided carbon-dioxide emission costs. As a result of the project, it is expected that carbon-dioxide

(333) http://bundesverband-gegen-SuedLink.de/ueber-uns/.
(334) https://tyndp.entsoe.eu/tyndp2018/projects/projects/235.

emissions will decrease by 1.5-3 million tonnes/year. Also, the project is expected to decrease grid losses by 665-802 GWh/year, which means a saving of approximately EUR 35-53 million a year. Additionally, it will increase the adequacy margin by 7-7.75 TWh.

The total estimated investment cost of the project is EUR 6.5 billion, with an uncertainty range of 20%, while the planned yearly operation cost for the two lines are EUR 52 million per year. We received no information about the benefit to cost ratio, or the net present value of the project, which would aggregate the presented costs and benefits, into one indicator.

The Federal Network Agency also carried out an assessment of the project, which is presented in the German Network Development Plan([335]). Based on this analysis, the project is proven to be effective in all scenarios as it will significantly reduce overload rates on other important highly utilised lines. The average utilisation rate of 75% across all scenarios for Brunsbüttel – Großgartach and 70% for Wilster – Grafenrheinfeld line showed that the project is also necessary.

The project's main aims are to integrate renewable energy into the German grid, to strengthen the electricity system of Germany by linking the northern and southern regions and to decrease the probability of overloads. No unexpected positive or negative effects associated with the TEN-E Regulation were identified by the stakeholders.

CBCA

Not relevant as no CBCA decision is in progress for the project.

Financing of the projects

As presented above, based on ENTSO-E TYNDP 2018, the total estimated investment cost of the project is EUR 6.5 billion, with an uncertainty range of 20%, while the planned yearly operation cost for the two lines are EUR 52 million per year([336]). The investment cost of the project may reach EUR 10 billion however, according to some estimates([337]). Before changing the plans to an underground cable, the announced cost of the project was EUR 4 billion([338]).

The project received CEF funding for the completion of the study required for the federal planning process, which narrows down the location of the lines to a 1000 m wide corridor([339]). The funding was received in 2016 and covers maximum 50% of the costs, associated with the completion of the study, including organisation of public consultations and distribution of information materials for citizens and stakeholders related to the project. The maximum possible funding accounts for EUR 40.25 million. The study was completed and submitted by the project promoters in early 2019, but as mentioned above a final decision has not yet been made about the full binding corridor by the Federal Network Agency.

Lessons learned for the future

In our view the case study highlights an important aspect of the TEN-E Regulation where further thinking might be necessary. One of the most important aims of the Regulation is to support the European green transition, which is why transmission projects aiming to integrate renewable energy into the European grid, such as SuedLink, are eligible for PCI status. On the other hand, we identified that in some countries, in this case Germany, there is a general public distrust towards large scale power sector projects, and many actors do not believe in the necessity of building long-range power transmission cables.

The SuedLink project is criticised on the basis that the development of the local power grid would be cheaper and more beneficial for the energy system. Because of the strong opposition, many

(335) https://data.netzausbau.de/2030-2019/NEP/NEP2019-2030_Bestaetigung.pdf.
(336) https://tyndp.entsoe.eu/tyndp2018/projects/projects/235.
(337) https://www.ndr.de/nachrichten/niedersachsen/lueneburg_heide_unterelbe/SuedLink-Korridor-fuer-ersten-Bauabschnitt-steht,SuedLink282.html.
(338) https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/092816-german-suedlink-grid-project-delayed-to-2025-as-cables-go-underground.
(339) https://ec.europa.eu/inea/en/connecting-europe-facility/cef-energy/2.10-0017-DE-S-M-16.

personal and online consultations were organised. These discussions with the public however, were only partly successful, as opposition towards the project remain present.

Based on these dynamics, two important conclusions can be drawn. First, that it is possible that public acceptance would be higher – at least in Germany – towards smaller projects. Interviews and targeted survey answers with German stakeholders underpin that they would welcome if the PCI selection process would provide more emphasis on projects which aim to reinforce local grids and decentralised power generation. Secondly, the PCI label as a brand is currently not strong enough to act as a game changer in public debates; the non-energy sector stakeholder does not have in-depth insight about PCIs and does not consider PCI status as a quality guarantee label. Therefore, it would be beneficial to raise awareness of a wider audience about the PCI framework and the exact projects.

An additional important element to highlight based on the findings of this case study is that the harmonisation of the TEN-E Regulation with national regulations is a very important challenge. The stakeholders of the SuedLink project argue, that the Regulation does not accelerate the permit granting process. They also argue that in some cases it is impossible to keep the deadlines of the Regulation because of national regulatory requirements. There are certainly important elements which do help the implementation process, such as the one stop shop. However, these beneficiary elements do not result in earlier commissions. In case of the SuedLink project, which is currently in the route selection process, at the time of the project initiation the expected commissioning date was 2022. Based on later regulatory changes the project commissioning date was pushed to 2025, and after accumulating further delays, to 2026. The case study also raises an important question about regulatory incentives in a developed regulatory system such as Germany, as in advanced system these incentives may be less important tools to enhance development.

The issue of administrative burdens was highlighted by several stakeholders. In on our view it is difficult to assess to what extent these burdens can be considered to be serious obstacles that the Regulation needs to overcome. We received no detailed information about the magnitude of administrative costs, relative to the total project expenses.

Finally, one positive element to highlight is the financial assistance delivered by the PCI status. The project received CEF funding of EUR 40.25 million in order to complete the necessary documentation for the Federal Planning, including the associated public consultation, and information materials. As we highlighted, the effectiveness of these consultations is difficult to measure, but surely, they increased the general awareness about the project, and provided room for information exchanges between the public, project promoters, and the regulatory authority.

Case study – Trans Adriatic Pipeline (TAP)

Main messages of the case study

The European Commission, Parliament and Council granted TAP the PCI status under the new guidelines for TEN-E, which has been on every list since 2013. It is recognized as key to the Southern Gas Corridor, one of 12 so-called energy corridors identified by the EU as priorities for the single market. With a project of such magnitude, it took a long time to commission it in 2020 although FID has been taken by 2012.

Regulatory cooperation between the three host countries (Greece, Albania and Italy) has improved the level of wider regional cooperation to provide harmonized treatment across borders in the Pan-European internal market([340]). Consistent EU support by assigning TAP the PCI label in all four previous lists was essential for the project implementation. This gave an additional high-level EU political support that supplemented bilateral intergovernmental agreements signed with all host countries. The PCI status also helped to secure EIB and EBRD funding for the project, the main regulatory incentives - a 25 year exemption from ownership unbundling, third party access and regulated tariffs. The first 10 bcm/a of 20 bcm/a of TAP capacity is exempted from third party access (TPA) with the rest offered to the market through regular market tests. The TPA exemption was crucial for the long-term ship or pay contracts signed by the owners of the Shah Deniz consortium, some of whom are also shareholders in the TAP project, which guarantees the bankability of the project. CEF grants were only used for studies and not project works.

Under conditions of the exemption decision, TAP includes exit points in Albania and in Greece to help these countries diversify and develop domestic gas markets. Now is the time for host and connecting countries like Montenegro, Croatia, Northern Macedonia, Bulgaria to take advantage of the opportunity of natural gas being available and connect their national systems with projects supported by CESEC and PECIs of the Energy Community.

There was some opposition to the Environmental Impact Assessment in Italy during public consultations. Traditional opponents with different agendas united under the territorial movement called "NO TAP" in 2016. Environmental concerns were cited but this was part of a larger movement to empower local governments to stand their ground with federal or supranational authorities. The substantial efforts of the company provided additional means of public participation and involvement, however, the negative attitude towards the project remained, even though the opposition significantly decreased over time. Environmentalist protests, delays in the permitting process and fulfilment of additional environmental criteria at the landfall section in Italy caused some additional works and related costs.

Public consultations held by the TAP company – in total more than 1700 public and 13000 individual meetings were conducted – were key to the final successful implementation of the project and can be an example for similar projects in the future. The PCI consultation organized by the Commission for each PCI list should be channelled into the public consultation framework of the Promoter or responded to directly.

PCI status helped to streamline permit granting and secure financing for a project. Based on TAP experiences, Member States should implement a one stop shop or single authority.

In the view of the promoter the benefits outweigh the administrative burden related to PCI status.

Introduction

([340]) Joint Opinion of the Energy Regulators on TAP AG's Exemption Application (Autorità per l'energia elettrica,e il gas (hereinafter "AEEG", now ARERA, from Italy), Enti Regullator i Energjise (hereinafter 'ERE', from Albania), Ρυθμιστική Αρχή Ενέργειας" -THIS IS THE GREEK TRANSLITERATION OF ERE, NOT JOINT OPINION (hereinafter 'Joint Opinion'), dated 28 February 2013, COMMISSION DECISION of 16.5.2013 on the exemption of the Trans Adriatic Pipeline from the requirements on third party access, tariff regulation and ownership unbundling laid down in Articles 9, 32, 41(6), 41(8) and 41(10) of Directive 2009/73/EC.

The EU gas market is increasingly dependent on imported gas as domestic production declines. The Member States that joined the EU after 2004 and the Balkan countries are especially vulnerable to the dominance of a single supplier. TEN-E regulation aimed to end energy isolation in the EU and its periphery through source and route diversification.

For a long time, the EU has been aiming to connect its market to the natural gas resources of the Caspian basin and the Middle East through what is referred to as the Southern Gas Corridor. TAP is connected to two upstream pipelines - TANAP (Trans Anatolian Pipeline) and SCP (Southern Caucasus Pipeline) - bringing the giant Shah Deniz field in Azerbaijani to the EU market. The entire corridor is about 3500 km long, and building it was worth of an investment of approximately USD 40 billion([341]), out of which is EUR 4.5 billion is the investment into the TAP pipeline. TAP crosses the territories of two EU Member States (Greece and Italy), and an Energy Community Contracting Party (Albania).

Previous incarnations like Nabucco have failed while new project proposals emerged with new discoveries in the Mediterranean like EastMed Pipeline. The TAP project was successful because there was a strong regulatory setup to secure the gas source and the financing.

TAP aims to play a key role in providing the EU with secure, reliable and affordable energy, whilst strengthening Europe's energy security and respecting the environment and communities along the pipeline's route. Furthermore, TAP aims to help to decarbonise South East Europe and the Western Balkans by switching from coal and lignite in power generation. With energy demand expected to recover after the COVID-19 crisis, natural gas will help replace fuels such as coal, lignite and wood that are commonly used in the region for electricity and heat.

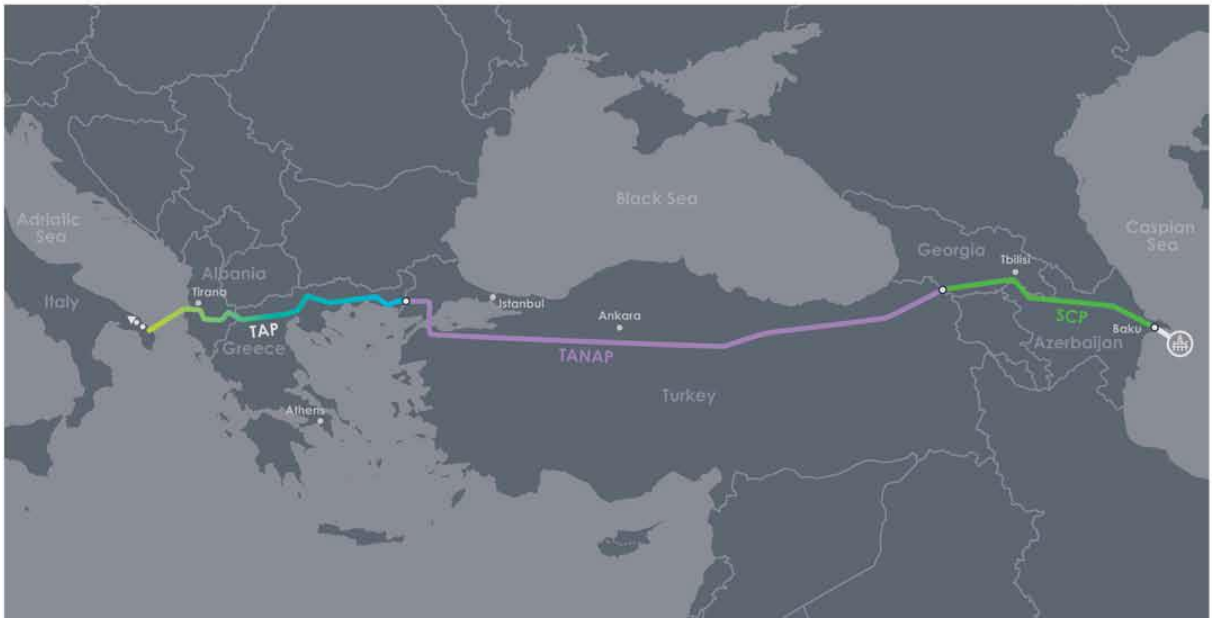
Description of the project

Trans Adriatic Pipeline is a new onshore and offshore natural gas pipeline between Greece, Albania and Italy with a total length of approximately 878 km (773 km onshore and 105 km offshore). Connecting with TANAP at the Greek-Turkish border, TAP will cross Northern Greece, Albania and the Adriatic Sea before reaching Southern Italy, where it connects to the Italian gas transmission network. The project is in the commissioning phase: testing started in November 2019. At the end of June 2020, more than 96% of the construction has been completed([342]). The project is 10 bcm/a capacity with possible 20 bcm/a in case of sufficient demand.

([341]) https://www.tap-ag.com/the-pipeline/the-big-picture/southern-gas-corridor.

([342]) Clara Risso: Permitting, Monitoring and Involvement of Stakeholders: The TAP Pipeline project Presentation on June 11, 2020, **#**4 Stakeholder Webinar on the revision of Regulation (EU) 347/2013 on the guidelines for trans-European energy infrastructure PCI Implementation.

Map:



Source of map: Tap-ag.com.

Sector: **GAS**
Name of case study: **Trans-Adriatic Pipeline -TAP**
PCI Code: **[7.1.3]**
Project promoters: **DESFA S.A. (EL); Trans Adriatic Pipeline A.G. (TAP Pipeline) (AL, GR, IT)**
Regional Group: **[Southern Gas Corridor: SGC]**
Project status: **[Under construction]**
Hosting countries**: [Greece, Albania, Italy]**

	Date of first initiation	1st PCI list (2013)	2nd PCI list (2015)	3rd PCI list (2017)	4th PCI list (2019)
Expected date of commissioning	Pre-feasibility launched in 2003	2015	2019	2020	2020 the main pipeline to Italy 02/2024 (Greek transmission to TAP)
Planned capacity		10bcm/yr (+ 10 bcm/yr)	10bcm/yr (+ 10 bcm/yr)	10bcm/yr (+ 10 bcm/yr)	10bcm/yr (+ 10 bcm/yr)
Planned route	Turkey-Greece border to Italy via Greece, Albania and offshore section to Italy.	Same	Same	Same	Same
Ownership structure	TAP AG is a consortium established by the Norwegian company Statoil ASA (42,5%), the Swiss company Axpo AG (42,5%) and	In August 2012, consortium partners BP, SOCAR and Total S.A. signed a funding agreement with TAP's shareholders, including an option to take		Snam 20% (acquired Statoil's share), BP 20%, SOCAR 20%, Fluxys 19%, Enagas 16%, Axpo 5%	

	Date of first initiation	1st PCI list (2013)	2nd PCI list (2015)	3rd PCI list (2017)	4th PCI list (2019)
	in 2015 joined by the German company E.On Ruhrgas AG, (15%).	up to 50% equity in the project.			

The project started with a pre-feasibility study launched in 2003 investigating the technical and financial feasibility of a pipeline that would connect the EU to new sources in the Caspian basin or the Middle East, thereby contributing to security of supply and competition in the Balkans and the EU. The landfall section in Italy was selected following the assessment of 11 alternatives along the Apulian shore between Brindisi and Otranto. TAP implemented a wide range of mitigation measures, as well as a tunnelling construction methodology that avoided all physical disturbance to the beach and seasonal work restrictions to address stakeholder and environmental concerns. The final investment decision was taken in December 2013 following the Shah Deniz consortium's decision to choose TAP as the route to be used to connect TANAP with the EU markets. TAP shareholders (Statoil, Axpo and E.ON) and Shah Deniz partners (SOCAR, BP and Total) agreed on the governance. The current ownership structure is the following: BP (20%), SOCAR (20%), Snam (20%), Fluxys (19%), Enagás (16%) and Axpo (5%).

As part of a larger upstream investment (Shah Deniz field Phase 2 in Azerbaijan and the connecting pipelines, SCP and TANAP) in Azerbaijan, Georgia and Turkey, TAP depends on the development of those projects. This was part of the reason for the delay from the original commissioning date from 2015 to 2019 and commercial operations in 2020. After the Energy Community included TAP among its PECIs in 2013 the project has not applied in subsequent years for PECI status. It has been named as an important enabler of many of the PECI projects. TAP is also a top priority project for the Central Eastern and South-Eastern European Gas Connectivity (CESEC).

Permit granting

Intergovernmental agreements (IGAs) played a crucial role in the implementation process to secure the political and administrative support necessary for projects of such scale. The IGAs were signed in February 2013 between Albania, Greece and Italy, and Albania was the first to grant environmental permits by April. The Host Government Agreements were ratified the same year in Albania and Greece. The project promoter acknowledged the PCI status helped streamline the administrative process.

In Greece, the legal framework is well-adapted to EU norms but TAP was a uniquely challenging project to implement at regional and local levels. It received considerable assistance from the Ministry of Development and Ministry of Energy as one-stop-shop authorities for all permitting procedures.

In Albania, the legal framework for construction and operation of large-scale projects like pipelines was not in line with EU standards (Law on Natural Gas Sector was approved in 2015; technical regulations are still being drafted and approved). Several permitting authorities were involved and despite no experience in gas markets, Albania delivered fewer permitting interfaces.

The Italian legal framework is harmonized with the EU. The Ministry of Economic Development is the competent Authority for PCI projects and issues authorizing the Single Authorisation (SA) permit to build and operate energy infrastructure.

As a PCI, the TAP pipeline received support from the Ministry of Economic Development throughout all phases of the project.

Public participation

TAP consulted with stakeholders from the earliest phases of the project following the framework developed from experiences and lessons learned by the World Bank and other international

organizations and projects([343])([344])([345]). They viewed a very extensive and transparent public consultation as fundamental to ensuring successful implementation that is a win-win solution for the promoter and all other stakeholders. Inclusive consultations were conducted in Greece, Albania and Italy to provide stakeholders with opportunities to express their views which ultimately achieved stakeholder acceptability.

TAP‘s approach has been to ensure continuous engagement with stakeholders tailored to each stage of the Project. Stakeholder engagement is considered as a cross-cutting theme through all project activities and disciplines and a variety of engagement methodologies have been employed:

- Over 1,710 public meetings were held on the Environmental and Social Impact Assessment;
- During the construction phase, specific one-on-one engagements were undertaken with each project affected household before works, during construction, and on reinstatement and hand-back of land parcels. There have been an estimated 130,000 individual meetings across three countries to date;
- In addition, TAP`s outreach engagement, independent of a specific Project activity, continues to respond to stakeholders’ concerns. TAP is involved with thematic campaigns and consultation processes, including perception surveys and introductory meetings to build shared understanding amongst stakeholders on specific topics.

Comprehensive Environmental and Social Impact Assessments have been undertaken by TAP in each project host country and thus approved by the competent authorities. They detail potential environmental, cultural and socio-economic impacts associated with the pipeline both during and after the construction and operations.

TAP has developed a grievance procedure that allows locals to express concerns and objections to the pipeline that will be reviewed and resolved as part of its Corporate Social Responsibility policy. To address the human rights concerns raised, TAP is one of the first pipeline projects to commit to the Voluntary Principles on Security and Human Rights. Reflecting this commitment, the extensive Environmental and Social Impact Assessments (ESIAs) conducted in its three host countries included human rights issues. TAP’s Land Easement and Acquisition process ensures that all affected people are compensated fairly and transparently during the acquisition of access rights to land along the pipeline’s route and a livelihood restoration program to support Project-Affected Households and particularly those at an elevated risk of experiencing adverse livelihood impacts, to fully restore, if not improve, their production, income and livelihoods. Furthermore, in the frame of the Social and Environmental Investment projects TAP is committed to invest over EUR 55 million in the communities along its route([346]).

([343]) IFC (2006), Lessons of Experience - The Baku-Tbilisi-Ceyhan (BTC) Pipeline Project. Retrieved from: https://www.ifc.org/wps/wcm/connect/227f116b-f504-4d64-92c4-415edd461d2d/BTC_LOE_Final.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-227f116b-f504-4d64-92c4-415edd461d2d-jqeJ4q9 .

([344]) IADB (2019), Meaningful stakeholder engagement. Retrieved from: https://publications.iadb.org/publications/english/document/Meaningful_Stakeholder_Engagement_A_Joint_Publication_of_the_MFI_Working_Group_on_Environmental_and_Social_Standards_en.pdf.

([345]) World Bank (2014), Strategic framework for mainstreaming citizen engagement in World Bank Group operations: engaging with citizens for improved results. Retrieved from: http://documents.worldbank.org/curated/en/266371468124780089/Strategic-framework-for-mainstreaming-citizen-engagement-in-World-Bank-Group-operations-engaging-with-citizens-for-improved-results.

([346]) The objectives of TAP’s SEI programme are to:
- strengthens livelihoods within local communities;
- support improved community quality of life along the pipeline route;
- enables improved skills and abilities through support for education and training initiatives;
- enhances environmental management, including through support for biodiversity.

Each of the host countries have different development priorities. The themes are therefore deliberately high level in order to allow for each country to work within them whilst also responding to the country context. In Greece, priority areas include social needs, infrastructure and capacity building; in Albania, community infrastructure, agricultural livelihoods, education and training, and community safety and medical support; and, in Italy, the focus has been on livelihoods, particularly tourism, agriculture and fisheries sectors, environmental management and community services and infrastructure.

The SEI is based on principles of inclusiveness, participation, capacity strengthening, leveraging local assets and sustainability. Project funding ranges from small scale grants, through to local community initiatives and regional development partnerships.

In Greece, public consultation remains at the local level. The route in Greece, for the most part, follows the domestic pipeline system, making for a smoother permitting process without major opposition. The PCI status and the investment into local projects contributed to the public acceptance of the project. In Albania no major issues were raised.

Despite all the efforts of the TAP AG there have been protests by both local citizens and government officials against the Trans Adriatic Pipeline([347]). The "NO TAP" movement emerged from the public consultation on the environmental impact assessment, bringing together civil and environmentalist movements with very different agendas ([348]).

The following local concerns were raised against TAP throughout the protest movements:

- In Italy, TAP required construction of a gas terminal in an olive grove in the countryside near the Apulian town of Melendugno. The site presents some century-old olive trees that raised concern in the local public and was criticized by environmentalists.([349]) The relocation of the olive trees was successful and has been published in numerous videos on TAP AG's webpage([350]). The trees will be transferred back to the original place after the commercial operation will start;
- Furthermore, the pipeline's landing point on the Italian coast is located under the pristine beach of San Foca, a popular destination for beachgoers. Locals and environmentalists, supported by multiple mayors from the area and the governor of the region of Apulia, have raised safety concerns that could negatively impact the region's essential tourism and agricultural sectors.([351]) To address this concern a micro tunnel was constructed in 2019 and beachgoers can enjoy the place again as before.

The above concerns fundamentally differ from those that were received later in 2019 during public consultations on the 4th PCI list that were more geopolitical in nature and relate to the policy goals of the EU([352]):

- Opponents question the real impact of Southern Gas Corridor (SGC) on the EU's energy security goals. They do not think that SGC increases energy security and might in fact end up channelling Russian gas, adding that a 10 bcm/a capacity will only have marginal impact on the overall EU gas demand (about 500 bcm in 2019);
- The responses also highlighted that EU support for SGC is contradictory to its goals and principles on human rights, since it directly supports the Azerbaijani government;

([347]) Energy VS environment: Italians rally against TAP pipeline28.03.2017 https://www.euronews.com/2017/03/28/energy-vs-environment-italians-rally-against-tap-pipeline *Retrieved 13.04.2020.*

([348]) By today NO TAP and other networks (referred to as territorial networks in the literature[348]) "personify a general dislike against the evolution of a society in which decisions which may have an impact on collectives are not taken collectively; the rejection of macro processes that make economic values the unique model of reproduction of society; the opposition against large infrastructure projects with a geopolitical character, that symbolize the vicious relationship between economic and state power". Michele Longo: Local Conflicts and the NO-TAP Protest TAFTERJOURNAL N. 105 - MARZO - APRILE 2019 https://www.tafterjournal.it/2019/03/15/local-conflicts-and-the-no-tap-protest/ Retrieved: 15 April 2020.

([349]) Reuters (2016), Italian olive grove stands in way of European energy security. Retrieved from: https://uk.reuters.com/article/uk-italy-energy-trees-insight/italian-olive-grove-stands-in-way-of-european-energy-security-idUKKCN1240GE Accessed on 15.04.2020.

([350]) *Temporary removal of the oil trees* https://www.tap-ag.com/resource-library/media-library/videos?page=6 *Retrieved 15.04.2020:*
Taking care of the olive trees in Puglia https://www.tap-ag.com/resource-library/media-library/videos?page=6 *Retrieved 15.04.2020 ;*
The olive trees are healthy https://www.tap-ag.com/resource-library/media-library/videos?page=5 *Retrieved 15.04.2020.*

([351]) Italian mayors protest against the Trans Adriatic Pipeline https://bankwatch.org/blog/guest-post-italian-mayors-protest-against-the-trans-adriatic-pipeline.

([352]) European Commission (2019e), Targeted consultation on candidate Projects of Common Interest (PCIs) in electricity infrastructure PCI process 2018-2019 – summary. Retrieved from: https://ec.europa.eu/info/sites/info/files/energy_climate_change_environment/electricity_candidate_pcis_consultation_summary.pdf.

- Furthermore, the participants objected to the cost of the project and significant financial support coming from EU funds and public banks. Criticism was also aimed at financing fossil fuel projects that contradict climate goals;([353])
- There are also arguments for the potential risk of creating stranded assets due to the declining gas demand in the region.

Feedback from stakeholders suggest that the public consultation on the PCI list could be significantly improved with more follow up actions, beginning with project feedback channels to the Promoters allowing them to address the concerns or accusations.

Regulatory incentives

There has been an unprecedented cooperation between the regulatory authorities of the host countries, the European Commission, and the Secretariat of the Energy Community based on the EU acquis Communautaire. In 2013 regulators in the three host countries, Autorità per l'energia elettrica e il gas (Italy) – ARERA, Enti Rregullator I Energjise (Albania) - ERE and Rujmistik Arq Enèrgeiac (Greece) - RAE issued a Joint opinion([354]) on the exemption request of the TAP AG that formed part of the individual exemption decisions([355]) of the authorities.

The Italian and the Greek decisions were forming the basis for the European Commission's Decision [C(2013)2949 final] on the exemption, dated 16th of May 2013([356]). The Albanian exemption decision was approved by the Opinion 1/2013 of the Energy Community Secretariat dated 14th of May 2013([357]).

According to Article 36, exemptions for major new infrastructure constitute an exception to the general rules on regulated third party access and unbundling in Directive 2009/73/EC. Therefore, they must be duly justified and limited in scope and duration to what is strictly necessary for project implementation. Albania has no gas market in place and regulatory rules are being designed based on the EU Energy law as a signatory party to the Energy Community Treaty. The Opinion of the Energy Community Secretariat highlighted the importance of the TAP project for enabling many other planned infrastructure throughout the Energy Community. The IAP([358]) pipeline and the Gas Ring([359]) both aim to connect the region to a Southern Gas hub and EU gas markets. To provide support for the implementation of the project and market development in Albania the wider region, regulators granted long term exemptions while applying conditions that would help reduce any related market distortions.

For the initial 10 bcm/a capacity over 25 years, exemptions were granted form third party access, regulated tariffs and ownership unbundling.

Conditions	How the conditions were met?

([353]) Adam Vaughan: EIB accused of marring EU climate goals with EUR 1.5 billion gas pipeline loan in The Guardian 10 Dec 2017 https://www.theguardian.com/business/2017/dec/10/eib-accused-eu-climate-goals-gas-pipeline-loan-european-investment-bank-summit-paris Retrieved: 4 April 2020.

([354]) Joint Opinion of the Energy Regulators on TAP AG's Exemption Application (https://www.autorita.energia.it/allegati/docs/13/249-13all.pdf).

([355]) AEEG Deliberation 249/2013/R/GAS of the 6th of June 2013; RAE Decision n. 269/2013 of 12th of June 2013; ERE Decision n. 64/13.06.2013.

([356]) Commission Decision of 16.5.2013 on the exemption of the Trans Adriatic Pipeline from the requirements on third party access, tariff regulation and ownership unbundling laid down in Articles 9, 32, 41(6), 41(8) and 41(10) of Directive 2009/73/EC (https://ec.europa.eu/energy/sites/ener/files/documents/2013_tap_decision_en.pdf).

([357]) Opinion 1/2013 of the Energy Community Secretariat dated 14th of May 2013 (https://energy-community.org/dam/jcr:f0dcb857-747f-432e-a155-5c6b177e5048/Opinion_01_2013_ECS_exemption.pdf).

([358]) The IAP project is planned to connect the existing Croatian gas transmission system, via Montenegro and Albania, with the TAP gas pipeline system (Trans Adriatic Pipeline). An exit to Bosnia and Herzegovina is planned. Plinacro (Croatian gas TSO) is the project promoter and the project is submitted for the TYNDP under the code: TRA-N-68.

([359]) Gas Ring is a concept was first proposed in the South East Europe Regional Gasification Study, 2009. The idea was to gasify the Balkans based on existing projects and via smaller interconnectors, and at the same time to secure anchor load in the countries by building gas fired power plans in parallel to transmission infrastructure. Certain projects that were part of the concept are still proposed projects on the Balkan, mainly by Serbia (e.g. Serbia-Montenegro, Serbia North Macedonia).

TAP is obliged to ensure that at least 5 bcm/y capacity is provided for physical reverse flow for emergency situations in accordance with the SOS Regulation and must provide at least 5 bcm/y for virtual reverse flow for commercial operations.	This condition is met by the capacities of the pipeline. See network Code Appendix 1-2.([360])
Additional capacity expansion (another 10 bcm/yr) will be offered to the market at least every second year via Market Tests (not exempt from TPA).	TAP will offer this Expansion Capacity to the market by means of Market Tests conducted on a bi-annual basis available to all interested parties.
At least 5% of the capacity offered will be allocated to short-term transportation contracts (not more than one year).	This will happen once TAP starts auctioning capacity on PRISMA. The market will be informed at least 2 months before start of auctions with enough time for registration and fulfilling the necessary requirements.
At least one exit point is foreseen in Albania with a minimum capacity of 2 mcm/day (0.73 bcm/yr), bidirectional and expandable to a maximum of 10 mcm/day as soon as TAP itself starts operating.	Condition has been fulfilled by TAP AG further gas infrastructure investment is necessary in Albania create the system.
Functional unbundling guaranteed by TAP AG.	TAP is Certified as an ITO by the NRAs through Final Certification Decisions issued in 2016.
The pipeline has to be operational by 1 January 2019.	According to the Commission's Prolongation Decision, the pipeline should be in operation by 31 Dec 2020([361]).

Administrative burdens

TAP AG has offices in Switzerland and each host country. Currently TAP employs approximately 200 oil and gas specialists. It is difficult to assess the direct costs related to the PCI status of the project as application and submitting data for monitoring it is part of the work of some employees. Although direct costs (expert time and traveling costs to meetings) related to the PCI projects might be negligible compared to the total cost of the project, expert efforts were substantial.

Providing monitoring data ACER (as part of being upfront and frank on project developments towards stakeholders) is considered business as usual by the company.

Among benefits of the PCI selection it was mentioned that the PCI and the TYNDP process as such provided important information and contributed to international cooperation on expert level, therefore was considered as highly useful. The benefits related to PCI label especially in the permit granting and in the public acceptance are difficult to monetize. All in all, TAP benefited from the PCI status, and it is estimated that the benefits of the PCI status were greater than the costs.

CBA: Benefits and costs of the projects

The ENTSOG cost benefit analysis([362]) is not available for TAP alone but the entire Southern Gas Corridor (SCG_1a) including TCP, South Caucasus Pipeline extension (SCP-X) and TANAP, TAP and projects enabling TAP connection to the Greek system - altogether an investment of EUR

([360]) TAP Network Code, 10 August 2020.
([361]) https://ec.europa.eu/energy/sites/ener/files/documents/2015_tap_prolongation_decision_en.pdf.
([362]) ENTSOG (2018c), Ten-Year Network Development Plan – Project-Specific-Cost-Benefit-Analysis, p. 454-468. Retrieved from: https://www.entsog.eu/sites/default/files/2019-04/TYNDP%202018%20Project-Specific%20CBA%20Results.pdf.

15 billion([363]). The TYNDP states that the project contributes to competition by reducing dependence on Russian gas and LNG for Southeast Europe. Under certain infrastructure scenarios, the positive economic benefits of the additional new source can reach even Germany and the Benelux states. The main beneficiaries are Italy and Greece but also CEE in the form of security of supply. ENTSOG attributed most of the benefits in the form of lower gas prices due to increased competition, valued at around EUR 500 million/yr (with more competition between sources, it might be up to maximum EUR 1500 million/yr), The monetised security of supply benefits vary between EUR 1-37 million/year. The monetised benefits of CO_2 savings range between EUR 9-29 million/yr. Benefits that are related to fuel switch from oil to gas are between EUR 7-13 million/yr in different scenarios. For the PCI ranking, the Distributed generation low infrastructure scenario was supposed to be used (column 1 in the following table), therefore we estimate a B/C ratio based on these published numbers. The monetised benefits of the project are EUR 515.3 million/year in the reference scenario, with SOS benefits of EUR 10.4 million/year for the Peak day flexibility and EUR 3.4 million/day for the 2 weeks disruption scenario. Additional benefits form CO savings is EUR 17.4 million/year([364]) and from fuel switching EUR 0.3 million/year.

	SCENARIO	DISTRIBUTED GENERATION	SUSTAINABLE TRANSITION	GLOBAL CLIMATE	DISTRIBUTED GENERATION	SUSTAINABLE TRANSITION	GLOBAL CLIMATE
	Infrastructure level	Low	Low	Low	Advanced	Advanced	Advanced
Project benefits (Meur)	EU Bill Benefits (MEUR/y)						
	Reference	515.3	689.0	574.5	529.8	737.5	611.9
	Supply Maximization	1,029.5	1,210.6	1,077.7	1,217.7	1,463.2	1,306.3
	Mitigation in Disrupted Demand (MEUR/y)						
	Peak Day	10.4	13.1	11.9	1.8	3.0	2.6
	2 Weeks	3.4	37.4	37.1	1.3	5.7	5.5
	Fuel & CO_2 Savings (MEUR/y)						
	CO_2 Savings	17.4	26.5	29.0	9.4	15.2	15.8
	Fuel Switch savings	9.3	12.8	12.9	9.3	8.2	6.9

of

oup

is approximately 1.9([365]).

Both the Joint Opinion of the three regulators in 2013 and the ECS Opinion 1/2013 agree that TAP will enhance competition in the region and contribute to increased security of gas supply. By passing through Albania to Italy and receiving commercial reverse flows from Italy, it is an opportunity to develop a gas market in Albania and beyond. "TAP (together with IAP) has the potential to develop markets in Montenegro and provide new sources of supply for the markets in Bosnia and Herzegovina and Croatia, which will enable new market entrants to challenge the monopolies or dominant positions of the respective incumbent gas suppliers". (Opinion 1/2013, para 34&35).

Remark on the PCI selection:

- Based on the documents publicly available and own calculations, the Southern Gas Corridor (as a cluster of projects) has a socio-economic benefit /cost ratio above 1;

([363]) Please note that this figure differs from what TAP AG communicated as the investment cost for the entire value chain (40 bn USD) including the upstream investments. The TYNDP scenario SGC 01a has a total estimated CAPEX of EUR 15000 million, where TCP is EUR 1500 million, SCP(f)X is about EUR 1050 million, TANAP is about EUR 7477 million, TAP is EUR 4500 million, the Greek national system development need of DESFA is about EUR 72 million, the Italian national system development need (Snam) is EUR 183 million. (figures are reported in 2018).

([364]) The monetized figures for the CO2 savings were provided by project promoters to ENTSOG without further double-check by the European Commission.

([365]) This is a REKK estimate, as unfortunately the ENTSOG document does not provide this indicator, nor any official EU document. It is for the Promoter to decide if they even provide the B/C figure for the national regulators of the hosting countries. In this case it did not happen, therefore REKK estimated the B/C ratio.

- A potential methodological shortcoming of the CBA analysis of project clusters is when none essential projects are also part of the cluster (e.g. TCP not the only enabler source for TAP and its extension) making benefits from the single projects (here TAP) difficult to assess. Still the PCI cluster 7.1. Southern Gas Corridor is no doubt a project that meets the eligibility criteria of the TEN-E Regulation on costs and benefits([366]) having the B/C ratio above 1;
- Regulators interviewed raised concerns about the selection process since the B/C ratio (based on monetised benefits and costs) was not the basis for the selection of the PCI projects ([367]);
- The transparency on the projects could significantly improve and it is recommended for the B/C ratio to be part of the project specific CBA published by ENTSOG.

CBCA

There has been no CBCA decision made and the project never aimed for any cross-border cost allocation.

Financing of the projects

The total cost of the pipeline is EUR 4.5 billion, including the design and engineering works that have been ongoing since 2009.

In 2018 the project raised EUR 3765 million in third party senior debt with a door-to-door tenor of 16.5 years, combining commercial debt along with development financial institutions (DFI) and export credit agencies (ECA) related financing([368]):

- EIB Direct Facility, benefitting from a guarantee from the European Union under the European Fund for Strategic Investments EFSI: EUR 700 million;
- EBRD A-Loan: EUR 500 million;
- EBRD B-Loan: EUR 500 million funded by commercial banks;
- ECA facilities, benefiting from comprehensive cover by:
  - Bpifrance Facility, EUR 450 million;
  - Euler Hermes Facility, EUR 280 million;
  - A SACE Facility, EUR 700 million.
- Commercial term loan facility: EUR 635 million directly provided by commercial banks without any ECA or multilateral involvement.

Together the project financing for TAP was the largest loan agreed for a European infrastructure project in 2018.

Since TAP is not regulated (exempted), it is not eligible for Connecting Europe facility (CEF) grants for works. Still it did successfully received grants for studies (7.1.3-0013-ELIT-S-M-16) amounting to EUR 14,018,347([369]).

The funds covered 50% of the estimated costs for multiple trial trench investigations and rescue excavation activities during the ground-breaking construction activities carried out along the Greek route of the pipeline in the regions of Kavala, Drama, Kilkis, Thessaloniki, Serres, Florina, Pella,

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([366]) Genaral criteria 347/2013 Article 4 b states: Projects of common interest shall meet the following general criteria: the potential overall benefits of the project, outweigh its costs, including in the longer term.

([367]) ACER (2019c), Opinion no 19/2019 on the draft regional lists of proposed gas projects of common interest 2019, Paragraph 24. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2019-2019%20on%20Gas%20PCI%20list.pdf. ACER notes that the PCI assessment methodology used for the scoring and the ranking of the candidate projects only used non-monetised indicators, i.e. the methodology relies entirely on multi-criteria analyses and assessments, and completely bypasses the capabilities of the existing 2nd CBA Methodology to monetise benefits, as well as any already available information about monetised benefits. Even when taking into consideration the serious limitations of the 2nd CBA Methodology for monetising benefits.

([368]) https://www.eib.org/en/press/all/2019-004-trans-adriatic-pipeline-tap-completes-successful-eur-3-9-billion-project-financing.https://www.tap-ag.com/news-and-events/2019/01/11/tap-completes-successful-euros-39-billion-project-financing.

([369]) https://ec.europa.eu/inea/en/connecting-europe-facility/cef-energy/7.1.3-0013-ELIT-S-M-16.

Imathia, Kozani and Kastoria. The CEF funding contributed to the implementation of the TAP project (PCI No. 7.1.3) and better understanding of the archaeology and the cultural heritage landscape in Northern Greece.

All in all, having a PCI and A PECI status has helped to promote the pipeline to investors and access to EIB and EBRD loans.([370])

Lessons learned for the future

- Political support is inevitable (even in form of IGs) especially for the public acceptance;
- Public participation, support and acceptance is the key challenge, must be achieved through engagement, procurement, employment and investment initiatives;
- Cooperation between national regulatory authorities and local and regional actors is key for project endeavours and public support;
- Regulatory conditions under the exemption decision can provide fair, rightful cost divisions to benefit the hosting countries;
- A proper CBA with Economic Performance indicators shall be the basis of the ranking of projects and the selection of the PCIs to strengthen the value of the label both for the expert community involved and the wider public;
- The natural gas via TAP will support the decarbonisation of economies, particularly in South East Europe and the Western Balkans, currently heavily reliant on coal and lignite for power generation. Natural gas will help replace fuels such as coal, lignite and wood that are commonly used in the region. In addition, it opens further cooperation opportunities for renewable gases and hydrogen blending in the existing gas infrastructure;
- TAP is the key infrastructure to drive forward adjacent domestic and international gas infrastructure such as:
  - Interconnector Greece Bulgaria (IGB) - PCI project currently under construction;
  - the Greece-North Macedonia PECI project - project of mutual interest (PMI) of the Energy Community, where the investment on the Greek part (Nea Mesimvria([371])-Evzonon/Gevgelija) is estimated to be EUR 51.4 million;([372])
  - Fier-Vlora gas pipeline in Albania([373]) where work towards the Detailed Design and Tender Documents have been recently launched([374]) and estimated at EUR 17.48 million in total investment;
  - Albania-Kosovo project([375]) - Project of Energy Community interest (PECI) aiming to gasify Kosovo([376]) with estimated investment costs to be EUR 221 million.

Case study – GIPL

Main messages of the case study

The main message of the GIPL project is that a CBCA decision can be taken by ACER and be respected by all involved parties, why the TEN-E regulation is functioning. Without the CBCA decision, the agreement on cost and benefit allocation would likely be more cumbersome.

The main messages include:

- CBCA decision by ACER was effective:
  - GIPL is one of the few PCIs where compensation was granted in the CBCA procedure by non-constructing countries (Latvia and Estonia). The case shows that ACER can decide on CBCA and that the decision was respected by all parties. The CBCA decision was provided with detailed explanation and transparency. The CBCA aimed to compensate the losses of the cost bearer but did not aim to arrive to the same B/C for

([370]) www.tap-ag.com.
([371]) Nea Mesimvria location is the main Exit point of TAP in Greece.
([372]) https://worldenergynews.gr/index.php?id=48326 (21/08/2020).
([373]) https://www.wbif.eu/project/PRJ-ALB-ENE-020.
([374]) https://www.wbif.eu/news-details/eu-supports-additional-technical-assistance-gas-transmission-network-albania (07/07/2020).
([375]) https://www.monitor.al/perfundon-studimi-linja-e-gazit-shqiperi-kosove-kushton-211-mln-euro/ *full text in Albanian 08/20/2020.*
([376]) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

all parties. Therefore, the Polish side was not really interested to push for this project. Yet, the Polish TSO recognises that the CBCA procedure was of paramount importance in the decision-making process and financial viability (FID) of the project.

- Cooperation between TSOs and NRAs is important to find the right economic incentive schemes:
  - Driven by the results of a project cost assessment, the Lithuanian TSO claimed that the long development time and complexity of the project would create a high liquidity risk. Accordingly, in 2014 the TSO submitted a request for "project-specific risk-based" incentive, under Article 13 in the TEN-E regulation. This allowed the TSO to include project-related work-in-progress costs in the Regulated Asset Base (RAB), which may result in being instrumental in alleviating the financial/liquidity risk by providing a higher return of investment.
- Public consultation was very important and driven by the TSOs:
  - The Polish TSO emphasised that the public consultation at the inception of the project had a positive effect on the public acceptance, while the PCI-label reinforced the national and European benefits brought in. The Lithuanian TSO emphasized the positive impact public acceptance played during both the permitting and construction stage. As for the preconstruction stages to apply for the permits, the National Regulation mandates public consultation. They also took the initiative to engage local communities in the construction phase to resolve any possible conflict during this phase, although it was not required by the legislation. Their conclusion was that TSOs can alleviate later setbacks by public complaints in the project by engaging with the public from the beginning of the project development.

Introduction

This case offers a valuable insight into how determinant the TEN-E Regulation is in supporting energy related infrastructure through leveraging on ad-hoc funds (e.g. CEF funding) and applying an effective CBCA procedure in situations of disagreement on cost allocation among NRAs of the project hosting and non-hosting countries.

The GIPL interconnection project was hailed positively by the EC since its early award as PCI project as part of the BEMIP in October 2013. It was considered as an essential missing piece of the European gas market development. The Eastern Baltic Sea was often regarded as being an "isolated" gas market region strongly dependent on Russian supply. In this light, the GIPL project was a gas corridor connecting the Baltic gas market with the Western European one.

By doing so, the Baltic countries not only would diversify gas suppliers and routes, but also increase the security of supply of the region by weakening its dependency on Russian gas. In addition, the GIPL project would also contribute to the gas market integration with the Finnish gas market upon the completion of the gas interconnector between Finland and Estonia (Baltic Connector). In the Polish TSO's opinion, the contribution of the project to the goals of the TEN-E Regulation was primarily gas market integration and security of supply since the project allowed the Baltic countries to be connected to the European intercontinental gas grid and diversify the gas suppliers in the region.

Main insights of the case study

Despite an early onset of the project in July 2012, when Gaz-System S.A. and AB Lietuvos Dujos **(**today known as AB Amber Grid) assigned a project feasibility study to a consulting company([377]), the unravelling of the GIPL project was strongly affected by the disagreement on benefits definition and cost allocations between the TSOs of the hosting (Poland and Lithuania) and non-hosting (Latvia and Estonia) countries. The importance of the gas infrastructure investment was; however, signalled in October 2013 when the undertaking was awarded the PCI status as part of the BEMIP. The struggle in reaching a consensus among the TSOs can be ascribed to the financial burden the TSOs had to sustain upfront. A tangible push to project progression arrived in 2014 when ACER conducted a CBCA analysis between Poland, Lithuania, Latvia and Estonia. In 2015, upon the establishment of two different CEF grant agreements between the project promoters, AB Amber Grid and GAZ-SYSTEM S.A., and the EU Innovation Network Executive Agency (INEA), the project

[377] https://en.gaz-system.pl/centrum-prasowe/aktualnosci/informacja/artykul/201520/.

was granted 50% of the cost of the project preparatory work, equal to EUR 10.6 million. Later, EUR 266.4 million were granted in financial support for the project development. In the aftermath of the CBCA, a Non-Binding Open Season Procedure for Gas Interconnection Poland – Lithuania Project, launched by the Polish and Lithuanian gas TSOs, confirmed tangible market interest in the long-term use of the gas pipeline by market participants. This paved the way to the FID which only took place in May 2018 in conjunction with the signature of an agreement of formal acceptance of ACER's CBCA by the TSOs. Public consultations arranged between 2017 and 2019 pointed out some adversity to the project from the Polish side based on a foreseen gas demand decrease in the region due to energy efficiency and renewable energy EU targets. Praises, nonetheless, came predominantly from the Lithuanian government, claiming the need of gas supply diversification, and Finnish stakeholders.

General information

The project had been studied in many variants since 1990 (for some years under the name of Amber pipeline). It was eventually included under the BEMIP gas plan. Thereafter, upon the agreement on the execution of a feasibility study by a third company in July 2012, the "Gas Interconnection Poland-Lithuania" (GIPL) project was added to the 2013 PCI list upon having been selected by the Regional Group for the draft final list of eligible PCI projects.

The gas pipeline crosses the borders of Poland and Lithuania. On the Polish side, it comprises a 357 Km long DN-700 gas pipeline between Hoowczyce and the PL-LT border, a new 16 MW compressor station in Gustorzyn, and the extension, modernization and connection of the pipeline to the Hoowczyce node as well as the related necessary improvements of the Hoowczyce compressor station. On the Lithuanian territory, the GIPL system comprises a 165 Km long DN-700 between the PL-LT border and Jauniunai, along with the construction of gas pressure reduction and metering station near the PL-LT border in Lithuania to decrease the Maximum Operating Pressure (MOP) of the pipeline system. The gas transportation system will offer a capacity of 2.4 bcm/year in the direction PL to LT and up to 1.9 bcm/year in the inverse direction LT to PL.

Figure 0.1 GIPL gas pipeline location

Sector: Gas
Name of case study: GIPL
PCI Code: 8.5
Project promoters: Gaz-System S.A. and AB Amber Grid
Regional group: Eastern Baltic Sea region, BEMIP
Project status: Under construction
Hosting countries: Poland, Lithuania (along with the rest of the Baltic countries, i.e. Latvia and Estonia)

Table 0.1 GIPL gas pipeline project on PCI list

	Date of first initiation	1st PCI list 2013-2015	2nd PCI list 2015-2017	3rd PCI list 2017-2019	4th PCI list 2019-2021
Reference	July 2012 when Gaz-System S.A. and AB Amber Grid, assigned a	ACER - Consolidated Report on the progress of electricity	ACER - Consolidated Report on the progress of electricity and gas projects of	ACER - Consolidated Report on the progress of	2020 Technical information on PCI

	Date of first initiation	1st PCI list 2013-2015	2nd PCI list 2015-2017	3rd PCI list 2017-2019	4th PCI list 2019-2021
	project feasibility study to a consulting company([378])	and gas projects of Common Interest for the year 2015	Common Interest for the year 2016	electricity and gas projects of Common Interest for the year 2019	
Expected date of commissioning	-	2019	2021	2021	2021
Status in PCI list	-	"Planned, but not yet in design and permitting phase"([379])	"Permitting"([380])	"Design and Permitting" ([381])	"Under construction"([382])
PCI progress	-	On time	Rescheduled	On time([383])	-
Planned capacity	2.4 bcm/year direction PL to LT; 1.9 bcm/year in direction LT to PL	-	-	-	-
Planned route	-	-	-	-	-
Estimated investment cost	-	-	-	€497 million (2019)([384])	-

The GIPL project has been present on all the PCI lists since 2013. Its expected date of commissioning was officially amended in the 2nd PCI list from 2019 to 2021, and a series of events, among others smaller technical issues, might have contributed to the postponed commissioning date.

[378] https://en.gaz-system.pl/centrum-prasowe/aktualnosci/informacja/artykul/201520/.

[379] ACER (2016), Consolidated report on the progress of electricity and gas projects of common interest for the year 2015. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20PROJECTS%20OF%20COMMON%20INTEREST%20for%20the%20year%202015.pdf.

[380] ACER (2017a), Consolidated Report on the progress of electricity and gas Projects of Common Interest for the year 2016. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20for%20the%20year%202016.pdf.

[381] European Commission (2018), Technical information on Projects of Common Interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/technical_document_3rd_list_with_subheadings.pdf.

[382] European Commission (2020a), Technical information on Projects of Common Interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/technical_document_4th_pci_list.pdf.

[383] ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest – 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

[384] ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest – 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

Permit granting

In May 2015, upon the stipulation of the agreement between the project promoters and INEA over the financial assistance of the EU to the Project "Preparatory Works for the Poland-Lithuania Gas Interconnection up to building permission(s) obtainment", the EU granted EUR 10.6 million equal to 50% of the overall study cost, the maximum allowable funding for a preparatory study.

By Ambergrid([385]) it was reported that the following was investigated: The Project's Environmental Impact Assessment Procedures concerning the Lithuanian territory, initiated in 2013, ended in 2015, while a territorial planning and design work was commissioned in the same year and completed in 2016. In July 2015, moreover, the Polish and Lithuanian gas TSOs launched a Non-Binding Open Season Procedure for Gas Interconnection Poland – Lithuania to examine market participants' demand for the capacity at the Entry/Exit Point. Beside these events, in 2015 there was an intense work of negotiation between the project promoters, AB Amber Grid and GAZ-SYSTEM S.A, and INEA, over the financial assistance of the EU to the project preparatory study, and the construction of the pipeline and related infrastructures.

By Gaz System it was reported that the PCI label of the project did not affect the permit granting procedure as it followed the standard permit granting procedure established by the Polish legislation. Moreover, given the acts dictated by the country's legal framework, the one-stop-shop principle was partially applied. On the Lithuanian side, Amber Grid also recognises that the PCI label sensibly accelerated the permitting process through providing the possibility to exempt some procedures which otherwise would entail time allocation. In the design stage, moreover, the PCI status provided the possibility of having the construction permit documents issued by one institution; the same process would, for non-PCI projects, require approaching every municipality of the territory a pipeline infrastructure crosses.

Public consultation

The outcome of the "Targeted consultation on candidate PCIs in gas infrastructure PCI process 2018-2019" was a balanced vision on the need for the GIPL. The project was welcomed positively by the contributors of the undertaking in virtue of an evident need for supply diversification in the Eastern Baltic gas market. Yet, some respondents were sceptical about the infrastructure utilization in Poland based on two different reasons. The first reason was that Poland was already well positioned to fulfil the security of supply criterion. The second one was that a drop of 33% in gas demand (which was registered in Estonia, Finland, Latvia, Lithuania and Sweden between 2011 and 2017, accompanied by energy efficiency policy and renewable energy targets) could make the GIPL infrastructure a potential future stranded asset, which would increase the number of already underutilized gas infrastructure in Poland.

The report "Public consultation on the third list of projects of common interest" was published in 2017. There were negative comments listed in this report, that constituted 30% of the total number of comments. These comments questioned the necessity of this gas infrastructure in the light of a foreseen gas demand decline in the region. However, the Polish TSO emphasises that the public consultation at the inception of the project had a positive effect on the public acceptance, while the PCI-label reinforced the national and European benefits brought in. The Lithuanian TSO emphasized the positive impact public acceptance played during both the permitting and construction stage. As for the preconstruction stages to apply for the permits, the National Regulation mandates public consultation. They also took the initiative to engage local communities in the construction phase to resolve any possible conflict during this phase, although it was not required by the legislation.

Regulatory incentives

Driven by the results of a project cost assessment, the Lithuanian TSO claimed that the long development time and complexity of the project would create a high liquidity risk. Accordingly, in 2014 the TSO submitted a request for "project-specific risk-based" incentive, under Article 13 of Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure (TEN-E

([385]) https://www.ambergrid.lt/en/projects/gas-interconnection-poland-lithuania-gipl).

Regulation)([386]). Through the granted incentive by the NRA to include costs of work-in-progress in the Regulatory Asset Base (RAB), the Lithuanian TSO was able to receive a higher return on investment.

Administrative burden

Despite recognising that there were some additional costs related to the PCI status (e.g. costs of human resources, travel, studies, consultancy, etc.), the Polish TSO confirms that the project-related "expected" socio-economic benefits, as well as the "unexpected" ones originated by the international cooperation with other TSOs, outweighs any additional PCI-specific administrative cost. Ambergrid estimated the costs associated with the TEN-E Regulation to span from approximately EUR 200,000 to 250,000 in terms of man hours and travel expenses([387]). These costs must however be seen in the light of the economic benefit of the project reported below.

CBA: Costs and benefits of the projects

Prior to the execution of the CBCA by ACER, Gaz-System S.A. (Poland) and AB Amber Grid (Lithuania) submitted an investment request in 2013. It was accompanied by a CBA to all the involved NRAs, namely, Urząd Regulacji Energetyki for the Republic of Poland, Valstybinė kainų ir energetikos kontrolės komisija for the Republic of Lithuania, Sabiedrisko Pakalpojumu Regulēšanas Komisijā for the Republic of Latvia, and Konkurentsiamet for the Republic of Estonia.

The outcome of the assessment made by the project promoters indicated that benefit to cost ratio was 2.2 with a total benefit of EUR 1.170 million and total cost of EUR 547 million. EUR. Although the project benefit outweighed the cost, the economic indicators differ from country to country. The indicators which were calculated were the Economic Net Present Value (ENPV), the Economic Rate of Return (ERR) and the Benefit-to-Cost Ratio (BCR).

Table 0.2 CBA breakdown by ACER([388])

Countries	ENPV (mil.EUR)	ERR	BCR (mil.EUR)	Net beneficiary (NB)/Cost Bearer(CB)
Poland	-155	<0	<1	CB
Lithuania	431	28%	4.5	NB
Latvia	263	-	-	NB
Estonia	84	-	-	NB

AB Amber Grid recognizes that the project nowadays has become more relevant for Lithuania than in 2013 given the revised pipeline utilization rate which has increased from 20% to 40/50%, based on their latest evaluation. In terms of sustainability targets, the Lithuanian TSO claims that the project was beneficial for climate and energy targets particularly in Poland because of the fuel switch from coal to gas.

Cross border cost allocation

The project promoters Gaz-System S.A. (Poland) and AB Amber Grid (Lithuania) sent an investment request to the impacted NRAs on the 31st of October 2013([389]). The NRAs were unable to reach a consensus on the assumptions made for the future values, upon which the socio-

([386]) ACER (2018), Summary report on project-specific risk-based incentives. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER-summary-report-on-project-specific-risk-based-incentives_2018.pdf.

([387]) From the interview with Amber Grid held on the 27th of August 2020.

([388]) ACER (2014a), Decision No 01/2014 on the investment request including cross-border cost allocation for the gas interconnection polandlithuania project of common interest no 8.5. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/ACER%20Individual%20Decision%2001-2014%20on%20GIPL.pdf.

([389]) ACER (2014a), Decision No 01/2014 on the investment request including cross-border cost allocation for the gas interconnection polandlithuania project of common interest no 8.5. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/ACER%20Individual%20Decision%2001-2014%20on%20GIPL.pdf.

economic calculations were based (gas prices, etc.), within six months from the request reception. According to the Regulation, the assessment of the investment request was transferred to ACER.

In the CBCA, Poland and Lithuania were the hosting countries of the gas infrastructure, whereas Latvia and Estonia were the beneficiary non-hosting ones. The CBCA was conducted by ACER which calculated all costs and benefits as Net Future Value as of the commissioning year of the project (2018). By doing so, Poland was identified as net cost bearer, while Lithuania, Latvia and Estonia were judged as beneficiaries. To calculate the compensation of the Net beneficiaries to the Net cost bearer, a 10% significance threshold over the total positive net benefits for the GIPL, equal to EUR 105.5 million, was considered. A compensation contribution factor was calculated based on the benefits over the 10% threshold. The CBCA aimed to compensate the losses of the cost bearer but did not aim to arrive to the same B/C for all parties. Therefore, the Polish side was not really interested to push for this project. Yet, the Polish TSO recognises that the CBCA procedure was of paramount importance in the decision-making process and financial viability (FID) of the project.

Table 0.3 GIPL CBCA decision by ACER([390]) (million EUR year 2018)

Country	Benefit	Cost	Net benefit	Benefit over 10% GIPL net benefit (€105.6 million)	Compensation contributor indicator	Value of financial Revenue	Aggregate financial Cross-border compensation due	Cross-border cost allocation
Poland (promoter)	301.4	528.1	-226.7	(Cost bearer)	(Cost bearer)	140	85.8	0
Lithuania (Promoter)	723.2	145	578.2	472.6	64%	31.6	-	54.9
Latvia (non-hosting)	359.6	0.6	359.1	253.5	34.3%	-	-	29.4
Estonia (non-hosting)	118.5	0	118.5	12.9	1.7%	-	-	1.5
Total GIPL benefit	1502.7	673.7	829.1	-	-	-	-	-
Total GIPL benefit of Net beneficiaries	-	-	1055.8	739	100%		85.8	85.8

Considering that transmission tariffs and the amount of external funding requested to achieve the minimum required profitability level (8% IRR) was sensitive to the pipeline yearly utilization rate (promoters' estimate was 20% of maximum pipeline capacity), ACER also realised that, although with low probability, there was a potential for considerable margin. Accordingly, ACER decided that in case future revenues exceeded the revenues that had been envisioned by the project promoters, the contributing TSOs should also participate in the upside through a reduction of the payments as established in the CBCA.

Financing of the project

In May 2015, the EU granted EUR 10.6 million equal to 50% of the overall study cost, the maximum allowable funding for a preparatory study, paving the way for a grant agreement

[390] ACER (2014a), Decision No 01/2014 on the investment request including cross-border cost allocation for the gas interconnection polandlithuania project of common interest no 8.5. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/ACER%20Individual%20Decision%2001-2014%20on%20GIPL.pdf.

between the project promoters and INEA([391]) on the financial assistance of the project "Preparatory Works for the Poland-Lithuania Gas Interconnection up to building permission(s) obtainment".

In October 2015, a new trilateral agreement between AB Amber Grid and GAZ-SYSTEM S.A., and INEA on the EU financial support for the project development ("Construction of the Gas Interconnection Poland-Lithuania (GIPL) including supporting infrastructure") set forth a new allocation of EU aid fund under the CEF for the undertaking amounting to EUR 266.4 million (EUR 58 million was allocated to Amber Grid, while EUR 208.4 million to GAZ-SYSTEM). Owning to the PCI status and strategic importance of the infrastructure for the European gas market, the Polish and Lithuanian TSOs had access to energy-project specific loan scheme offered by the European Investment Bank at favourable conditions.

Table 0.4 CEF grants([392]) (million EUR), 2015

Project promoters	"Preparatory work" CEF grant	"Construction work" CEF grant
GAZ-SYSTEM	7.6	208.4
Amber Grid	2.5	58.0
Total	10.1	266.4

Case Study – ACON Smart Grid

Main message of the case study

- The main message of the ACON Smart Grid case study is that the TEN-E Regulation provisions are less suited to smart grid projects. Instead, the TEN-E Regulation seems to be better suited to TSO projects. Smart grids are limited to apply for PCI status since low voltage level infrastructures are not contemplated and they are required to operate grids where at least 20% of the electricity originates from renewable resources. Reporting requirements obey to the characteristics of TSO project permitting and implementation, which may not be entirely suited to smart grid projects. Smart grids involve a multiple number of projects, overlapping timings of permitting and construction, and some works that do not require permitting like software development. The main messages of the case study include:
  - Challenges in providing the necessary information for the PCI Application. Some challenges were found in the application for PCI status. The necessary information, indicators, cost benefit analysis to be provided in the application was difficult to understand to the project promoters. The collaboration with DG ENER and the Joint Research Group (JRC) of the EC was deemed very valuable to the successful completion of the application process. CBA Assessment from the JRC EC concludes a B/C ratio of 1.6. The JRC performed an evaluation of smart grid projects candidates for the third PCI list in 2017. According to this document, the total societal benefits of the project for the concerned region are EUR 41.8 million with a B/C ratio of 1.6.
- Insufficient traceability of the project assessment to be selected as PCI:
  - No detailed costs and benefits have been accessible for the project from public documents and from direct consultation to the project promoters. This seems to be an evidence of the lack of transparency that has been pointed out in targeted surveys and interviews by the stakeholders regarding the PCI selection process in the regional groups. The insufficient detailed documentation of projects CBA assessments and the regional groups assessments and decisions impedes traceability and transparency.
- One-stop-shop not applicable. TEN-E requirements made the permitting process heavier:
  - The one-stop-shop permitting procedure has not been implemented in Slovakia nor in the Czech Republic. In practice, the project promoters must apply their national regulation, which entails numerous local authorities for permits. Both project promoters stated that in some cases the TEN-E regulation added additional work in terms of permitting.
- CEF funding covered 50% of the project eligible costs:
  - The project received a maximum EU contribution of EUR 91 million, corresponding to 50% of the EUR 182 million maximum eligible costs, to be fully implemented by 2024. Without the CEF funding, the ACON project would have not been implemented as it has, according to both project promoters.

([391]) https://en.gaz-system.pl/centrum-prasowe/aktualnosci/informacja/artykul/202748/.
([392]) https://en.gaz-system.pl/centrum-prasowe/aktualnosci/informacja/artykul/202748/.

- High public acceptance and beneficial PCI status for project communication and consultation:
  - The level of acceptance of the ACON project is very high from citizens and local stakeholders. The PCI status is regarded as beneficial in this sense.
- Beneficial international experience for DSOs:
  - Both project promoters highlighted the value of the international experience, the cooperation and knowledge sharing between the two DSOs, which are eminently regional businesses and do not interact with other DSOs and European institutions on their usual activities.

Introduction

In the current 4th PCI list, there are only six smart grid projects among the total of 149 projects. Smart grid projects must comply with the general eligibility criteria defined in the TEN-E regulation EU 347/2013 Article 4, as of having a significant cross-border impact, defined in Annex IV (1) (e), which restricts the scope of the projects in the category of smart grids to equipment and installations designed for a voltage of 10 kV or more. Smart grid projects entail a multiple number of infrastructures and actions both at a medium and low voltage level, e.g. smart meters of low voltage end-users are of paramount importance for smart grid projects. In this regard, the voltage level threshold of 10 kV defined in the TEN-E regulation limits the eligibility of smart grid projects.

The JRC developed guidelines for the CBA of smart grid projects in 2012([393]). In 2017, an update of assessment framework for PCI in the field of smart grids was released ([394])([395]). In 2017, following the latter guidelines, developed by the JRC and adopted within the smart grid Regional Group, the JRC released a report presenting the outcome of the evaluation process of candidate PCIs in the priority thematic area of smart grids deployment. This has been the basis of the CBA section.

The ACON project consists of technologies and solutions which prove necessary for the smart grid deployment thematic area (Annex I, 4(10) to the Regulation). The ACON project involves DSOs from two Member States, Czech DSO *E.ON Distribuce* and the Slovak DSO *Západoslovenská Distribučná* (part of the group Západoslovenská Energetika, whose shareholders are EON,49%, and the Slovak Republic, 51%). TSOs are also expected to be involved in the project and benefit from more efficient and reliable operation of the distribution networks in the project area. In this respect, the project complies with Article 4 (1) (c) (i) of the Regulation. The ACON project demonstrates significant contribution to the six smart grid specific criteria, outlined in Article 4(2)(c) of the Regulation and positive outcome of the project's societal cost-benefit analysis.([396])

The main project goals are as follows:

- Enhancement of network security and quality of supply;
- Improvement of distribution and transmission network operational efficiency;
- Enabling growing penetration level of RES in the region;
- Leveraging the benefits of increased cross-border co-operation and connectivity.

Description of the project

ACON is a smart grid project that will facilitate better cross-border cooperation at DSO level between the Czech DSO *E.ON Distribuce* and the Slovak DSO *Západoslovenská Distribučná*. The

([393]) JRC (2012), Guidelines for conducting a cost benefit analysis of smart grid projects. Retrieved from: https://ses.jrc.ec.europa.eu/sites/ses/files/documents/guidelines_for_conducting_a_cost-benefit_analysis_of_smart_grid_projects.pdf.

([394]) JRC (2017), Assessment framework for projects of common interest in the field of smart grids. Retrieved from: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC105603/kjna28439enn.pdf.

([395]) JRC (2017a), Evaluation of Smart Grid projects for inclusion in the third Unionwide list of Projects of Common Interest. Retrieved from: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC107348/jrc_smart_grid_pci_science_for_policy_report_2017_gk_final.pdf.

project consists of several elements to improve the efficiency of the existing power distribution grids and help improve the cross-border operation between the two DSO´s. Furthermore, new IT elements will be implemented for smart grid operation. The project covers among others the following:

- Border areas and cross-border connections improvement: Includes operation change of 2x110 kV high voltage (HV) lines between the two DSO areas, reconstruction of automation of medium voltage feeders and construction of a new 22 kV line between the Holíč (SK) and Hodonín (CZ) substations;
- Construction and improvement of existing distribution grid: The electricity networks in both DSO areas will be improved to ensure a higher reliability and flexibility of the operation;
- Distribution grid communication (smart grid): This part includes installation of new IT equipment to allow remote access and better data transmission and handling by installing optic cables on existing HV lines and deployment of new information technology;
- Implementation and integration of smart grid IT solutions: This includes installation of smart meters to improve data gathering and data handling and data analysis. This in turn can lead to a better distribution grid operation, lower maintenance costs and improved planning of new infrastructure.

Figure 0.2 E.ON Distribuce and Západoslovenská Distribučná DSO areas

The ACON project is mainly driven by the necessity in the project area to significantly improve the efficiency of the distribution networks in both MSs, while strengthening cooperation between the Czech and Slovak Republic and delivering benefits to the broader territorial cohesion of the Eastern European region. The project strengthens the existing cross-border connections at distribution network level (at 110 kV and 22 kV) and constructs additional ones. In this context, the project addresses smart grid and conventional elements, both necessary for strengthening the network operational security. Current 110 kV and 22 kV cross-border connections at the distribution network level are mainly used in non-standard operational conditions.

On the other hand, future regional needs – mainly taking care of growing RES integration while ensuring network security and quality of supply - would lead to increasing interregional flows at the distribution network level. The construction of additional 110 kV and 22 kV interconnection capacity are expected to secure efficient energy exchanges between the involved MSs, particularly in case of increased transfer capacity needs at the DSO level, while maintaining network stability.

The smart grid elements introduced by the project include smart metering and control functionalities, installed mainly at MVand HV distribution network levels. Nevertheless, some part of the equipment will be also installed at LV level.

The project consists of a variety of different projects concerning among others: new distribution lines, new smart meters, new optic cables and measurement devices and improved control and analysis. Some of the projects are domestic at the respective DSOs, while the distribution lines are to be cross-border projects. Thus, not only do the two DSOs have an interest in the project, but the cooperation of the TSOs in Slovakia and Czech Republic (Slovenská elektrizačná prenosová sústava and ČEPS) has also been important for the project development and implementation. The

project has a direct impact on the cross-border capacity of the involved MSs as it addresses cross-border connections at 110 kV and 22 kV network level.

Sector: Smart grid
Name of case study: ACON Smart Grids
PCI Code: 10.4
Geographical area: Smart Grids Priority Thematic Area
Implementation phase: Under Construction / Permitting([397]).
Hosting countries: Czech Republic (CZ), Slovakia (SK).
Project promoters: The project promoters are the Slovak DSO *Západoslovenská distribučná* and the Czech DSO *E.ON Distribuce.*

Table 0.5 ACON smart grid project on PCI list

	3rd PCI list 2017-2019	4th PCI list 2019-2021
Expected date of commissioning	10.04.2023([398]), 2024([399])([400])	10.04.2024 ([401])
Planned capacity	No detail of total electric capacity affected. Brief technical description of technical components included.	No detail of total electric capacity affected. More detailed description of project elements.
Planned route	Not specified on the PCI list documents.	New cross border connection at DSO level: 22kV lines between Holíč (SK) and Hodonín (CZ) substations. All other elements across DSO grids in SK and CZ.([402])
Estimated investment cost	EUR 221 million (ACER report 2018 and 2019)([403])([404]) EUR 269.85 million (ACER report 2020)([405])	

[397] ACER (2020b) Consolidated Report on the progress of PCI projects, Annex I Electricity PCI. Retrieved from: https://www.acer.europa.eu/Official_documents/Publications/Annexes%20to%20PCI%20monitoring%20report_2020/2020_ACER_PCI_Monitoring_report_Annex_1_ele_NON-confidential.pdf.

[398] European Commission (2018), Technical information on Projects of Common Interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/technical_document_3rd_list_with_subheadings.pdf.

[399] ACER (2018b), Consolidated Report on the progress of electricity and gas Projects of Common Interest for the year 2017. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20for%20the%20year%202017.pdf.

[400] ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest – 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

[401] European Commission (2020a), Technical information on Projects of Common Interest. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/technical_document_4th_pci_list.pdf.

[402] Technical information on PCI March 2020. https://ec.europa.eu/energy/sites/ener/files/technical_document_4th_pci_list.pdf.

[403] ACER (2018b), Consolidated Report on the progress of electricity and gas Projects of Common Interest for the year 2017. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20for%20the%20year%202017.pdf.

[404] ACER (2019a), Consolidated Report on the Progress of Electricity and Gas Projects of Common Interest – 2019. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf.

[405] ACER (2020b) Consolidated Report on the progress of PCI projects. Retrieved from: https://www.acer.europa.eu/Official_documents/Publications/Annexes%20to%20PCI%20monitoring%20report_2020/2020_ACER_PCI_Monitoring_report_Annex_1_ele_NON-confidential.pdf.

The project was initiated for the first time on the 1st of January 2017. The final investment decision was made on the 1st of July 2018. The expected year of commissioning is 2024 according to the annual monitoring reports by ACER from July 2018, July 2019 and July 2020, which defined its annual progress as *On Time*.

According to the last ACER monitoring report ([406]), the following works and activities have been carried out during the last reporting period: preparation of permitting files; contracts and other documents; negotiations with landowners and land acquisition; detailed technical design; tendering; preparatory works for construction (e.g. land preparation); construction; commissioning.

Permit granting

According to the last ACER monitoring report from 9 July 2020([407]), the permit granting procedure was initiated in October 2019 and is expected to finish in December 2023. The construction of some of the infrastructures has already been initiated.

As mentioned by the project promoters, smart grid projects involve many projects with specific construction permits. Smart grid projects can cover around 100 different installations. In the case of Slovakia, these need to be applied no earlier than two years before the start of the works, since construction permits have a validity of two years in Slovakia, which makes it impossible for smart grid projects to have all permits granted before starting the construction for all works.

The one-stop-shop permitting process conceived by the TEN-E regulation has not been applied in Slovakia nor in the Czech Republic. Hundreds of local permits are needed for the ACON project. According to the Slovak DSO, it was challenging to get in time all these local permits to comply with the TEN-E requirements in Article 10 to maintain the PCI status. These requirements were judged as "too strict" for the nature of this project. It was mentioned that they even had to apply for permits they did not need in order to comply with TEN-E reporting requirements. This was the case for software development under the smart grid project, which does not require any permit according to Slovakian regulation. They did apply for permission to get an official notification that they did not need any permit. Given the number of permits required, a special task force was established in the company.

In Slovakia, permit applications involve a couple of meetings with the relevant authorities before the actual application is sent. The authorities have 30 business days to conclude on the permits, yet this is almost never respected, and in practice it usually takes 200 to 250 days to get a permit. This happens due to comments and inquiries that need to be addressed along the permitting procedure from the different authorities that evaluate and conclude on the permits. The fact that the project has a PCI status does not make any legal difference regarding the national administrations. However, it was mentioned that the Minister of Economy of Slovakia elaborated a letter stating that the project is part of the EU PCI list and therefore a strategic project for Slovakia and the EU. This letter is attached when they submit applications for local permits. In view of the representative of the Slovak DSO, the PCI status has a potential to accelerate permitting and internal approval within the company.

The Czech DSO mentioned that the permitting requirements derived from the TEN-E Regulation added additional work to the usual permit procedures they would have gone through for a non-PCI project. In the current TEN-E regulation, the permit granting process defined in Article 10 seems to

[406] ACER (2020b) Consolidated Report on the progress of PCI projects. Retrieved from: https://www.acer.europa.eu/Official_documents/Publications/Annexes%20to%20PCI%20monitoring%20report_2020/2020_ACER_PCI_Monitoring_report_Annex_1_ele_NON-confidential.pdf.

[407] ACER (2020b), Consolidated Report on the progress of PCI projects, Annex I Electricity PCI. Retrieved from: https://www.acer.europa.eu/Official_documents/Publications/Annexes%20to%20PCI%20monitoring%20report_2020/2020_ACER_PCI_Monitoring_report_Annex_1_ele_NON-confidential.pdf.

be designed for large projects, with clear and few separated milestones. For these TSO-like projects, Article 10 may lead to a faster permit granting. However, for smaller projects like those covered under smart grids, the procedures related to Article 10 may represent time consuming processes (especially the pre-application procedure).

Public consultation

The project participated in the public consultation on the 3rd PCI list. The project received positive comments. The respondents argued that the cross-border cooperation between Czech Republic and Slovakia will improve the delivery of electricity in both regions ensuring an economically efficient, sustainable electricity system with low losses and high quality of supply and safety and implementation of smart elements into the distribution network([408]). Additionally, the project has its own website (https://www.acon-smartgrids.cz/) with general information. Two contact representatives from the two project promoters are available on the website.

In Slovakia, DSO projects were not involved any public consultation in the past. However, in view of Article 9 of the TEN-E regulation, they have developed planning activities engaging local municipalities, stakeholders and citizens to explain the benefits of the smart-grid projects they are currently developing. The Slovak DSO is organizing events with representatives of the EC to explain how these projects are strategic for the country and have a national and international benefit. The current level of acceptance of these projects is very high. They receive very positive feedback from citizens and local stakeholders. Their idea in this public consultation process is to use municipalities as front runners to advocate for the project with the local communities.

In the case of the Czech Republic, national regulation defines the public consultation requirements. The TEN-E public consultation requirements complement those needed by the national regulation. The PCI status is seen as beneficial by the Czech DSO for communication purposes, especially with public authorities. Additionally, it is commented that the PCI status attracts more media attention into the project, with favourable opinions in general.

Regulatory incentives

No regulatory incentives were applied to the project.

Administrative burden

The extra costs of the TEN-E regulation (for a PCI project vs. a regular project) are the following:

- Application process for PCI;
- Reporting and monitoring requirements;
- Coordination and cross-border cooperation.

All these require time and travelling expenses that would not have been incurred if the project had not applied for PCI. However, it was mentioned that it was too early to monetize these costs.

According to the representative of the Slovak DSO, the TEN-E regulation benefits outweigh its costs. For a DSO, an eminent regional business with very little or no international exposure at all, having participated in these TEN-E procedures has provided them with a very valuable international experience. They have gained experience in international cooperation with a foreign DSO, with EU authorities and institutions like the EIB. This will be of high value when they pursue future large projects with an international perspective.

CBA: Costs and benefits of the projects

No detailed costs and benefits have been accessible for the project (at least, at its current stage) from public documents and from direct consultation to the project promoters. This seems to be an evidence of the lack of transparency that has been pointed out in targeted surveys and interviews by the stakeholders regarding the PCI selection process in the regional groups. The insufficient

([408]) Public Consultation on Smart Grids projects for PCI list. https://ec.europa.eu/info/consultations/consultation-candidate-projects-common-interest-smart-grids_en.

detailed documentation of projects CBA assessments and the regional groups assessments and decisions impedes traceability and transparency.

The Joint Research Centre of the EC performed an evaluation of smart grid projects candidates for the third PCI list in 2017([409]). The report aimed to assist the smart grids Regional Group in proposing PCIs. According to this document, the total societal benefits of the project for the concerned region are EUR 41.8 million with a B/C ratio of 1.6. The breakdown of costs and benefits is not available.

Yet, in the project evaluation, the main costs associated with the project deployment are listed and include smart technologies related to new substation dispatching control and protection system (remote control, cabling, voltage regulation, intelligent metering system, smart distribution board, reclosers, platform for demand side management, etc.); smart technologies related to communication and network management, including smart meters (new dispatching model, optic wires, smart meters, high speed PLC communication, intelligent algorithms for network management, etc.); modernisation of current cross-border MV and HV power lines, and construction of new cross-border MV power lines for increase of network capacity for new network users.

The project is expected to deliver a set of benefits that includes: reduced maintenance costs of assets, reduced cost of equipment breakdowns, deferred distribution capacity investments due to consumption reduction, deferred distribution capacity investments due to peak load shift, reduced electricity technical losses, electricity savings due to consumption reduction, electricity savings due to peak load transfer, increased value of service due to reduced outage times, recovered revenue due to reduced outages, reduced CO2 emissions due to reduced losses, reduced CO2 emissions due to wider diffusion of low carbon generation sources and reduced fossil fuel usage. Furthermore, the project lists a set of non-monetised benefits such as reduced air pollutants due to reduced line losses and wider diffusion of low-carbon generation sources, reduced soil occupation, lower threat to animal species and reduced visual impact of any new distribution lines.

Although the cost breakdown of the ACON project activities is available, since the ACON project involves the Czech DSO EON Distribuce and the Západoslovenská Distribučná is partially state-owned, they need to discuss internally and between the two project promoters what information can be disclosed.

The project is at a very early stage to assess any effects derived from it and evaluate its expected benefits, according to the representative of the Slovak DSO.

Cross border cost allocation (CBCA)

CBCA does not apply to smart grids projects.

Financing of the project

The ACON project has been co-financed by the Connecting Europe Facility (CEF) of the European Funds([410]). The grant agreement was signed in January 2019 corresponding to call of proposals from 2018 by the INEA for the CEF funds. The project received a maximum EU contribution of EUR 91,237,868, corresponding to 50% of the EUR 182,475,736 maximum eligible costs. The Action fully implements the PCI with an implementation schedule from October 2018 to December 2024([411]).

([409]) JRC (2017a), Evaluation of Smart Grid projects for inclusion in the third Unionwide list of Projects of Common Interest. Retrieved from: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC107348/jrc_smart_grid_pci_science_for_policy_report_2017_qk_final.pdf.

([410]) CEF Energy Projects and Actions. https://ec.europa.eu/inea/connecting-europe-facility/cef-energy/cef-energy-projects-and-actions.

([411]) INEA (2019), Connecting Europe Facility – ENERGY - Supported Actions - May 2019. Retrieved from: https://ec.europa.eu/inea/sites/inea/files/cefpub/cef_energy_brochure_2019-web.pdf.

According to press releases from the two DSO project promoters([412]) ([413]), they value very positively the granting from EU of EUR 91.2 million for the project execution and financing.

According to both representatives of the Slovak and Czech DSOs, the project would not have been implemented as it has without the CEF funding. Some investments may have been performed, but not all of them and they would have happened in a longer time period.

Case study – TransPorts

Main messages of the case study

PCI project 12.3 CO2TransPorts offers valuable insights into the application of the various components of the TEN-E Regulation on a relatively novel thematic area and the suitability of the Regulation for addressing new challenges in these areas, in this case cross-border carbon dioxide networks. The project is unique for connecting, and therewith facilitating cooperation between competing ports.

Based on desk research and stakeholder consultation, the following main conclusions can be drawn:

1. The main incentive for the project promoter to apply for PCI status was the possibility to gain access to CEF funding. Through national regulation in the Netherlands the Dutch part of the project, which forms the basis of the system, would have been granted a similar priority status as resulting from the TEN-E Regulation. Moreover, CO2 projects are not eligible for other specific incentive provisions such as CBCA or regulatory incentives;
2. Cross-border carbon dioxide networks differ considerably from electricity and gas projects but they are treated the same. The project promoter experiences difficulties concerning application and compliance due to forms and guidelines being initially designed for electricity and gas projects. The following difficulties are highlighted:
   - For CO2 projects storage and transport are closely connected, making it difficult for project promoters to separate the two in their reporting. Currently, a PCI status can only apply to the pipeline connecting carbon dioxide sources with storage sites, not the storage site itself;
   - A period of two years for PCI status may be short for CO2 networks: the realisation of CO2 networks is a long-term process and market circumstances are relatively stable;
   - Guidelines and templates for CO2 networks are not available: project promoters for CO2 projects have few standardised forms to their disposal concerning application and compliance and general forms usually contain questions that are not applicable to CO2 PCIs. As a result, although the benefits through grants are considered to outweigh the costs, the administrative burden is considered to be unnecessarily high;
   - The need for specific CBA methodology that captures the decarbonisation effects of cross-border carbon dioxide networks is highlighted in this case study: using the current methodology, the assessment of the project is considered to be less relevant and inaccurate.

Introduction

For certain industry sectors, CCUS is currently the fastest way to substantially reduce CO2 emissions with relatively low costs. CCUS is an important technique especially for the chemical sector, hydrogen producers and refineries to significantly increase sustainability of their production process in the short term, while working on fundamental and structural innovations to production processes for the long term. The CO2TransPorts project is a planned infrastructure project involving an onshore pipeline through the Port of Rotterdam, continuing offshore to be connected to empty gas fields beneath the North Sea. CO2 that is captured by various industrial companies in the port area will be supplied to the collective pipeline running through the Rotterdam port area, to

([412]) Project promoter E.ON Distribuce (DSO CZ) press release. https://www.eon-distribuce.cz/sites/default/files/2020-03/TZ_EON%20z%C3%ADskal%20ze%20zdroj%C5%AF%20EU%20rekordn%C3%ADch%2091%20milion%C5%AF%20EUR.pdf.

([413]) Project promoter Západoslovenská distribučná (DSO SK) press release. https://www.zsdis.sk/app/novinky/Energeticky-projekt-ACON-ziskal-z-EU-zdrojov-vyse-90-milionov-EUR.html.

be transported through the offshore pipeline to a platform in the North Sea and to be stored in the empty gas fields.

The main trajectory (Port of Rotterdam to gas fields in the Dutch part of the North sea) is planned to be connected with a further connection to empty UK gas fields and an antecedent connection from the North Sea Port (Gent, BE) and the Port of Antwerp (Antwerp, BE). These expansions make it a cross-border activity, creating the eligibility for a PCI status. The PCI status was granted to CO2TransPorts for addressing the needs to establish the necessary infrastructure to facilitate the large-scale capture, transport and storage of CO2 from three of the most important ports of Europe([414]).

The project was initiated around 2017 when it was granted its first PCI status in the 3rd PCI list. Before 2017 only the main trajectory was being investigated and the interconnection with the UK was initiated to become eligible for the PCI status and consequentially for gaining access to CEF funding. Towards the 4th PCI list, the trajectory was further addressed and expanded to connect BE ports onshore towards Rotterdam, while the interconnection with the UK was later removed at its re-entry to the list, resulting in a NL-BE hosted project listed in the 4th PCI list. The project is unique for connecting, and therewith facilitating cooperation between competing ports.

General information

CO2Transports is a system of multiple pipelines proposed to be developed in three distinct phases, each realising a separate section of the system. The following phases are distinguished, the first phase is currently adopted in the PCI list [https://ec.europa.eu/energy/maps/pci_fiches/PciFiche_12.3.pdf]:

1. The development of CO2 transport and storage infrastructure at the Port of Rotterdam (NL). This involves the development of:
    a. An onshore pipeline through the Port of Rotterdam (functioning as an open, collective system for all users) with a diameter of 900 mm or 1080 mm and a maximum length of 33 km, operating under a pressure between 15 and 40 bar;
    b. A 20 MW compressor station that will operate at a pressure of about 30 bar at maximum. The compressor station brings the CO2 for the offshore transport pipeline to pressures at a maximum of 120 bar;
    c. An offshore pipeline with a length of approximately 25 km, a diameter of up to 600 mm and an operational pressure of maximum 120 bar to access the P18 gas fields for CO2 storage.

The expected date of the commissioning of this phase is currently estimated at 2023.

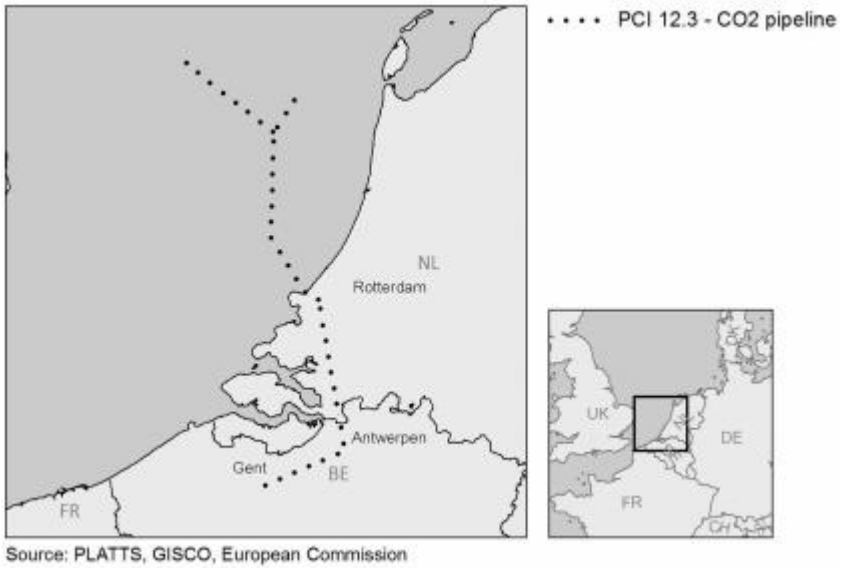
2. An approximated 150km long cross border CO2 pipeline connecting the North Sea Port (BE), the Port of Antwerp (BE) and the Port of Rotterdam (NL). A CO2 pipeline collection network will be developed in Antwerp and North Sea Port and through an interconnection between the three ports, the CO2 sources in Belgium will be connected to Rotterdam. This infrastructure provides access to CO2 storage sites in the North Sea for Dutch and Belgian sources; however, to achieve this, additional offshore pipelines must be developed. The planned commissioning date for phase 2 is currently set on 2026;
3. The CO2TransPorts consortium has projected that under reliable economic and regulatory conditions, the total CO2 transport demand from the 3 regions may exceed the maximum design capacity of Phases 1 and 2 of 10 Mt/year. Furthermore, demand for CO2 transport may arise from third-party countries needing access to offshore storage sites. In order to prepare the necessary capacity (pipelines and storage), this phase will start with a pre-feasibility study. The results will be input for decisions on pipeline dimensioning and storage capacity within Phases 1 and 2. Realisation of Phase 3 is expected from 2030. Expected realisation of phase 3 is currently estimated at 2030+.

The TEN-E Regulation was, in contrary to the TEN-T regulation, initially not known with the project promoter. When TEN-E was mentioned in a research proposal, positive former experiences with the TEN-T regulation and specifically the potential access to CEF funding through the Regulation were the reason to apply for a PCI status. PCI listing and TEN-E information is currently focussed on the

([414]) https://ec.europa.eu/info/sites/info/files/detailed_information_regarding_the_candidate_projects_in_CO2_network_0.pdf.

realisation of **phase 1** only. Both entries in the 3rd and 4th list provide information on phase 1 only, while indicating various forms of international cooperation (Figure 1 – CO2TransPorts trajectory).

Figure 0.3 CO2TransPorts trajectory



Sector: CO2
Name of case study: CO2TransPorts: infrastructure for large-scale capture, transport and storage of CO2 from Rotterdam, Antwerp and North Sea Port
PCI Code: 12.3
Project promoters: Havenbedrijf Rotterdam N.V. (NL)
Regional Group: Cross-border carbon dioxide network thematic area
Project status: Planned but not yet in permitting
Hosting countries: NL / BE

	Date of project launch	1st PCI list	2nd PCI list	3rd PCI list	4th PCI list
expected date of commissioning	2023	-	-	2023	2023
planned capacity	4-10 Mt per year	-	-	4-10 Mt per year	4-10 Mt per year
planned route	From Port of Rotterdam via P18 to offshore P15, Q1, P01-FA and Earlham clusters (UK).	-	-	From Port of Rotterdam via P18 to offshore P15, Q1, P01-FA and Earlham clusters (UK).	Onshore from North Sea Port via Antwerpen to Port of Rotterdam (open system). Offshore from Maasvlakte to Platform P18-A in the centre of P18 gas fields
estimated investment cost	400-500 million Euro	-	-	400-500 million Euro	400-500 million Euro

The CO2TransPorts project is referred to by various names as a result of the development of the project plans over the past years:

- The Project Promoter, the Port of Rotterdam (Havenbedrijf Rotterdam N.V.), generally refers to the main, Dutch part (phase 1) of the project as "Porthos";

- After expanding the project towards its first international context, the project gained its first status as PCI with its entry to the 3rd PCI list in 2017. The project was listed as a NL-UK hosted project under the name "The Rotterdam Nucleus". The trajectory was planned to be expanded from the NL empty gas fields onwards to empty UK gas fields;
- Making its entry in the 4th PCI list, the planned trajectory is adjusted: "CO2TransPorts" is listed as a NL-BE hosted project, connecting three (among which the two largest) ports of Europe (Port of Rotterdam, Port of Antwerp and the North Sea Port) with the P18 empty gas fields.

Current status of the project is *planned but not yet in permitting*. The feasibility study is concluded positively at the end of 2018. CEF funding (EUR 6,518,350, Percentage of EU support: 50%) is granted in 2019 and used for delivering a CBA and for the currently ongoing Front-End Engineering Design (FEED) that is to be completed in 2020. The FID and the beginning of the planned construction of phase 1 of the PCI are estimated to start at the beginning of 2021.

Permit granting

CO2TransPorts is currently planned but not yet in permitting. However, the PCI status of the project implies the project to be eligible for national coordination in the Netherlands. This means that the project is officially listed as a project of national interest that will then be under coordination of the Minister of Economic Affairs and Climate Policy. The project will therefore receive a form of priority treatment regarding permitting and exemption procedures. However, since Porthos falls under the definition of 'mining works for storage of substances and associated pipelines' it would have been eligible for the same national priority treatment without the PCI status as well.

Due to the current stage of the project, there is limited experience on the permitting part. The project promoter does mention that they currently have come across various difficulties during preparations for permitting but it is difficult to say whether this is due to the priority treatment and the associated procedures because there is no alternative for projects of this type. Carbon dioxide networks in the Netherlands are new in general, making existing procedures difficult to apply directly. The additional attention of the relevant Ministry as a result of the priority status is considered to be beneficial here.

Public consultation

Overall, CCS in the Netherlands (using offshore gas fields) is generally accepted with the exemption of a relatively limited number of parties that have expressed their concerns towards the project. CCS is an important pillar of the national 'climate agreement'.

Stakeholder consultation on the environmental impact assessment resulted in five responses among which two of the responding parties expressed their support to the project, one party reacted neutral (focussing on highlighting specific considerations) and only two parties that advocated against the project. The main reason for resistance towards the project seems to be based on CCS enabling the future continuation of industrial processes with a negative environmental impact.

The majority of the media coverage concerns viability of the projects, mentioning financial aspects such as subsidies (CEF or national subsidies) and potential clients declaring their dedication towards the project.

The project promoter mentioned that the PCI status and with that the EU expressing their support towards the project does to some extent contribute to the public acceptance of the project.

The trajectory of the CO2 network is limited to an industrial area within the port of Rotterdam. This means a limited number of stakeholders are directly affected.

Regulatory incentives

CO2 networks are not regulated. Regulatory incentives in the TEN-E Regulation specifically target regulated sectors (electricity and gas).

Administrative burden

Overall the administrative burden is considered to be heavy but both acceptable and understandable. The application and compliance parts of the administration associated with the Regulation are experienced differently, each showing specific complications. In the end, the benefits are worth the investment according to the project promoter. However, some thoughts on suitability are shared concerning both the application process and compliance/reporting:

Application:

The application process is a short but intensive process. Although considered not excessive, the project promoter experienced a lack of guidance and definitions for cross-border carbon dioxide networks. Forms and guidelines seem to be based on electricity and gas networks and can be less relevant or applicable to other sectors. Important factors affecting the suitability are:

- CO2 is a waste product, where most procedures and guidelines are based on commodities like electricity or gas;
- There is no market for CO2 transport and the projects are very locally oriented in facilitating CCS in industrial clusters, instead of being part of an international, integrated market;
- There is no regulator for carbon dioxide networks.

PCI status expiring after two years is considered to be too short. The lead time for Porthos is seven years and over 10 years for the full cross-border CO2TransPorts projects. Keeping in mind that the market landscape of CO2 networks is relatively stable this implies that renewing the application every two years may be unnecessary. According to the project promoter a period of four years would be more suitable for cross-border carbon dioxide networks. The project promoter suggested that an option could be introduced to extend the application instead of renewal.

Estimating the labour costs for the PCI list application, the project promoter speaks in terms of weeks concerning full-time work of a small team together with an external consultant. The following specific costs have been estimated by the project promoter concerning a single PCI- and CEF-application process individually, based on an hourly rate of EUR 110:

Table 0.6 Breakdown of estimated administrative costs for PCI- and CEF-applications

	PCI application		CEF application	
Cost category	*Hours spent*	*Costs [EUR]*	*Hours spent*	*Costs [EUR]*
External consultant	-	42 000	-	40 000
Internal labour costs	232	25 520	328	36 080
Workflow leads	56	6 160	56	6 160
Total		**73 680**		**82 240**

Compliance and reporting:

The administrative burden for compliance and reporting is continuous and heavy, according to the project promoter. It is specifically mentioned that the demands for yearly progress reporting for both PCI and CEF largely overlap, doubling the burden of this overlap while the output remains the same.

While estimating labour costs for the compliance and reporting the following continuous yearly costs have been reported, based on an hourly rate of EUR 110:

Figure 0.0.1 Breakdown of estimated yearly administrative costs for compliance and reporting

	Compliance and reporting	
Cost category	*Hours*	*Costs [EUR]*
Compliance officer	208	22 880

Team input	260	28 600
Total		**51 480**

CBA: Costs and benefits of the projects

CBAs have been composed and submitted for the specific purpose of applying for the PCI list and the CEF fund. The CBA reports are not publicly available and no additional project-specific CBA has been made.

The main contribution addresses climate and energy targets: decreasing CO2 emissions by capturing the CO2 that is emitted by industrial clusters in the ports and storing this in empty gas fields beneath the North Sea. The onshore system will be open, enabling all interested industries to benefit from CCS. Additionally, production of blue hydrogen is an important beneficent because of the relatively easily captured CO2 from the process and because of the positive environmental impacts of the usage of hydrogen in industrial processes.

For similar reasons mentioned under the administrative burden section, the CBA procedures for both PCI and CEF applications is experienced to be not fully suitable for cross-border carbon dioxide transport. The project promoter mentioned that there was no suitable template available. An important problem that the project promoter experienced is the lack of the societal aspects of the costs and benefits which concerns a key aspect of the purpose of CO2 projects. In practice, aside from the price per ton of reduced CO2 emissions via ETS there are no guidelines on how to quantify other (societal) aspects.

Cross border cost allocation (CBCA)

CBCA not applicable([415]).

Financing of the project

CEF Funding: Yes
Date: 15 February 2019.
Awarded amount of grant: EUR 6,518,350
Percentage of EU support: 50%
Type of granted action: Work (delivering the FEEDs and delivering an elaborate CBA)

Public funding is essential according to the project promoter. For CO2 there is a clear financial gap: ETS versus costs of CCS. Decreasing this gap is important for industry to implement CCS. When looking forward it is more efficient to build a bigger system than strictly necessary but the subsidy mechanism in the Netherlands does not compensate the oversizing of the project. The additional role of the EU is deemed essential here.

The project promoter mentioned a specific gap in the Regulation: storage is not defined as infrastructure. Storage is key in a CC(U)S and CO2 transport project. Leaving this section from all applications is not only difficult (CAPEX can be split but other costs such as labour or research are too much intertwined) but also inconsistent since the network is useless without also creating the storage capacity.

[415] European Commission (2020l), Project of Common Interest 12.3 PCI Implementation Plan. Retrieved from: https://ec.europa.eu/energy/maps/pci_fiches/PciImplementationPlan_12.3.pdf.

ANNEX III MODELLING METHODOLOGY AND RESULTS

In this section the social economic benefits of the Regulation are assessed, which are measured as the benefit of commissioning the PCI projects to the European markets. Benefits are monetised **separately for gas and electricity markets**. This section presents the modelling results and main messages derived from them, first for the European gas market and then for the electricity market.

The key objective of the TEN-E Regulation was the development and interoperability of trans-European energy networks and connection to such networks by timely implementation of PCIs which interconnect the energy markets across Europe. The objective was that PCIs lead to market integration, to better integration of renewable energy sources, improved security of supply and higher competition within markets that lowers prices.

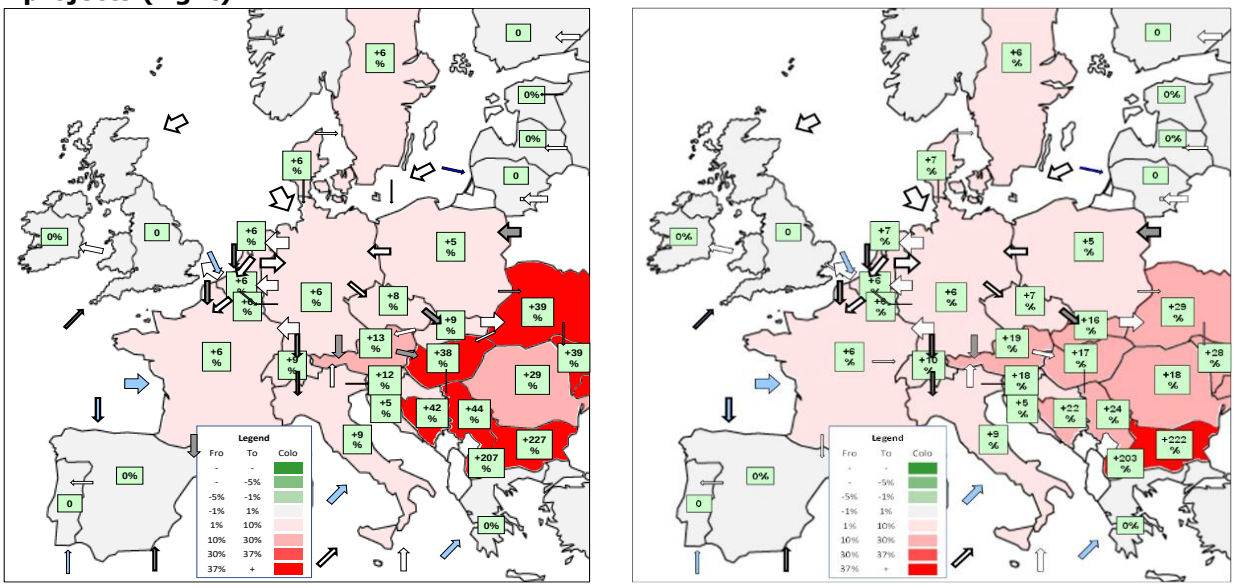
III.1 Modelling of the gas market

Introduction: market environment in the past few years

At the time when the Regulation came into force in the field of **natural gas security of supply concerns were setting the agenda** (see for example the SOS Regulation, the SOS Strategy, ENTSOs' Reports on System Resilience). The major concern was related to supply disruptions related to repeated disruptions of gas supply by Russia, most severe of them occurred in January 2009.

The following maps illustrate the modelled price effect of security of supply disruption, and the positive effect that the already commissioned PCIs would have eventuated if they had been commissioned at the time when the Regulation came into force. A 100% supply cut of Russian deliveries through Ukraine during a whole month in January was modelled assuming 2013 market circumstances. Figure 0.4 below shows the modelled price increase in January due to this supply cut (on the left-hand side), and that how it could have been moderated by the already commissioned PCIs if they had been commissioned that time (on the right-hand side).

Figure 0.1 Wholesale price increase (%) due to a supply cut through Ukraine assuming the 2013 market infrastructure (left) and added also the already commissioned PCI projects (right)



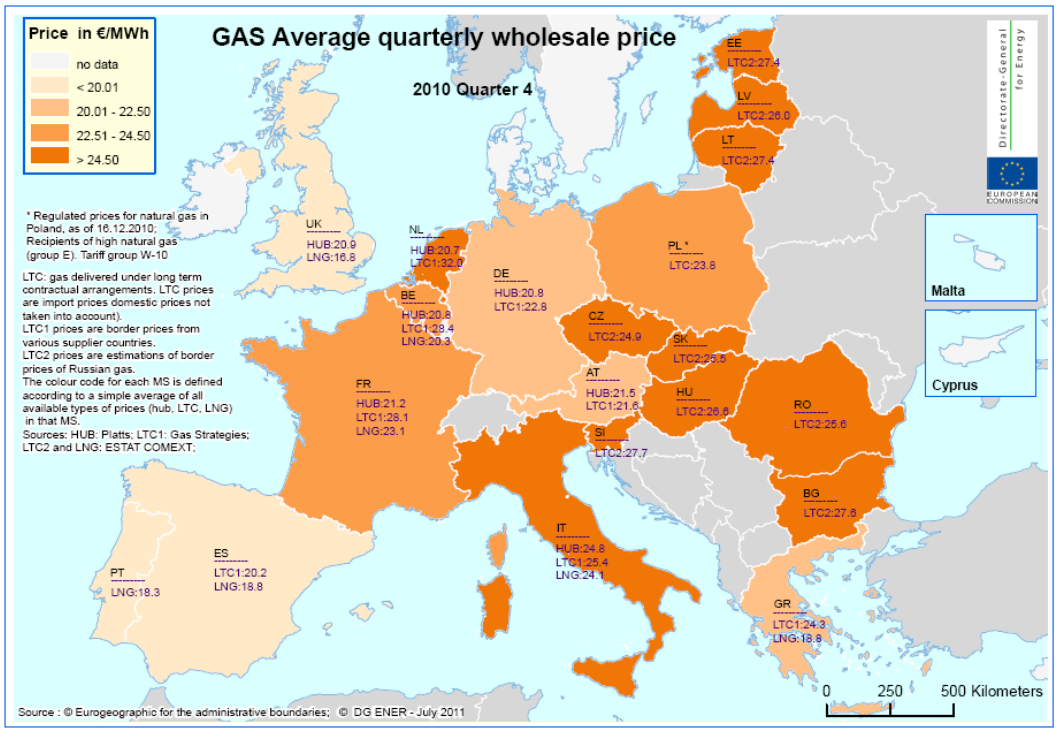
Source: REKK modelling.

It can be seen on the maps that a supply cut through Ukraine resulted in significant price increase, mainly in the CSEE region. It is also visible that the already commissioned PCI projects would have significantly moderated this price increase. This suggests that these projects would have resulted in significant SOS benefits in 2013.

The fragmented structure of the network left certain Member States isolated from the interconnected EU transmission system. Isolation of gas markets was the most pressing need identified for the Baltics and Finland (BEMIP).

The limited interconnectivity between member states allowed for large differences in the wholesale gas prices resulting in a high margin in the new Member States, that were typically sourcing their gas from a single source.

Figure 0.2 Average quarterly wholesale gas prices in Europe, 2010Q4



Source: Quarterly Report on the European Gas markets.

Investments in 2010-11 into the network were predominantly related to new import pipelines (from Russia, Libya, Norway and Algeria) and LNG terminals, to a large extent exempted from third party access rules. New interconnectors between member states were rare, and typically also exempted (e.g. OPAL, BBL)([416]). Therefore, the need for interconnections that can contribute to market integration was crucial. Most of the newly built interconnectors since 2010 in the gas system were PCIs and supported by CEF (or by other EU grants). Without this support most of them (or maybe any of them) would not have been built.

Besides TEN-E, other EU legislation and actions were also targeting to support the general goals of security of supply. Most important from an infrastructure point of view is the SOS Regulation provision on the need to introduce reverse flow between Member States. The reverse flow projects on existing pipelines did not only contribute to the security of supply goals but also contributed to market integration and price convergence, allowing gas to flow from the cheaper to the higher priced markets.

Investment into infrastructure provided the necessary hardware, but creating the internal market needed the development of software – regulatory tools - as well. In addition to infrastructure, the gas network codes (on capacity allocation, congestion management, transmission tariff setting,

([416]) European Commission (2011), Commission Staff Working Paper: Impact assessment, Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC. Retrieved from: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:1233:FIN:EN:PDF.

balancing and interoperability) and the competition cases investigated by the EU contributed to what was achieved by 2020. Nowadays a resilient gas network has been developed, where gas prices are correlated and infrastructure capacities are auctioned and used to provide the necessary flexibility to the market([417]).

There is a general consensus that the gas market today is much more resilient to supply shocks than it was in 2009. A good example for that is the March 2018 price hike on the European hubs. The unprecedented high prices on European gas exchanges was a result of a combined supply and demand challenge: Norwegian fields dropped out, Russian-Ukrainian scheduled gas deliveries were cancelled by Russian side (as a response to the unfavourable decision on the Arbitration case between Naftogas and Gazprom) and additionally below average low temperature was combined with low storage levels at the end of the winter. The high prices were giving clear signals to the market participant about where the gas was most needed, and the market reacted. There were no curtailments of vulnerable consumers needed, and the high prices prevailed only for a few days.([418])

Global market developments also contributed to the favourable changes on the EU gas market. The oversupply on the European and on the global gas market has coincided with substantial gas demand drop in the EU due to the financial crisis but also due to energy efficiency and renewable energy policies.

Due to partly the regulatory scrutiny of the third package but mainly to the competition of the few suppliers to the EU (pipeline and LNG) the contractual conditions in the EU changed dramatically: shorter contracts on smaller volumes are priced on (now liquid) hubs rather than on oil, with delivery points on hub and not on borders([419]). As a consequence, more short-term trade and better utilization of the existing infrastructure happens.

The very favourable EU gas market conditions (including prices that are converged) are no doubt a combined impact of TEN-E, the SOS Regulation, the Network Codes, energy efficiency investments, demand drop due to the crisis and favourable global market conditions. The latest Quarterly Report on the Gas markets reports unprecedentedly low wholesale gas prices that are about 50% lower than those reported in 2010.([420])

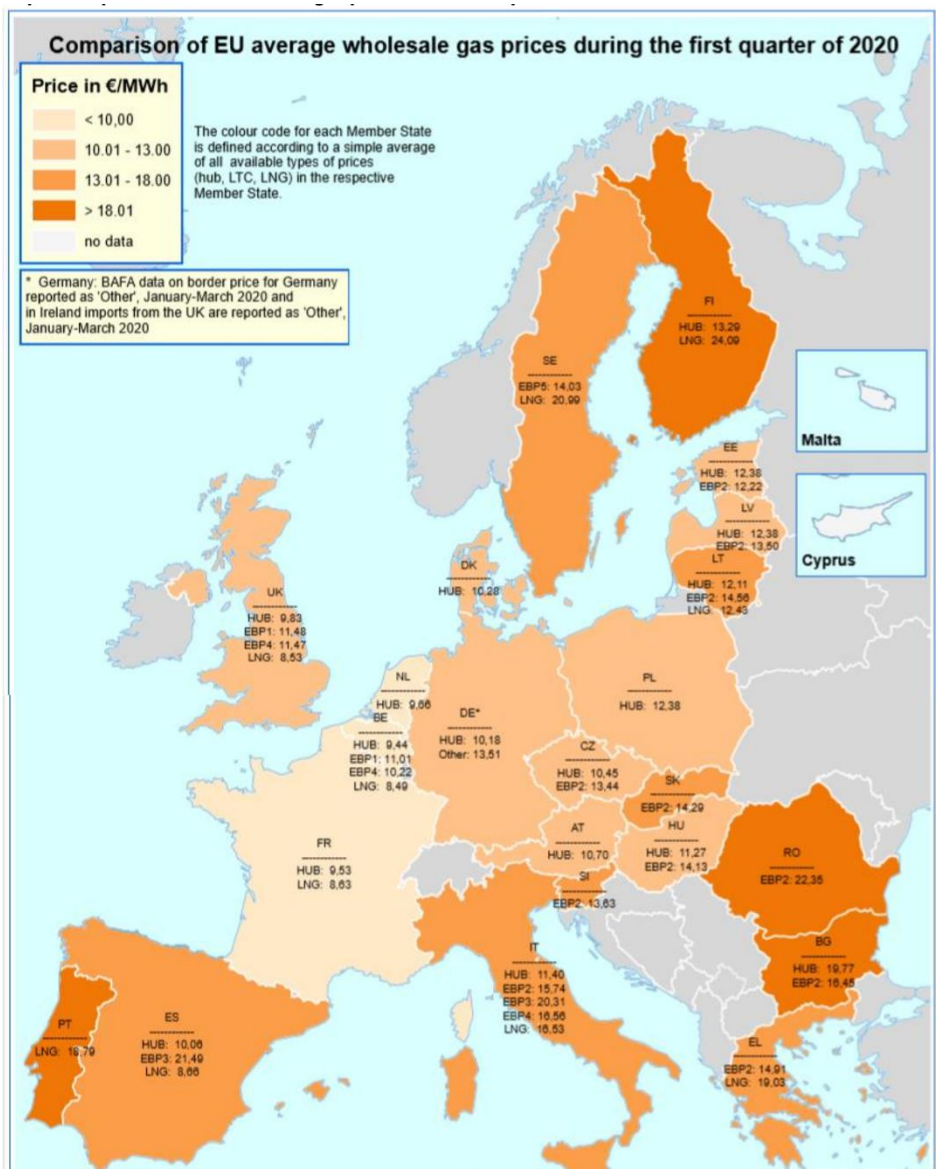
[417] ACER (2019f), Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2018. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202018%20-%20Electricity%20Wholesale%20Markets%20Volume.pdf.

[418] Kotek, P. Takácsné Tóth B. & Mezősi A (2018), What caused the March 2018 price hike on TTF? Rekk Policy Brief 2/2018.

[419] OIES, ACER.

[420] European Commission (2020m), Quarterly Report on European Gas Markets - Market Observatory for Energy. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/quarterly_report_on_european_gas_markets_q1_2020.pdf.

Figure 0.3 Average quarterly wholesale gas prices in Europe, 2020Q1



Source: Quarterly Report on the European Gas markets Q1 2020.

Our previous modelling results([421]) support the general understanding that the current gas infrastructure is in general well equipped to supply market needs already today, it allows access for a wide range of supplies and it is resilient to a number of disruption cases.([422])

There are no isolated markets in the EU and the market players can make good use of the substantial LNG terminal and storage capacities when market circumstances are favourable, as in 2019-2020.

As the policy of the EU shifts from security of supply to more sustainability and decarbonization, the future outlook of the gas markets has also changed dramatically. At the time when the TEN-E

[421] Quo vadis, LNG study.
[422] ENTSOG (2017), Ten Year Network Development Plan 2017, https://www.entsog.eu/publications/tyndp#ENTSOG-TEN-YEAR-NETWORK-DEVELOPMENT-PLAN-2017.

Regulation was drafted the market forecasts were predicting a gas demand increase in the EU, which has also changed, first to forecasts referring to high unpredictability of gas demand, but lately to a consensus on decreasing or at the most stagnating gas demand.

The remaining and already well-identified infrastructure needs are primarily in the Eastern Baltic Sea region, the Central and South-Eastern part of Europe.([423])

There is a consensus that not much has to be done or built as "large-scale energy infrastructure projects require a cautious approach to new investments in the gas sector in order to avoid over-investment and additional costs for consumers".

In the following the social economic benefits of the Regulation on the EU gas markets are assessed via market modelling. The benefit of the Regulation is measured as the benefit that the commissioning of the PCI projects would bring to the European markets.

Modelling methodology

Modelling tool
The evaluation of the gas PCI projects was carried out based on market modelling using EGMM model of REKK. For a short description of this model see Section 2.5.5.

Main assumptions on input data
The summary of input data and the sources used are presented in the table below.

Figure 0.4 Input data and sources used for EGMM

Input data	Unit	Source	Comment
Yearly gas demand	TWh/year	Primes EUCO 3232.5	
Monthly demand	In % of yearly	Eurostat	
Production	TWh/year	Primes EUCO 3232.5	
Pipeline Capacity	GWh/day	ENTSOG capacity map 2019	For future projects ENTSOG TYNDP 2020
Pipeline Tariff on IP	EUR/MWh	Regulators websites as of 2020	REKK calculation
Storage capacity	Working gas: TWh, Inj.. withdr: GWh/day	GSE	Data on each storage site – than aggregated on a country level
Storage tariff	EUR/MWh	Storage operators websites 2019	Capped by average winter-summer spread observed
LNG regas capacity	GWh/day	GIE 2019	Aggregated on a country level
LNG regas tariff	GWh/day	Operators websites	Entry into pipeline network is taken into account
LNG liquefaction	GWh/day	GIIGNL 2019	Source is constrained by liquefaction capacity
LNG transport cost	EUR/MWh	REKK calculation	Distance based. Takes into account ship rates and boil off cost
Long term contracts	ACQ: TWh/year. DCQ: GWh/day	REKK collection from press + Cedigaz	Delivery point on borders. Pricing based on foreign trade statistics. Delivery routes predefined

Infrastructure baselines and analysed scenarios
As the aim is to evaluate the effect of the Regulation, projects are not evaluated one-by-one, but as a whole group. Modelling was carried out for the years of 2020 and 2030, 2020 representing a

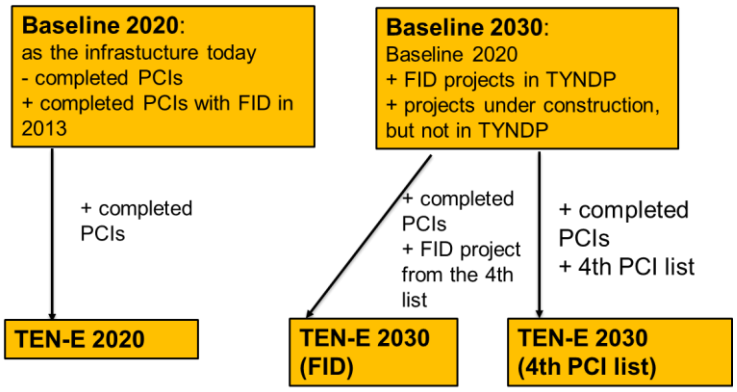
([423]) Artelyys, SET.NAV.

current gas infrastructure situation, while 2030 try to capture a best estimate for the future market situation.

The following scenarios were developed to estimate the monetised benefit of the TEN-E Regulation (PCI projects) in terms of socio-economic welfare change:

- A Baseline (without Regulation) scenario is defined as an infrastructure setup:
  - for 2020 as the infrastructure today: Latest (2019) capacity map of ENTSOs + FID projects of TYNDP 2018 that were planned to be commissioned by 2020 + those that were commissioned in 2019-2020 but are not part of the TYNDP (e.g. Turkish Stream 1), excluding all PCI projects that were commissioned until 1 January 2020 with the exception of those that already had an FID in 2013 (TAP-TANAP-SCPX are included into the Baseline);
  - For 2030: as the infrastructure for 2020 + FID projects of the TYNPD 2018 to be commissioned between 2020 and 2030 + the projects under construction that are not part of the TYNDP (e.g. Nord Stream 2, Turkish Stream 2).
- A 'TEN-E scenario' is compared to this baseline scenario: a market situation assuming the infrastructure of the baseline scenario plus:
  - for 2020 the already commissioned PCI projects up to now (TEN-E 2020);
  - for 2030 the 2020 setup + The PCI projects with an FID. (TEN-E 2030 FID).
- As a more forward-looking approach, the overall effect of the PCI projects already implemented and all the projects on the 4th PCI list are analysed (TEN-E 2030 4th PCI).

Figure 0.5 Summary of the analysed scenarios

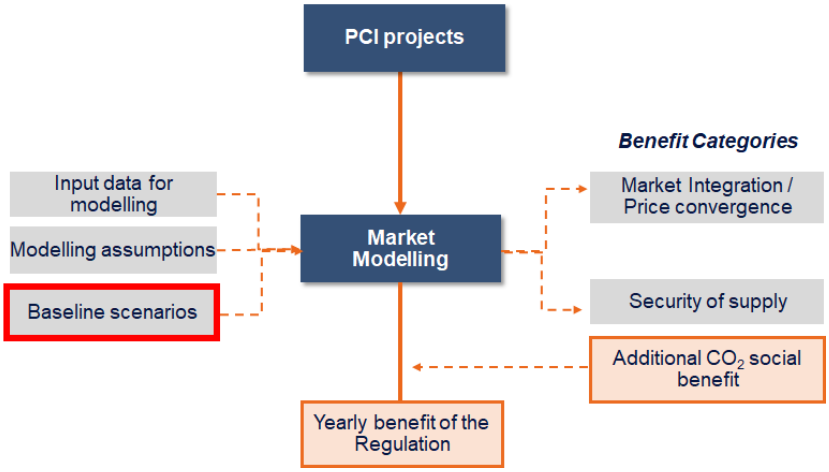


The difference of total social welfare between the TEN-E and Baseline scenarios gives the yearly benefit of the Regulation (brought by commissioning of PCIs) assuming a 2020 and 2030 state of the word.

Methodology for welfare analysis
Regulation 347/2013 aims to carry out a methodologically sound socio-economic cost-benefit analysis, and requires that market integration, security of supply and sustainability impact of the infrastructure should be monetised. The modelling approach meets this requirement and is in line with the ENTSOG project-specific CBA methodology as far as possible.

An important difference however is that ENTSOG models the PCI projects separately in clusters, and hence may overestimate the benefits of the projects by not considering the substitutability of certain projects in this report PCI projects are analysed together as a group.

Figure 0.6 Conceptual framework for monetizing the benefits using gas market modelling



During the modelling we follow the total welfare approach (welfare is quantified for all stakeholder groups including consumers, producers, traders and infrastructure operators) and incremental approach (total welfare change is measured by modelling the with and without the PCIs).

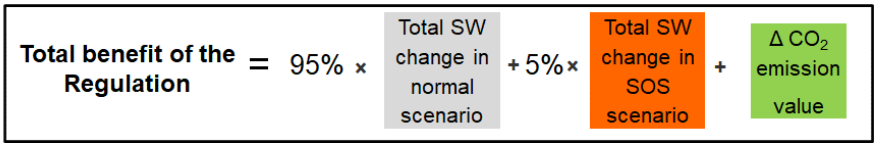
Changes in all welfare components due to price and flow changes in the TEN-E scenarios (when PCIs are included) compared to the Baselines capture the **market integration benefits and partly the competition related benefits**.

The **security of supply benefits** are measured by the change in welfare in the case of a modelled gas supply disruption. This disturbance is assessed as a 100% reduction of the riskiest delivery route of Russian long-term contracts in January for one month (on the Ukrainian route in 2020 and on the Turkish route in 2030). The difference in welfare between supply shocks scenarios with and without the projects represent the SOS benefit of the evaluated PCIs.

To calculate the aggregate change in socio-economic welfare for a given year due to the evaluated PCIs, we calculate the weighted sum of project related welfare changes under normal and SOS conditions. Weights are the assumed probabilities for normal and SOS scenarios to occur: 95% normal, 5% supply disruption – assuming a 1 in 20 probability of disruption.

Sustainability benefits are estimated by the reduction in greenhouse gas emissions. For gas infrastructure projects, this is estimated by multiplying the corresponding change in the countries' CO2 emissions with an exogenous carbon value. The modelled change in gas demand alters the average primary energy mix without crowding out renewables. To monetize these effects, a price for CO2 emissions was set to EUR 19.7 per tonne in 2020 and EUR 27 tonne in 2030.

Figure 0.9 Calculation of benefits due to the Regulation (SW= social welfare)



It must be noted that **this modelling approach is quite conservative** (might underestimate the benefits) because of the following reasons:

- Only the expected effects in 2020 and 2030 are captured: the benefits which were realized in the past years without other (not-PCI) infrastructure and in a higher price environment are not taken into consideration;
- Calibration to 2019 prices underestimates benefits: Building a large transmission project (or even a small cross-border section) has a long lead time. When investors take decisions on them, they will certainly make assumptions to their best knowledge on the future and try to address real market needs and real infrastructure constraints. When looking back to the last decade it must be noted that there were quite a few unexpected events that were not foreseen by anyone and that were beyond the control of the European TSOs. Just to name a few: a natural disaster in Japan (the Fukushima accident), technological

breakthrough (the shale gas revolution in the US), geopolitical turmoil (the Annexation of Crimea), and the CoVID pandemic, that all had tremendous impact on gas prices and on the energy policy in the EU. These sorts of events make any static modelling difficult. Would we calibrate the model to 2010 price situation we would certainly overestimate the benefits of the commissioned PCI projects, but as we calibrate them to 2019 prices the benefits for the projects that are in place since e.g. 2015 are for sure underestimated. As we do take a conservative approach, we do the latter;

- Competition effect only party included: the additional benefit from the exporters' price discount is not quantified. The abundant capacity on a system is not necessarily bad: it provides room for competition and can also increase the resilience of the system to supply or demand shocks. From the gas consumers point of view: they certainly pay for the more than minimal infrastructure, but at the same time in case of increased competition, even their long-term contracts can be re-negotiated on much better terms. This impact cannot be captured by static modelling. The Russian long-term contracts were calibrated to 2019 fact data, hence renegotiations that might have happened in the last few years partly due to the increased competition due to better interconnectivity could not have been taken into account. Hence the benefits here are again underestimated;
- Security of supply benefits may be also underestimated as only a reduction on one supply route is taken into account. Other supply risks or demand shocks are not modelled;
- The promoters make independent decisions on their investments, that are most probably based on a simulation that foresees a certain level of utilization of the given infrastructure under the market circumstances that are assumed as their best estimate. Change in the network structure outside of their jurisdiction and consequently change in the dominant flow direction can however shift flows from one internal EU route to another leaving some TSO's system underutilized. There is a significant change in flow in Europe due to the Russian large infrastructure projects (Nord Stream 1, Turk Stream 1 and 2) that had a huge impact on Ukraine and has redirected flows in Central and Eastern Europe. This change in Russian LTC flows can have an impact on the utilization of smaller interconnectors in the future some might receive more flow, some might experience drop of flows. The contribution to SOS goals will certainly also change. This difference will be only partly captured: none of our scenarios is run without Nord Stream 1 and TurkStream1. Any benefits that occurred before these projects were commissioned are not taken into account, as that is not modelled;
- Not all gas infrastructure that has been built in Europe is due to this Regulation, but some of the non-PCI project could have benefitted from commissioned PCI projects. This sort of positive impact we could not capture by modelling. For example, the Klaipeda LNG terminal was not a PCI project, but the pipeline connection to the network was. Here we took again the conservative approach and included the terminal into the baseline and did not assign any benefits to the connecting pipeline;
- When selecting the projects to be analysed all projects where the final investment decision (FID) was taken before the Regulation entered into force in 2013 were excluded. We take the assumption that these projects would have been realized without the Regulation as well. The entire southern corridor (TAP-TANAP-SCPX) were included into the baseline despite being on all 4 PCI list. The benefits related to this corridor are not assigned to the TEN-E;
- Not all projects have been commissioned at the same time. It is a simplification that they are included as a cluster. However, this allows to see their combined impact better;
- EGMM can only capture benefits of projects that have a direct cross border impact, and therefore part of the PCIs that target internal bottleneck or interoperability goals cannot be captured.

Analysed projects

Tables below summarize the PCI projects which were analysed in the different scenarios. It must be noted that only projects with cross-border effect can be evaluated.

Table 0.9 The already commissioned PCIs included into the evaluation

PCI number	Pipeline	From market	To market	Maximum flow (GWh/day)	Year	Cost (million EUR)
5.2	PCI Twinning of Southwest Scotland onshore system between Cluden and Brighouse Bay (United Kingdom)	UK	IE	12.1	2016	93

5.16	PCI Extension of the Zeebrugge LNG terminal	LNG	BE	472	2020	208
5.13	PCI New interconnection between Pitgam (France) and Maldegem (Belgium)	FR	BE	270	2016	186
5.11	Reverse flow interconnection between Italy and Switzerland at Passo Gries interconnection point	IT	CH	429	2018	738
8.1.1	Interconnection Estonia - Finland [currently known as "Balticconnector"]	EE	FI	48	2020	250
8.1.1	Interconnection Estonia - Finland [currently known as "Balticconnector"]	FI	EE	48	2020	
6.3	PCI Slovakia – Hungary Gas Interconnection between Vel'ké Zlievce (SK) – Balassagyarmat border (SK/HU) - Vecsés (HU)	HU	SK	52	2015	170
6.3	PCI Slovakia – Hungary Gas Interconnection between Vel'ké Zlievce (SK) – Balassagyarmat border (SK/HU) - Vecsés (HU)	SK	HU	127	2015	
6.5.5	Compressor station 1 at the Croatian gas transmission system	HR	HU	13.6	2019	25
6.24.1	Pipeline Ruse (BG)-Giurgiu (RO)	RO	BG	1.8	2019	21
	Pipeline Ruse (BG)-Giurgiu (RO)	BG	RO	7.9	2019	
5.10	Reverse flow on TENP	CH	DE	172.8	2018	17.3
Total investment cost (million EUR):						1,708

Table 0.10 The PCIs from the 4th list with FID included into the evaluation

List of FID PCIs						
PCI number	Project name	From market	To market	Maximum flow (GWh/day)	Year	Cost (million EUR)
6.2.1	Poland — Slovakia interconnection	SK	PL	175	2021	143.4
6.2.1	Poland — Slovakia interconnection	PL	SK	144	2021	
6.5.1	Development of an LNG terminal in Krk (HR) up to 2.6 bcm/a– Phase I and connecting pipeline Omišalj – Zlobin (HR)EN 7 EN	LNG	HR	109	2027	234
6.5.1	Development of an LNG terminal in Krk (HR) up to 2.6 bcm/a– Phase I and connecting pipeline Omišalj – Zlobin (HR)EN 7 EN	HR	HU	82	2020	27.3
6.5.5	"Compressor station 1" at the Croatian gas transmission system	HR	HU	14	2019	25
6.8.1	Interconnection Greece — Bulgaria [currently known as "IGB"] between Komotini (EL) and Stara Zagora (BG) and compressor station at Kipi (EL)	GR	BG	90	2020	240
6.8.1	Interconnection Greece — Bulgaria [currently known as "IGB"] between Komotini (EL) and Stara Zagora (BG) and compressor station at Kipi (EL)	BG	GR	90	2020	
6.8.3	Gas interconnection Bulgaria — Serbia [currently known as "IBS"] (6.10 on the 3rd PCI list)	RS	BG	51	2022	48
6.8.3	Gas interconnection Bulgaria — Serbia [currently known as "IBS"] (6.10 on the 3rd PCI list)	BG	RS	51	2022	
6.24.1	ROHU(AT)/BRUA – 1st phase, including: - Development of the transmission capacity in Romani a from Podișor to Recas, including, a new pipeline, metering station and three new compressor stations in Podisor, Bibesti and Jupa	RO	HU	47	2020	478.6
6.24.1	ROHU(AT)/BRUA – 1st phase, including: - Development of the transmission capacity in Romania from Podișor to Recas, including, a new pipeline, metering station and three new compressor stations in Podisor, Bibesti and Jupa	RO	BG	43	2020	
8.2.4	Enhancement of Inčukalns Underground Gas Storage (LV)	Storage	LV	84	2019	88.2
8.5	Poland-Lithuania interconnection [currently known as "GIPL"]	LT	PL	58	2021	458.9
8.5	Poland-Lithuania interconnection [currently known as "GIPL"]	PL	LT	74	2021	
Total investment cost (million EUR):						1,743

Figure 0.0.7 Other (non-FID) PCIs from the 4th list included into the evaluation

PCI number	Project name	From	To	Capacity (GWh/day)	Year	Investment cost, million EUR (TYNDP 2018)
5.3	Shannon LNG Terminal and connecting pipeline (IE)	LNG	IE	86	2022	450

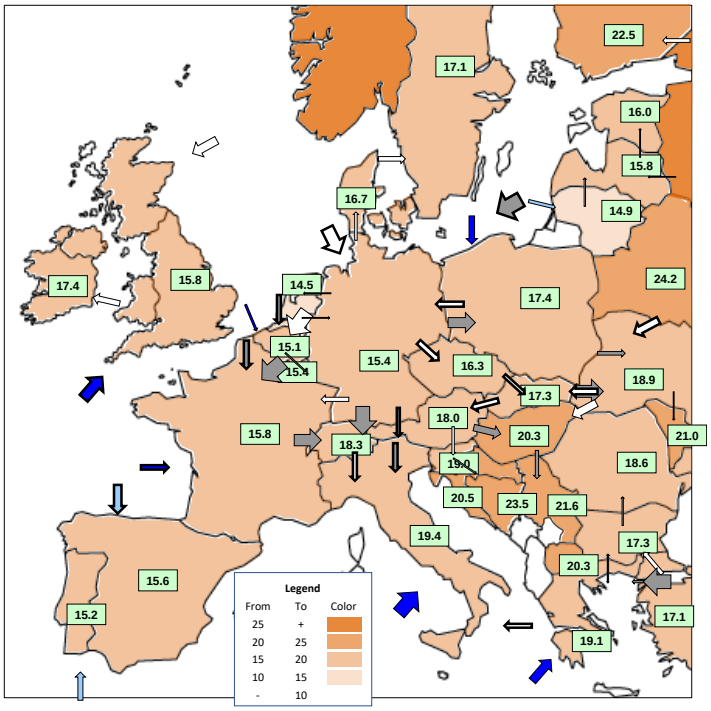
PCI number	Project name	From	To	Capacity (GWh/day)	Year	Investment cost, million EUR (TYNDP 2018)
5.19	Connection of Malta to the European gas network — pipeline interconnection with Italy at Gela	IT	MT	56	2024	342
5.19	Connection of Malta to the European gas network — pipeline interconnection with Italy at Gela	MT	IT	56	2024	
6.2.13	Development and enhancement of transmission capacity of Slovak-Hungarian interconnector	HU	SK	102	2022	58
6.2.13	Development and enhancement of transmission capacity of Slovak-Hungarian interconnector	SK	HU	26	2022	
6.9.1	LNG terminal in northern Greece	LNG	GR	253	2020	300
6.20.2	Chiren UGS expansion (BG)	storage	BG	48	2025	226
6.20.3	South Kavala UGS facility and metering and regulating station (EL) and one of the following PCIs:	storage	GR	44	2023	320
6.20.4	Depomures storage in Romania	storage	RO	15	2024	87
6.20.6	Sarmasel underground gas storage in Romania	storage	RO	45	2024	133
6.23	Hungary – Slovenia - Italy interconnection	SI	HU	12	2023	113
6.23	Hungary – Slovenia - Italy interconnection	HU	SI	12	2023	
6.24.4	ROHU(AT)/BRUA –2nd phase	HU	RO	78	2022	69
6.24.4	ROHU(AT)/BRUA –2nd phase	RO	HU	76	2022	
6.26.1	Cluster Croatia — Slovenia — Austria at Rogatec	SI	HR	162	2023	76
6.26.1	Cluster Croatia — Slovenia — Austria at Rogatec	HR	SI	121	2023	
6.26.1	Cluster Croatia — Slovenia — Austria at Rogatec	AT	SI	105	2023	100
6.26.1	Cluster Croatia — Slovenia — Austria at Rogatec	SI	AT	167	2023	
6.27	LNG Gdansk (PL)	LNG	PL	138	2025	196
7.3.1	Pipeline from the East Mediterranean gas reserves to Greece mainland via Crete	CY	GR	110	2025	5200
7.3.1	Pipeline from the East Mediterranean gas reserves to Greece mainland via Crete	GR	CY	30	2025	
7.5	Development of gas infrastructure in Cyprus [currently known as "Cyprus Gas2EU"]	LNG	CY	40	2022	261
8.2.1	Enhancement of Latvia — Lithuania interconnection	LV	LT	54	2023	20.7
8.2.1	Enhancement of Latvia — Lithuania interconnection	LT	LV	63	2023	4.7
8.3.1	Reinforcement of Nybro — Poland/Denmark Interconnection	NO	DK	307	2022	290

PCI number	Project name	From	To	Capacity (GWh/day)	Year	Investment cost, million EUR (TYNDP 2018)
8.3.2	Poland–Denmark interconnection [currently known as "Baltic Pipe"]	PL	DK	91	2022	485
8.3.2	Poland–Denmark interconnection [currently known as "Baltic Pipe"]	DK	PL	307	2022	
Total investment cost (million EUR):						8,732

Modelling results

2020 Baseline scenario
The 2020 Baseline scenario represents the European gas infrastructure as it is today (based on ENTSOG capacity map), leaving out completed PCIs except for TAP-TANAP-SCPX which are included into the baselines. Demand and production input data are derived from EUCO 3232.5[424]. The Ukrainian system is used to transit Russian long-term contracts and accordingly, in the SOS scenario a 100% supply cut through Ukraine in January is assumed.

Figure 0.8 Baseline 2020: Weighted average yearly wholesale gas prices, EUR/MWh



Benefit of commissioned PCIs compared to 2020 Baseline scenario
The overall social welfare benefit of the commissioned PCI projects assuming a 2020 market situation is EUR 132 million/year mainly due to the significant price decrease that occurs in Central-Southern-Eastern Europe and the price convergence in the Baltic Region.

The net benefit (modelled yearly benefits decreased by annualized investment costs[425]) of these projects calculated for 2020 is positive (even in the low price environment). Hence, in regards to the commissioned gas PCI projects, the potential overall benefits outweigh the cost of these projects including in the longer term as requested by the TEN-E Regulation Article 4 1(b)

[424] EUCO3232.5 is a policy scenario using the PRIMES model, and is designed to achieve a 32% share of renewable energy in gross final energy consumption and a 32.5% energy efficiency target in the EU up to 2030.
[425] Assuming 4% social discount rate and 25 years assessment period.

paragraph. Out of these benefits that were modelled for 2020 the vast majority is attributable to market integration benefits.

It is worth noting that the benefits under the SOS scenario are significantly lower assuming the 2020 market situation than it would have been under 2013 market circumstances (yearly EUR 118 million vs EUR 193 million). Hence, the projects that provide substantial SOS benefits in 2013 market situation (see Figure 0.1 as an illustration) are not signalling the same SOS benefits in 2020, given that the Russian transit flows via Ukraine have dropped by 50% in the last decade due to the Russian diversification strategy.

Our security of supply modelling confirmed that resilience of the natural gas network has improved substantially.

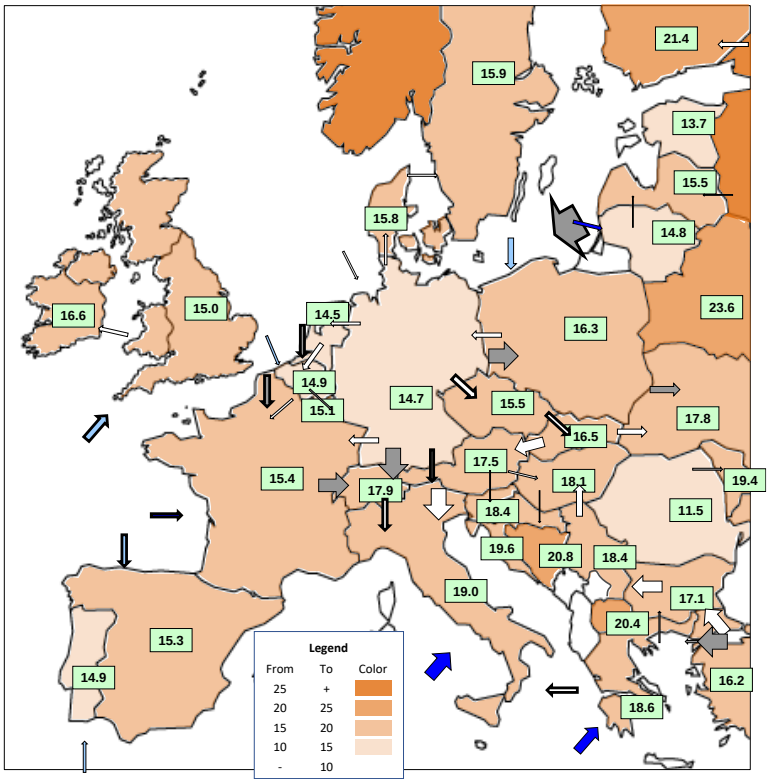
Modelling results for 2030 - forward looking analysis
Even if the positive impact of the already commissioned PCIs is significant, there are remaining infrastructure needs identified by the Regional Groups and some remaining bottlenecks that still need to be addressed. PCI projects are proposed to address the needs of the priority corridors mostly (e.g. market integration, supply source diversification, ending isolation, etc.).([426])

In order to quantify how much additional benefits, the projects of the 4th PCI lists would bring to the European gas markets, they were added to the 2030 Baseline scenario. The benefits are calculated in two steps: additional to the already commissioned projects first only those projects from the 4th PCI list which already reached the final investment decisions are included, then as a second step all projects from the list are included.

Baseline 2030
The infrastructure in the 2030 Baseline scenario is based on the Baseline 2020, but also includes the FID projects from the TYNDP 2018, and also those projects which are under construction, but not part of the TYNDP (Nord Stream 2, Turk Stream 2, TR-BG-RS-HU corridor (Balkan Stream)). Demand and production input data derive from EUCO 3232.5. A significant change compared to 2020 is that the Ukrainian system is not used to transit Russian long-term contracts; hence these are delivered through Nord Stream 2 and Turk Stream 2. Accordingly, in the SOS scenario a 100% supply cut of the Turk Stream in January is assumed.

([426]) Methodology for assessing the gas candidate PCI projects PCI 2018-2019 exercise 17 June 2019 Draft for Regional Groups comments.

Figure 0.9 Baseline 2030: Weighted average yearly wholesale gas prices, EUR/MWh



Welfare effect of the already commissioned PCIs and PCIs with FID compared to 2030 Baseline scenario
Compared to the Baseline 2030 first the overall welfare effect of the already commissioned PCIs and those projects from the 4th PCI list which have an FID are calculated. Only the projects with cross-border effect can be evaluated.

The overall social welfare change (the modelled benefit) of the commissioned PCI projects and FID projects from the 4th PCI list is modelled to be EUR 166 million/year assuming a 2030 market situation. The gas import needs of Europe assumed for 2030 is about the same as for 2020. There is no gas demand increase envisaged and the production within the EU is only slightly decreasing (based EUCO 3232.5 scenario). There is a converged gas market and high competition among external suppliers (pipeline and LNG) and the overall gas prices are dropping. Therefore, the new gas infrastructure need for the EU is limited.

Consequently, although those PCI projects which already have an FID would bring additional benefits besides those projects that are already operating, these benefits are considerably lower in 2030 than it was expected when they were decided to be implemented.

There are two main reasons for this:

(i) Forecasts for future gas demand have been lowered in the last decade substantially by all institutions;
(ii) Competing (partly non-PCI) projects have already been constructed.

A clear message of the results is that any delay in implementation of the FID projects hampers the benefits that can be gained and the risk of building stranded assets is increasing by time.

Welfare effect of the already commissioned PCIs and PCIs on the 4th list compared to 2030 Baseline scenario
The overall social welfare benefit of the commissioned PCI projects and all projects from the 4th PCI list is modelled to be EUR 608 million/year assuming a 2030 market situation. Comparing these benefits with total investment cost of these projects may be misleading, not only because the modelled benefits may be underestimated but mainly because there are several competing projects on the list aiming the same goals and probably not all of them will materialize.

The PCI list and the corridor approach can leave projects on the list that are about to solve the same regional need. This has been the case also in previous lists: about 40 percent of the proposed

PCI projects have been withdrawn or not resubmitted. The PCI selection process evaluated all project on an equal basis and did not select from two competing ones. The goal was to select the project that contribute to the validated needs. Therefore, although remaining bottlenecks still need to be addressed, this probably implies that not all the projects on the list are necessary to being built, otherwise some of them may result in financing stranded assets.

Sensitivity analysis

- As modelled benefits for 2030 highly depend on the assumptions applied in the EUCO3232.5 scenario, it is worth to analyse some sensitivity scenarios. A crucial assumption seems to be the high level of Romanian production - which is highly uncertain concerning 2020 market conditions. Still, the level of Romanian gas production significantly affects the benefit of the gas infrastructure projects in the CSEE region. Hence, a 2030 sensitivity scenario which assumes a lower level of Romanian production was analysed([427]).

In order to estimate the benefits of the PCI projects in a less oversupplied market, it was assumed that less LNG arrives in Europe. (50% of current 2020 LNG import, around 600 TWh). In this scenario there is a higher price environment than in our reference baseline.

Figure 0.10 Modelled benefits in the sensitivity scenarios, EU27

	TEN-E 2030 FID	TEN-E 2030 PCI
Total yearly benefit in Baseline 2030 (million EUR)	166	608
Total yearly benefit in low RO production sensitivity scenario (million EUR)	115	504
Total yearly benefit in low LNG sensitivity scenario (million EUR)	280	760

The table above illustrates that the modelled benefits vary significantly in the different scenarios: assuming lower Romanian production yield to significantly lower benefits related to the analysed projects, especially those that were planned to transmit partly this new Romanian source.

On the other hand, lower LNG inflow into Europe yields to much higher benefits of the analysed projects, as this implies higher gas price environment in general, and the projects generally perform better (in B/C) when gas prices are higher (both market integration and SOS). Proposed LNG terminals perform on contrary better when the global LNG inflow to Europe is higher.

Hence, Benefit/Cost ratio of the advanced PCI projects highly depends on market expectations. Despite in our base case the FID PCIs and the 4th list did not perform very well, in the sensitivity runs there were situations when the entire lists (commissioned PCIs + 4th PCI list) performed slightly better.

Calculated indicators based on modelling outputs

To provide comparison with the Commission Staff Working document SWD (2017) 425, similar indicators were calculated that were used in the previous assessment but modelling setup might not allow full replication of the assessment.

The indicators are calculated for all TEN-E infrastructure baselines, as previously described. Effects of the commissioned PCIs is compared to the 2020 reference baseline, while effects of the Commissioned plus +FID projects and Commissioned + all projects from the 4th list are assessed using the 2030 infrastructure baseline.

([427]) The assumption of 52.3 TWh/yr (in line with the ENTSOG TYNDP) was used, as opposed to the 123 TWh/year in the Baseline scenarios.

Figure 0.0.11 Indicators based on modelling results

	Commissioned PCIs vs Baseline 2020	Commissioned+ FID projects vs Baseline 2030	Commissioned+ All 4th list PCIs vs Baseline 2030
Decrease in average wholesale gas price (EUR/MWh)	-0.24	-0.23	-0.36
Decrease in average wholesale gas price (%)	-1.04 %	-0.43 %	-2.16 %
Decrease in consumption-weighted average wholesale gas price (EUR/MWh)	-0.07	0.04	-0.13
Decrease in consumption-weighted average wholesale gas price (%)	-0.30 %	0.65 %	-0.41 %
Standard deviation of prices (EUR/MWh)	-0.47	-0.69	-0.83
Price divergence change in EU28 (%)	-2.63 %	-4.16 %	-4.84 %
Change in total yearly trade in EU28 (TWh/year)	42.5	14.4	-8.4
Change in total yearly trade in EU28 (%)	2 %	1 %	-1 %
Change in LNG inflow (TWh/year)	18.3	22.7	98.5
Change in LNG inflow (%)	1.4 %	2.6 %	11.1 %
Increased consumer expenditure due to a major supply cut (MEUR) – mitigation of energy not served	-124.8	96.7	-404.9
Increased consumer expenditure due to a major supply cut (%)	-0.15 %	0.16 %	-0.69 %

Simple average and consumption-weighted average price effect serve as a general indicator of market effects. On the EU-28 level, commissioned PCIs contributed to a EUR 0.24 per MWh price decrease on average assuming a 2020 market situation.([428]) Taking market size into account([429]) this effect shrinks to EUR 0.07 MWh, as the most price effects were located in smaller Eastern European markets. Commissioning the FID projects as well would decrease the prices compared to the 2030 Baseline by EUR 0.23 per MWh, but if the market size is considered, this price decrease disappears. Commissioning all PCIs would result in EUR 0.36 per MWh average price decrease compared to the 2030 baseline and EUR 0.13 per MWh weighted average price decrease.

Price convergence effect of the PCIs can be measured by the relative standard deviation([430]) of European prices. This price dispersion was estimated to have dropped by EUR 0.47 per MWh due to the commissioning of PCIs by 2020.([431]) Further commissioning of FID projects would contribute to EUR 0.69 per MWh decrease in the average dispersion of prices (measured by standard deviations). Furthermore, if all PCIs are built from the 4th list, an EUR 0.83 per MWh decrease in price dispersion was modelled. These effects mean 3-5% decrease in relative standard deviation. Overall, it can be concluded that price changes resulted by the PCI projects are minor, however decrease in average wholesale price illustrates that on some smaller more isolated markets these

[428] Simple average of EU28 price change due to the projects, EUR/MWh.
[429] Consumption-weighted average of EU28 price change due to the projects.
[430] Absolute standard deviation divided by the average.
[431] The standard deviation of prices in the EU-28. Negative values mean better price convergence. Market size was not considered when checking the price divergence.

projects bring significant benefits. **All three assessed project groups help the formation of the single European market, by alleviating the price dispersion.**

New infrastructure is expected to bring additional trade opportunities, however at the same time it provides shorter routes and route diversification. To quantify these effects, we have listed all the interconnectors of EU28 with other Member States and added up total flow levels, and compared it to the baseline cases.([432]) The effect of commissioned interconnectors and FID projects was small, but positive compared to the total overall flow on the European gas network, while the entire 4th PCI list projects decreased the flows on the network by 1%. Overall, this indicator only shows that **the European network infrastructure (including the FID projects) is already adequate to serve the demand and building all the 4th PCI list projects would only help with the better utilisation of the grid**.

LNG inflow into Europe increases simultaneously with the new infrastructure assumed to be built. It can be partly explained by the new LNG terminals, but new interconnectors also help LNG to reach more European markets.

Total consumer expenditures show the gas bill European consumers have to pay for their consumption. Commissioned PCIs have a cost-decreasing effect on the 2020 reference case, as well as if all PCIs on the 4th list get commissioned, it has a relatively small effect. Still, comparing these savings to the total EU gas spending, cost reduction is merely 0.34-0.69%.

This indicator shows that via the price effect, consumers are better off due to the already implemented PCI projects.

Main messages based on gas modelling results

- Already commissioned PCIs have brought considerable price decreases in some more isolated member states, however the consumption weighted price decrease in Europe is minor. The overall social welfare effect of these projects is also significant: the yearly benefit is assumed to be at least EUR 132 million for Europe assuming the current market situation. Hence, the commissioned gas PCI projects prove to be very beneficial for the European citizens in terms of increasing the market integration and competition and mitigating most of the security of supply issues. Concerning the regional division of these benefits it is worth noting that most benefits are realized in peripheral countries, which highlights their market integration impact. The benefits of these projects on market integration can also be captured by the fact that the dispersion of European prices is lower, hence prices converge more when these projects are added to the Baseline scenarios;
- The price convergence within the single European gas market continues in the 2030 baseline as well, despite the change in flow patterns due to rerouting the Russian long-term contracts;
- The Benefit/Cost ratio of the future PCI projects highly depends on market expectations. Compared to the Baseline 2030 scenario the already commissioned PCIs and projects of the 4th PCI list altogether would result in a EUR 608 million yearly benefit, which ranges between EUR 504 million and EUR 760 million in the sensitivity analyses. Although FIDs and the less-advanced projects from the 4th PCI list when they are appraised together did not perform very well in our assessment, projects on the 4th PCI list may work as one of the many possible insurance solutions against high prices.

([432]) Total yearly trade refers to all flows in TWh on interconnectors between EU-EU Member States, e.g. DE-AT or BE-UK. Consequently, no entry points to the EU (e.g. RU-DE) or interconnections with third countries are considered in this indicator (e.g. HU-RS, DE-CH, CH-IT).

III.2 Modelling of the electricity market

Introduction: market environment in the past few years

Electricity PCI projects started being realised in 2016. Between 2016 and 2020 several electricity interconnectors were commissioned, bringing the European Energy Market closer to a highly integrated common power market. Most of these projects were decided to be realised in a different market environment compared to the one today. In the first half of the 2010s, fuel prices were higher, and assumed to stay at those levels, or even to increase, and also the CO2 price was expected to increase. This way not only electricity prices were higher, but also the price differences between countries. In this market environment PCI projects seemed highly beneficial in the long run.

There were some countries with very poor interconnectivity (e.g. Poland, the Baltic countries, Spain), that were far from being integrated to the common European Market, and needed additional connections. In order to create the common market and increase security of supply, the EU set interconnectivity targets for countries. PCIs also helped to reach these targets.

When the Regulation was adopted renewables had a less important role in the European electricity system. In the present, they have a much more significant share; but still, there are differences between countries, both in the level of already installed capacity and in RES potentials. Thus, connecting countries might help those with less access to green electricity.

As it is shown in the next chapter the market environment did change significantly in the past few years, and that has somewhat changed the effect of the commissioned power lines. Without question, the interconnectors are important: investments help to reach increased interconnectivity and bring the EU closer to the Energy Union. However, it should be noted, that in a lower price environment the benefits seem smaller than what was hoped for.

The modelling exercise carried out cannot capture all benefits, but it still can give an estimate of consumer welfare changes, producer welfare changes and TSO rent changes – these are the factors that can be monetised with the model. There are additional benefits, for all players, that might not be captured – such as benefits connected to security of supply (lower energy not supplied values and lower losses), to international competitiveness, or to climate change and air quality related issues. Several factors have changed the picture since 2013 (when the first projects were decided to be built), such as the global LNG glut, the increasing RES production that helped the wholesale electricity price decrease, and also narrowed the spreads between the national energy markets. The modelling shows that one of the most important factors is the CO2 price level: with higher ETS prices the overall benefits gained from either the already commissioned, or the future PCI projects from the 4th list significantly increase. With the Green Deal adopted a fast-growing CO2 price pathway will emerge – an even more ambitious increase, than the one outlined in the latest EUCO3232.5 scenario, that was used as a basis for our modelling in the reference case. This will make all PCI projects reach much higher welfare gains than the ones presented in this work.

Several additional benefits fostered by the PCI projects are demonstrated, such as the CO2 emission reduction, increased price convergence of EU electricity markets, and as a result lower overall wholesale prices, that brings the EU gains in the field of international competitiveness. Countries are also brought closer to their interconnectivity targets and isolated markets are more integrated.

Modelling methodology

Modelling tool
The evaluation of the electricity PCI projects was based on market modelling using EEMM model of REKK. For a short description of this model see Section 2.5.5.

Inputs for the modelling
In order to be in line with the latest information available for the Commission input data was cross-checked with JRC modelling team. Present and future interconnector capacities (in the modelling

the Net Transfer Capacities, NTCs are included) are based on ENTSO-E data, while most of the other relevant inputs are in line with the EUCO3232.5 modelling([433]). These include the following:

- CO2 prices (ETS) - for 2020 EUR19.7/t, for 2030 EUR 27/t;
- Coal prices - for 2020 EUR 3/GJ, for 2030 EUR 4.3/GJ;
- Yearly total load in EU Member States - CAGR between 2020 and 2030: 0.3% for EU27;
- Power generation installed capacities by fuel in 2030.

As it is presented above, in light of the Green Deal the assumed CO2 price pathway is conservative, thus sensitivity analysis was carried out to see the possible effect of a higher ETS price level.

Regarding the present, 2020 power generation portfolio the latest available information is collected for all modelled countries, on a block level for fossil and nuclear units, and on an aggregate level for RES capacities. The main sources are TSO and NRA websites, and reports of industry organisations (such as EWEA and Solar Power Europe).

For natural gas prices, we use our own forecast, prepared by the EGMM model of REKK, differentiated country by country and year by year. For both 2020 and 2030 lowest natural gas wholesale price in the EU is assumed in the Netherlands: around 14.5 EUR/MWh. The highest values, around 20-22 EUR MWh in 2020 and 19-21 EUR /MWh in 2030 are assumed in the Baltic countries (Finland, Estonia, Latvia) and in South-East-Europe (e.g. Croatia, Slovenia), but Italy is also relatively expensive. Inputs and assumptions about the natural gas market are cross-checked and harmonised with JRC models to keep consistency. Compared to the last 5-10 years relatively low natural gas prices are assumed, reflecting the present and the most likely future situation of natural gas markets in Europe.

Infrastructure baselines and analysed scenarios
For the electricity sector three scenarios are analysed to be able to capture the benefits of the already commissioned PCI projects and the benefits of the projects on the 4th PCI list. Only those projects are modelled, where either a cross-border capacity or a storage capacity increase could be identified and precisely quantified. The impacts are quantified for two years: 2020 and 2030.

The 2020 infrastructure baseline serves as the basis for comparison: this scenario shows what would have been the situation on the electricity markets of Europe without any PCI projects being implemented. For 2020, the Baseline scenario includes the present situation without the PCI projects – thus, interconnector capacities are lower than today, capacities of the twelve already commissioned projects (see Figure 0.12) are deducted. Similarly, in 2030 the most likely future outcome is included, but the same capacities are deducted, and none of the projects from the 4th PCI list are assumed to be commissioned.

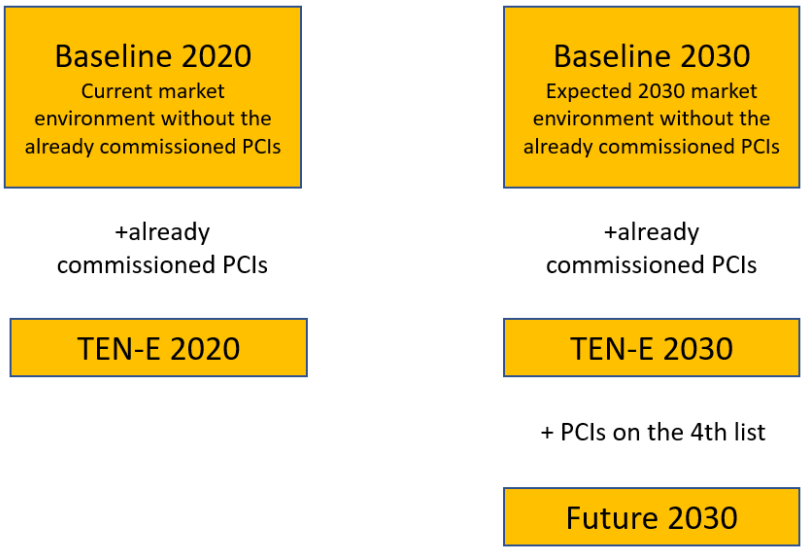
In the TEN-E scenario, the possible effect of the already commissioned PCI projects is calculated. To be able to do that for 2020 two situations are compared: the present market environment with and without these projects. The former represents the TEN-E scenario (this contains the infrastructure set-up as of today), while the latter represents a theoretical situation: "what if these projects were not implemented?" - the above presented Baseline. The same applies to 2030 –the most likely future market situation is chosen, including the already commissioned PCIs (this is the TEN-E scenario), but it is not assumed that any of the projects from the 4th list are commissioned. This is compared to the Baseline.

In the Future scenario, the effect of the commissioning of all projects from the 4th list is modelled. This means, that the only relevant modelling year is 2030, as the first year of commissioning from these projects is assumed to be 2021. For building up the Future scenario in 2030, the TEN-E scenario is used as a starting point, and then include all projects from the 4th list to see how they would affect market outcomes in 2030. When results are compared to the TEN-E Scenario, then the effect of the PCIs from the 4th list can be quantified. While comparing Future and Baseline shows

([433]) Modelling carried out for the European Commission, using PRIMES model, reflecting the 2030 targets: a share of at least 32% renewable energy in the EU energy mix, an improvement in energy efficiency of at least 32.5% at EU level and reduction of domestic greenhouse gas emissions by at least 40%. Technical note on the modelling is available here: https://ec.europa.eu/energy/sites/ener/files/technical_note_on_the_euco3232_final_14062019.pdf.

the effect of all – already commissioned and to be commissioned in the future – PCI projects on the European electricity market.

The three scenarios can be summarised the following way:



Analysed projects

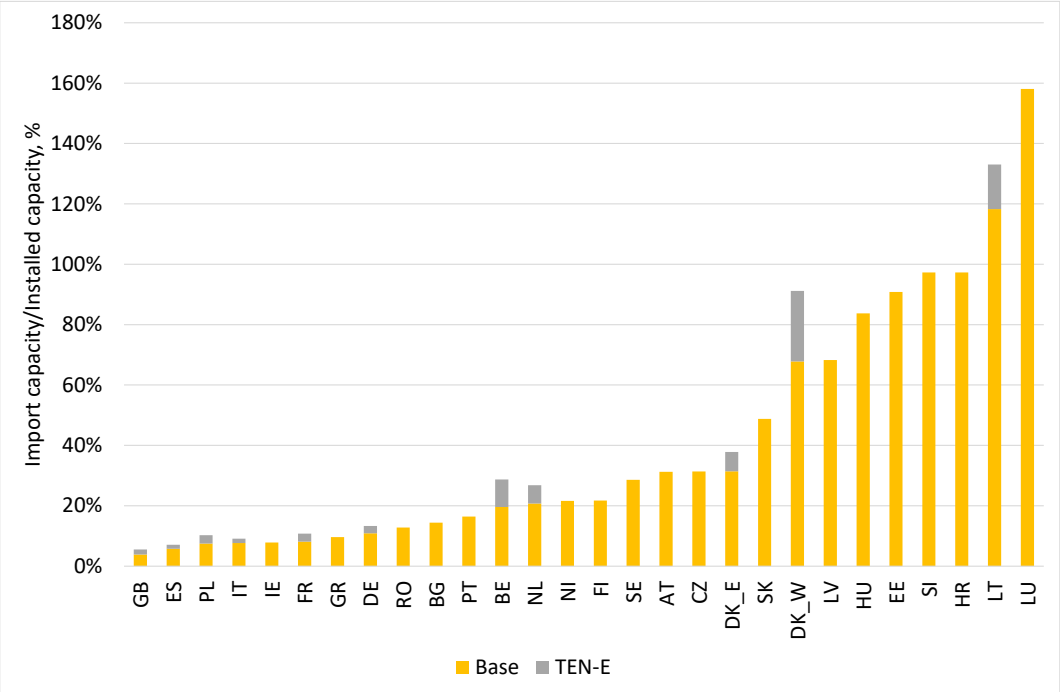
Already commissioned PCI projects
Key parameters of the analysed projects are summarised in the following table. The existing PCIs are all interconnectors, while some of the future projects (included on the 4th list) are electricity storage projects. These are also included in the modelling, with the indicated capacities. From the interconnector projects only those are modelled, where an exact cross-border effect – an increased NTC – could be identified. Projects, where the identified NTC effect is 0 (e.g. PCI 4.4, or 4.8.1 and 4.8.3) are not modelled.

Figure 0.12 List of already commissioned PCIs, and their key parameters

REKK modelled - PCIs commissioned latest in 2020, where cross-border effect could be quantified								
PCI	**Commissioning**	**Status**	**From (A)**	**To (B)**	**A>B (MW)**	**B>A (MW)**	**CAPEX (million EUR)**	**OPEX (million EUR/year)**
1.1.1	2016	Completed	BE	UK	1000	1000	660	25
2.2.1 + 2.2.2	2020	To be completed in 2020	DE	BE	1000	1000	790	12
2.12	2018	Completed	DE	NL	1500	1500	220	2
1.5	2019	Completed	DK_W	NL	700	700	620	4
1.4.1 + 1.4.2 + 1.4.3	2020	To be completed in 2020	DK_W	DE	700	1000	926	14
4.1	2019	Completed	DK_E	DE	400	400	349	16
3.15.1	2018	Completed	DE	PL	500	1500	225	5
4.5.1 + 4.5.5	2018	Completed	LT	PL	500	500	81	1
2.5.1	2020	completed	IT	FR	1000	1200	1260	5
2.6 + 2. 8	2017	Completed	FR	ES	1500	1900	720	11
3.22.5	2019	Completed	IT	ME	600	600	870	5

REKK modelled - PCIs commissioned latest in 2020, where cross-border effect could be quantified								
1.7.3	2020	To be completed in 2020	FR	UK	1000	1000	580	5

source: ENTSO-E, JRC.



4th PCI list
From the projects included on the 4th PCI list the PCIs list in the table are modelled.

Figure 0.0.13 List of PCIs included on the 4th list, and their key parameters

REKK modelled PCIs from the 4th list – Interconnectors								
PCI	Commissioning	Status	From (A)	To (B)	A>B (MW)	B>A (MW)	CAPEX (million EUR)	OPEX (million EUR/year)
1.20	2022	Permitting	DE	UK	1400	1400	1500	22
1.6	2026	Permitting	FR	IE	700	700	930	8
2.14	2024	Permitting	CH	IT	850	850	609	2
2.17	2021	Permitting	ES	PT	1900	1000	112	1
2.4	2024	Permitting	IT	FR	100	100	750	7
2.7	2027	Permitting	FR	ES	2200	2200	1750	10
3.4	2022	Permitting	AT	IT	150	150	92	2
1.3.1	2023	Permitting	DK_W	DE	500	500	210	2
1.7.1 + 1.7.5	2025	Permitting	FR	UK	1400	1400	850	8
1.9.1	2023	Permitting	IE	UK	500	500	396	8
1.10.1 + 1.10.2	2024	Permitting	UK	NO	1400	1400	1850	15.
3.1.1 & 3.1.2	2028	Permitting	AT	DE	2000	2000	375	3
3.9.1	2021	Permitting	HU	SI	1200	1200	133	0
2.13.1	2023	Permitting	IE	UK	900	950	349	1
3.21	2028	Permitting/Under consideration	IT	SI	1000	1000	755	4

REKK modelled PCIs from the 4th list – Interconnectors								
PCI	Commissioning	Status	From (A)	To (B)	A>B (MW)	B>A (MW)	CAPEX (million EUR)	OPEX (million EUR/year)
4.8.10	2025	Planned not yet permitting	LT	PL	1000	1000	335	1
2.13.2	2030	Planned not yet permitting	IE	UK	750	570	396	1
2.27.1 + 2.27.2	2030	Planned not yet permitting	ES	FR	3000	3000	1170	6
1.15	2028	Under consideration	BE	UK	1400	1400	1000	8
1.16	2030	Under consideration	NL	UK	2000	2000	850	6
1.14	2023	Under construction	DK_W	UK	1400	1400	1970	16
3.17 + 3.16.1	2021	Under construction	HU	SK	350	1850	82	1
1.8.1	2021	Under construction	DE	NO	1400	1400	1850	15
3.7.1	2023	Under construction	BG	GR	1350	800	224	3
4.2.1	2021	Under construction	EE	LV	479	479	200	1
3.22.1	2024	Under construction	RO	RS	844	600	173	1
3.11.3	2029	Permitting	DE	CZ	500	500	462	0
3.11.4	2028	Permitting	DE	CZ				
3.1.4	2025	Under consideration	DE	AT	600	600	299	2
3.8	2022	Under construction	RO	BG	600	600	174	1
3.8	2022	Under construction	RO	BG				
3.8	2024	Permitting	RO	BG				
3.22	2025	Under construction	RO	HU	617	335	173	1
3.11.1	2024	Permitting	DE	CZ	500	500	260	0
3.14	2024	Under construction	DE	PL	1500	500	271	2
4.10.2	2024		FI	SE	800	800	50	0
4.5.2	2024	Under construction	PL	LT	500	1000	335	1

REKK modelled PCIs from the 4th list – Electricity storage						
PCI	Commissioning	Status	Location (storage)	Capacity (storage, MW)	CAPEX (million EUR)	OPEX (million EUR/year)
1.17	2025	Permitting	NL	250	336	17
2.18	2034	Permitting	AT	400	2022	15
2.30	2026	Permitting	DE	300	386	3
4.6	2028	Permitting	EE	500	350	8
2.28.2	2024	Permitting	ES	548	212	4
2.28.3	2025	Permitting	ES	2756	2123	30
2.29	2026	Planned not yet permitting	IE	360	617	14
1.12.3	2027	Planned not yet permitting	UK	540	580	20
1.12.4	2027	Planned not yet permitting	UK	600	400	20
1.18	2024	Planned not yet permitting	BE	550	454	2
2.28.4	2028	Permitting	ES	234	126	2
3.23	2026	Permitting	BG	788	176	2
3.24	2025	Permitting (Still pending modification of EIA's Decision)	EL	680	502	5
4.7	2024	Under construction	LT	225	160	16

Source: ENTSO-E, JRC.

Modelling results

In this section, first, the methodology for the welfare analysis is presented and the methodology for the analysis of the PCIs impact on interconnectivity is presented. Second, the price developments in the Baseline scenario are demonstrated. Here the regions where the price differences are the highest in 2020 and 2030 are highlighted. Third the TEN-E scenario is compared with the Baseline scenario in both 2020 and 2030, including the analysis of welfare changes due to the already commissioned PCI projects, the CO2 emission effects of the new lines, and a price divergence indicator. The model is run with different input prices (natural gas, coal and CO2 prices) in order to check the robustness of the results. The results are compared to the Baseline scenario – this way the effects of all PCIs, existing and to be commissioned ones, can be calculated. The differences between the Future and the TEN-E scenario are also calculated, to quantify the effect solely of the projects which are on the fourth PCI list.

Methodology for welfare analysis
A simplified and somewhat conservative approach is followed with regards to the quantification of benefits. Instead of modelling 25-30 years, only two years – 2020 and 2030 – are modelled, thus welfare changes are only calculated for those years. As benefits are only quantified for 2020 and 2030, in a relatively low price environment (which is, however, currently realistic), overall benefits could be underestimated. Some projects – commissioned years before – might have brought higher benefits in the first few years of their existence, which is now not taken into account. Still, results can show how high the overall benefits are in 2020 and in 2030.

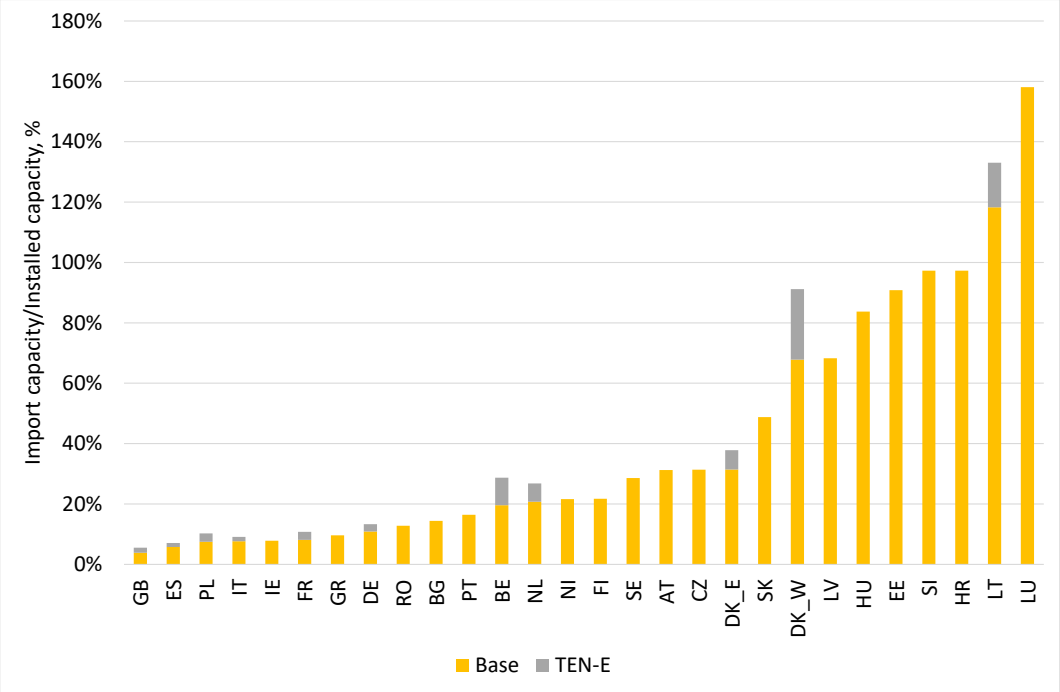
On one hand, for both scenarios (TEN-E and Future) aggregated welfares of consumers, producers and TSOs are compared to the Baseline. The difference is assumed to be the overall welfare effect of the analysed projects: for TEN-E the effect of the already commissioned PCIs, while for the Future scenario the effect of both the already commissioned PCIs and the projects on the 4th PCI list. On the other hand, differences between the welfare values of the TEN-E and Future scenarios are also calculated, these only indicate the effect of the projects on the 4th PCI list.

Other relevant changes are measured through additional indicators – such as the price divergence indicator or the changes in CO2 emission of the electricity sector – but these are not part of the welfare calculation.

The EU has set an interconnection target of minimum 10% by 2020 and 15% by 2030. The interconnection target is the comparison of total import transmission capacities to the installed

capacities of a country. According to our estimations there are six countries([434]) which cannot meet this target without the already commissioned PCI projects. PCI projects help two of these countries (France and Poland) reach the 10% target by 2020. From the six least interconnected countries, five are impacted by the PCI transmission lines and increase their interconnection levels. The highest growth rate of interconnectivity is visible on those projects, which connect periphery Member States, like Spain, Italy or UK. These PCI projects help to integrate these countries to Central Europe, which is one of the main goals of the PCI projects: "…encouraging the rational production, transportation, distribution and use of energy resources, to reduce the isolation of less-favoured and island regions, to secure and diversify the Union's energy supplies" – Regulation 347/2013.

Figure 0.14 Interconnectivity increase due to the commissioned PCIs in 2020

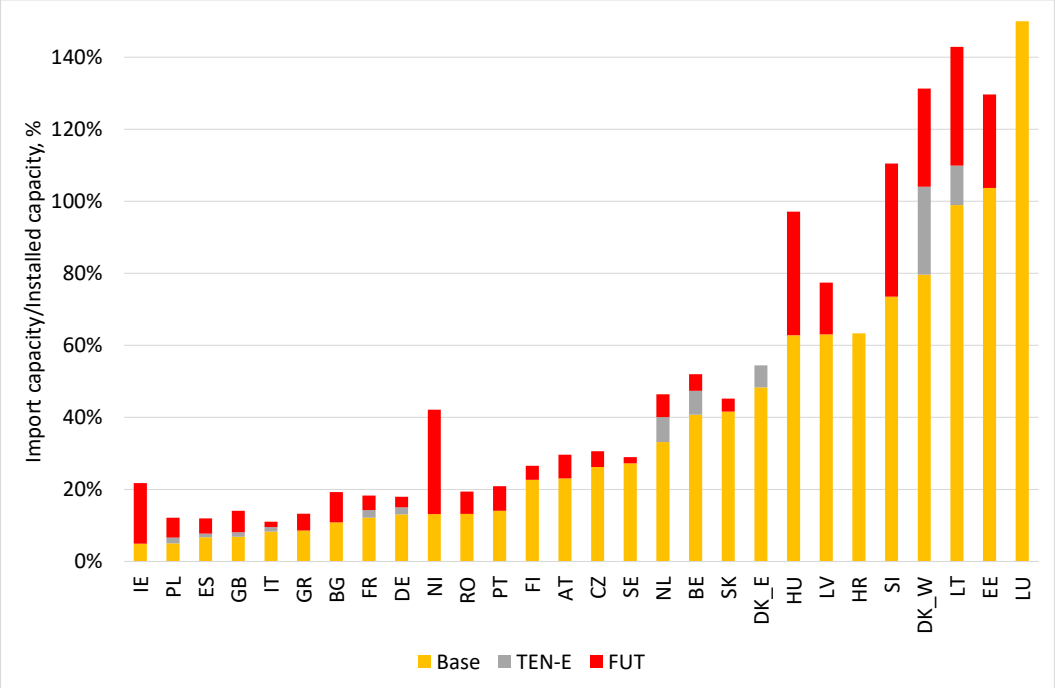


Source: REKK, ENTSO-E and JRC.

PCI projects have a major impact on the interconnectivity. Without these projects eleven countries cannot meet the 15% interconnection target in 2030. If these projects will be commissioned, this number is reduced to four: only Poland, Spain, Greece and Italy cannot meet this target with the capacity assumptions based on EUCO32325 scenario. Without the already commissioned PCI projects, and those which are on the 4th PCI list, the import capacity compared to the installed capacities would be much smaller. There are only two EU Member States([435]) where the PCI transmission projects have no impact, but both of them (Croatia and Luxemburg) already have a very high interconnectivity level both in 2020 and in 2030.

([434]) Cyprus and Malta are not calculated.
([435]) Cyprus and Malta are not analysed.

Figure 0.15 Interconnectivity increase due to all PCI projects: the already commissioned ones and the projects listed on the 4th PCI list in 2030



Source: REKK, ENTSO-E and JRC.

Baseline scenario results

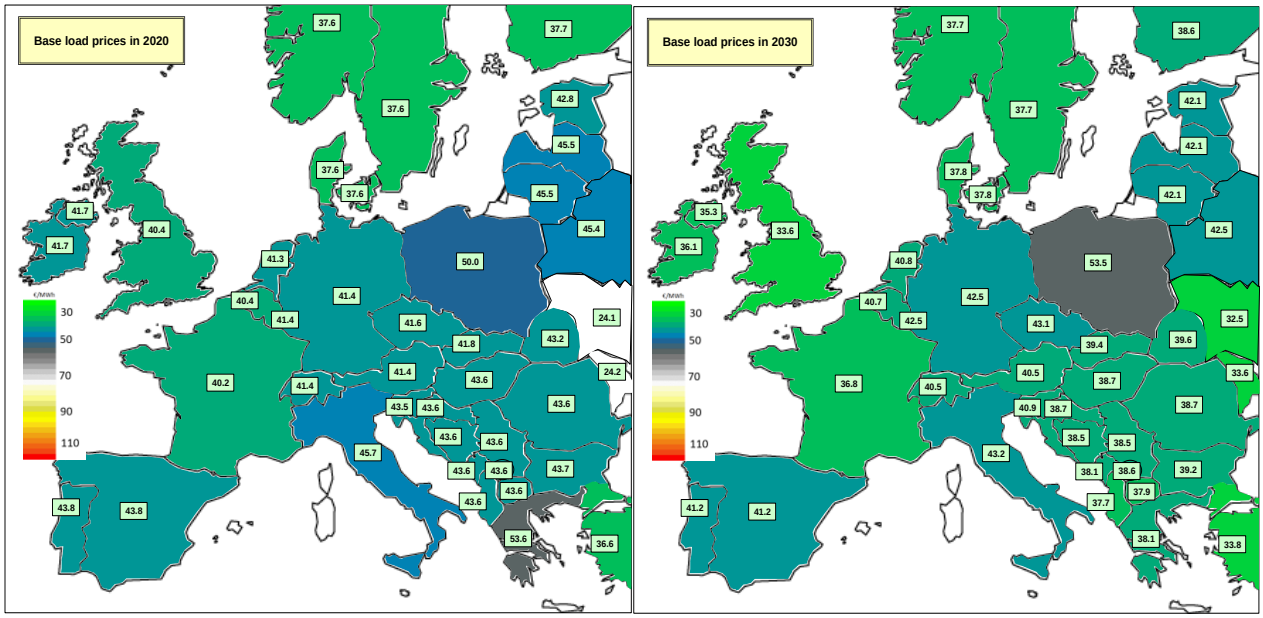
In the previous chapter, the main input data for 2020 and 2030 was presented. Using them, the modelled electricity wholesale prices are depicted. It is to be noted that these prices cannot be compared to the 2020 fact electricity prices, because the already commissioned PCI projects are excluded from the model runs.

It is possible to identify different price regions in Europe. The lowest electricity wholesale prices can be seen in the Nordic countries, with around 37-38 EUR/MWh. In the Western-European price region – including the Czech Republic, Slovakia and the UK - the prices are higher with 3-4 EUR/MWh. The highest prices are in Poland and in Greece where the electricity wholesale prices are above 50EUR/MWh.

In 2030 the wholesale electricity prices decrease in almost all analysed countries compared to 2020 due to the decreasing natural gas prices and the faster growth in renewable generation compared to the demand growth. In some regions the price decrease is more than 5 EUR/MWh (e.g. South-East Europe). However, there are some regions where price increase happens, such as Germany and Poland.

The average price divergence indicator (the load weighted relative standard deviation) is 1.43% and 2.06% for 2020 and 2030 respectively in the EU, indicating a somewhat less integrated market in 2030. In the total modelled region, the indicator is higher, 1.74 in 2020, but only changes slightly, to 1.77% in 2030. This means that in the 2030 context – where more RES is to be integrated in the system – additional infrastructure is necessary.

Figure 0.16 Electricity wholesale price in the Baseline scenario, 2020 (left), and 2030 (right) - EUR/MWh



Source: REKK modelling.

Figure 0.17 Key indicators resulting from the modelling

Change in number of price divergence hours (%)
Change in total yearly trade (%)
Change in overall transmission usage (%)
Change in average wholesale electricity price (%)
Price divergence change (%)
Change in CO2 emissions (kt)
Change in congestion charges (million EUR)
Total welfare change (million EUR)

Source: REKK.

When assessing either of the scenarios, the changes and indicators presented in the table above are calculated. To measure the change in competitiveness of the EU, the change in the (load weighted) average wholesale electricity prices is calculated. The average price divergence indicator is the load weighted relative standard deviation of yearly average wholesale prices. The higher the indicator, the lower the price convergence is. CO2 emission change in the electricity sector is an important indicator to measure the climate effect of the projects, and to see to what extent these project helped the Union reach its GHG reduction targets.

The total welfare change for the EU28 is also calculated in an aggregated way, which includes the consumer, producer and rent changes as well. The latter one is also demonstrated separately. Regarding the borders, three indicators are demonstrated: (1) number of price divergence hours (number of hours in a year when there is non-zero price difference between two connected EU countries, aggregated for all interconnectors), which shows how the PCI projects helps to equalise the wholesale electricity prices in Europe; (2)the total yearly trade within the EU28; (3)for the overall transmission usage the utilization of the new and "old" lines is quantified.

TEN-E Scenario results

In the following section the Baseline scenario – when no PCI projects are realized – is compared with the TEN-E scenario, where only the already commissioned PCI projects are taken into account, so those which are not on the 4th PCI list. The model is run for 2020 and 2030, in order to analyse the effect of these projects in two different circumstances. In Figure 0.18 the results for EU28 are summarised, and in brackets the indicator values for the wider region are shown as well: all 44 modelled markets (basically the whole ENTSO-E region, see exact coverage on Figure 0.16).

The already commissioned PCI projects have a significant effect on wholesale electricity price developments; however, rather on a country by country basis than on the overall average EU prices. In some countries, the price changes can be higher than 2 EUR/MWh, which equals around a 5 % change compared to the Baseline electricity price. In most of the less interconnected countries – like Poland, Italy and Spain - a quite significant price decrease is visible due to the PCI projects (LT-PL, DE-PL, ES-FR, IT-FR) both in 2020 and 2030. In the Baseline scenario the lowest electricity prices are in the Nordic countries. Due to this fact the PCIs connecting this region with their neighbours (like DK-DE, LT-PL, DK-NL projects) cause a price growth in these countries. The magnitude of this price increase is around EUR 1-2 per MWh. In the South-East European region only minor effect is visible, because only one already commissioned PCI project is in that territory (IT-ME undersea cable). Those projects which help to increase the connectivity of Great-Britain (GB-FR, BE-GB) cause a price increase in the UK, in 2020 the price increase is quite small, but in 2030 the effect is more significant. A lot of PCI projects connected Germany with their neighbours, some lead to price increase (like PL-DE), while others have a lowering effect on German prices (like DK-DE PCI projects). Due to that, in 2030 a price decrease is visible in Germany, while in 2020 the wholesale electricity price increases.

Figure 0.18 Key modelling results and indicators for the TEN-E Scenario

	EU28, in brackets the Total modelled region	
	TEN-E vs Baseline, 2020	TEN-E vs Baseline, 2030
Change in number of price divergence hours (%)	-6.2% (-3.8%)	-4.2% (-2.8%)
Change in total yearly trade (%)	16.2% (12.5%)	11.7% (9.5%)
Change in overall transmission usage (%)	-0.8% (.0.6%)	-0.7% (-0.4%)
Change in average wholesale electricity price (%)	-0.4% (-0.4%)	-1.4% (-1.3%)
Price divergence change (%)	-0.33% (-0.14%)	-0.36% (-0.22%)
Change in CO2 emissions (kt)	-2804 (-1829)	-10051 (-9195)
Change in congestion charges (million EUR)	-169.3 (-187.8)	-228.9 (-243.3)
Total welfare change (million EUR)	204.5 (220.8)	425.6 (460.8)

source: REKK.

Increased integration is confirmed by the decrease of the number of price divergence hours and the price divergence indicator as well. Price convergence is improved mainly inside the EU, and a bit more in 2030 than in 2020, mainly due to those projects which connect a less-interconnected region with their neighbour, e.g. Spain, Italy, UK. Total trade also increases significantly as a result of more available capacity, while overall transmission usage remains more or less the same.

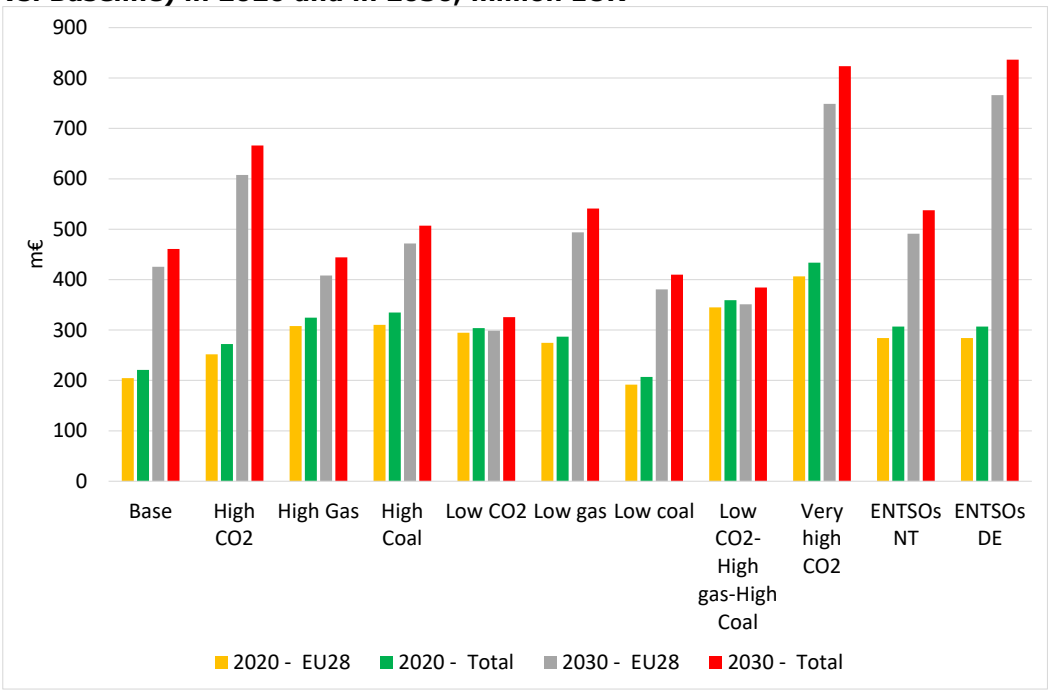
Another important issue is the climate effect: CO2 emission decrease is not included explicitly in our welfare calculation – though, producers do pay for emissions in the ETS system in the modelling -, thus this impact needs to be highlighted separately. Total CO2 emission decrease in the electricity sector is around 3 Mt in 2020 and 10 Mt in 2030 in the EU – however, part of the emission "leaks" outside the EU, as the total emission decrease is somewhat lower in the total modelled region. Still, around 2 and 9 Mt less CO2 is emitted as a result of the commissioning of

PCIs until the end of 2020. Considering a EUR32/t social cost of carbon (SCC)[436] in 2020 and EUR47/t in 2030, meaning EUR12/t and EUR20/t respectively on top of the ETS (which is already taken into account, thus "priced in" in the modelling) additional EUR 21.9 million and EUR 183.9 million benefits can come from lower emissions in 2020 and 2030 respectively, considering – as a prudent approach - the total European electricity system.

Both in 2020 and in 2030 it is clearly visible, that the projects bring significant benefits to the EU and to the total modelled region – thus the European electricity market – as well. While the change in congestion charges is negative, the sum of rent change, consumer and producer welfare change is highly positive: in 2020 more than EUR 200 million, in 2030 even more than EUR 400 million benefit is brought to the EU as a result of completion of the already commissioned PCIs. However, the realisation of these projects also required significant investments, that might not be entirely covered from welfare gains that could be monetised with the modelling in the reference set-up.

As presented above, in this assessment the model is run only for two years: 2020 and 2030. In order to check the robustness of the results ten sensitivity analyses for the major input data are carried out, including the following. For the CO2 prices a low, a high and a very high pathway was considered, for coal and natural gas prices both a higher and lower price was assumed in the sensitivity analysis, compared to the reference. A combination of high coal and gas and low CO2 price is also covered. In the two ENTSOs scenario sensitivities (National Trends and Distributed Energy) their input prices are applied for these inputs, that also means a relatively high CO2 price pathway.

Figure 0.19 Sensitivity analyses on benefits of the already commissioned project (TEN-E vs. Baseline) in 2020 and in 2030, million EUR



source: REKK.

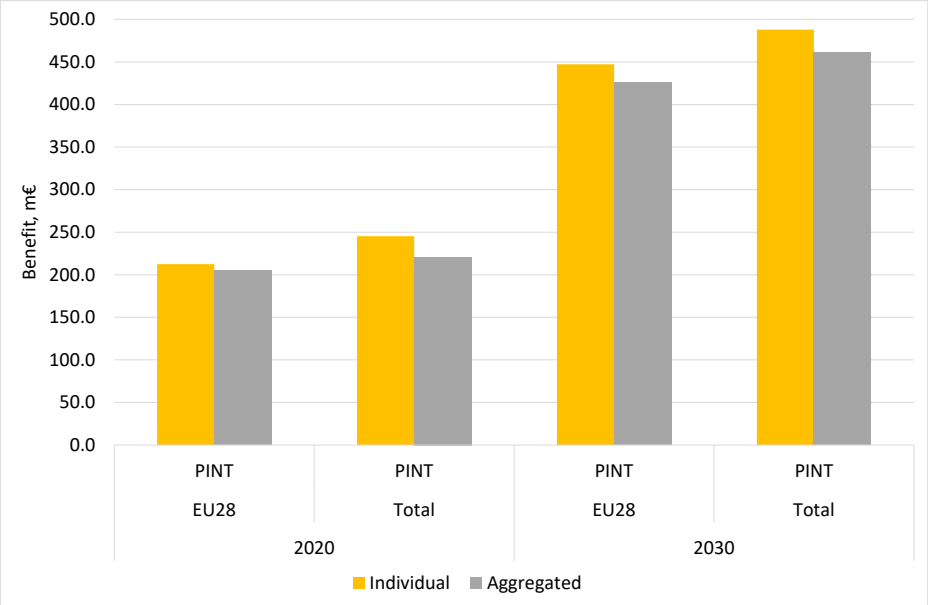
It is interesting that the Base 2020 value is one of the worst cases from the benefit point of view. Benefits are smaller than that only once, in the low coal price sensitivity case. In general, the higher the CO2 price is, the higher the benefits are. In very high CO2 price in 2030 (EUR 50 per tonne) the benefits are the highest. Similarly, high benefits are visible in the case of ENTSOs Distributed Energy scenario, which assumes EUR 53 per tonne CO2 price level. A sensitivity run is carried out with the price levels which were characterised the mid 2010's, when the assessed PCI projects were planned and constructed. In these years the CO2 price was very low, while the coal

[436] Based on Ecorys (2017): Support the selection process of PCI candidates in the thematic area of cross-border carbon dioxide networks - Cost-benefit analysis methodology and PCI application template Final report; calculating with the 4% SCC estimates, in EUR_{2019}.

and natural gas prices were high compared to the present situation. In this run both in 2020 and 2030 the benefit is higher in 2020, but much smaller in 2030.

The following figure depicts the complementarity assessment. In the "aggregated" value the net benefits comparing the Baseline scenario with the TEN-E scenario are indicated, when the projects are assessed together. In the PINT (put one in at a time) methodology we run the model without any PCI projects excluding one project. In this case the model is run twelve times (there are twelve commissioned projects) and then sum the net benefits, which is indicated on the figure. It is visible, that the overall benefit of all projects together is very close to the sum of the benefits of the individual projects, but the former is a bit smaller. This means, that some projects may be competing ones, but this is not very significant in case of the already commissioned projects.

Figure 0.20 Aggregated individual PINT benefits compared to the overall benefits together of the already commissioned PCI projects (TEN-E vs. Baseline), million EUR



Source: REKK.

Future scenario results

In the previous section the effect of already commissioned PCI projects was demonstrated. In this section the effect of the PCI projects listed on the 4th list is analysed. In the following the Future scenario – which includes all the PCI projects – is compared with the TEN-E scenario. This comparison is used, because with this method the effect of the already commissioned PCI projects are distinguished, and the later commissioned PCI projects. The overall effect of all PCIs can be easily calculated when comparing the indicators of the Baseline and the Future scenario. For the main indicators both comparisons are included. The model is run for year 2030, but a sensitivity analyses is carried out to measure how robust the results are. Results are summarised in

Figure 0.21, similarly as above, numbers in brackets represent results for the total modelled region.

The price changes due to the projects listed on the 4th list, are similar to the effect of the already commissioned PCI projects. Most of the countries which face a price decrease due to the already commissioned projects face further lowering prices as a result of the commissioning of the projects from the 4th list. The highest change can be seen in Poland, where the price drops by EUR 7 per MWh. Also, a very significant price effect is visible on the Iberian Peninsula, due to the France-Spain interconnectors, and also due to the pumped storage projects in Spain. In Central-Western Europe including Germany, Austria and the Benelux countries also a price decrease happens. However, there are a lot of countries, where price increases are visible, including the Baltic and the Nordic countries, the whole SEE region, UK and France.

Figure 0.21 Key modelling results and indicators for the Future Scenario in EU28 and in all modelled countries (in brackets)

	EU28 (Total modelled region)	
	Future vs Baseline, 2030	Future vs TEN-E, 2030
Change in number of price divergence hours (%)	-17.4% (-10.7%)	-13.7% (-8.2%)
Change in total yearly trade (%)	33.7% (29.8%)	19.7% (18.6%)
Change in overall transmission usage (%)	-6.9% (-5.3%)	-6.2% (-4.9%)
Change in average wholesale electricity price (%)	-5.0% (-4.4%)	-3.6% (-3.1%)
Price divergence change (%)	-0.98% (-0.55%)	-0.62% (-0.33%)
Change in CO2 emissions (kt)	-31601 (-27962)	-21549 (-18767)
Change in congestion charges (million EUR)	-1012 (-1047)	-783 (-803)
Total welfare change (million EUR)	1139 (1248)	713 (787)

Source: REKK modelling results.

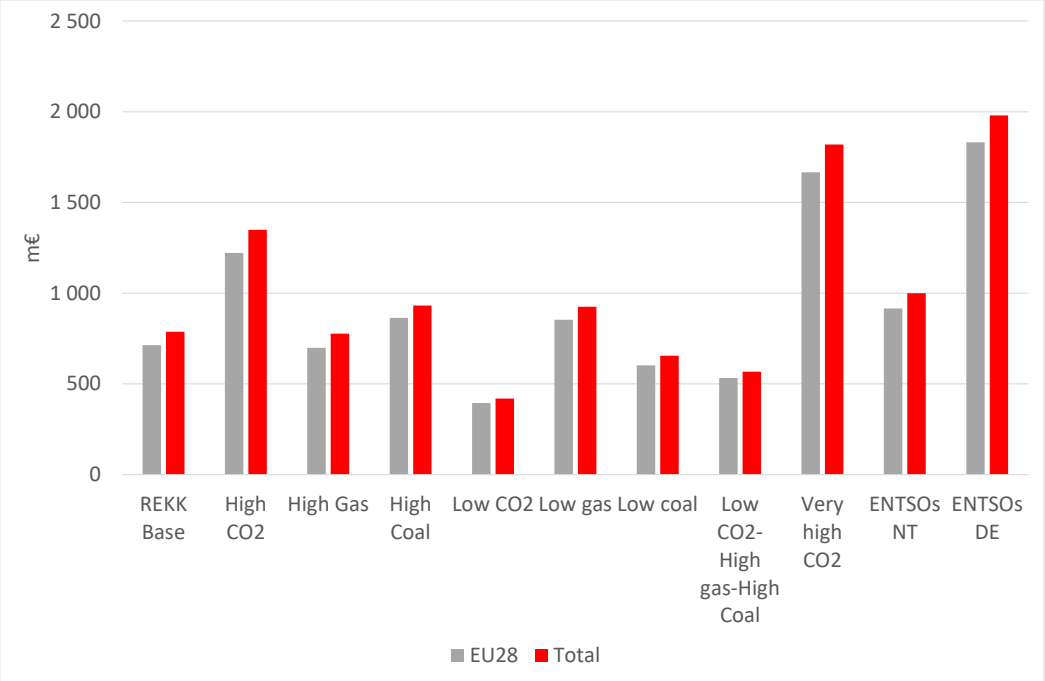
Total CO2 emission decreases significantly, with the realisation of the projects on the 4th list an additional 21.5 Mt decrease is foreseen in the EU on top of the around 10 mt generated by the existing PCIs. The decrease is 3-4 Mt less if calculated for the whole European electricity system. Applying the above presented calculation method for the social cost of carbon (see details in the TEN-E Scenario results subsection), emission reduction related benefits account for EUR 375.3 million in case of projects on the 4th list, while all PCI projects together could bring EUR 559.2 million benefit in 2030 when taking into account the total European electricity system.

Price convergence also increases, similarly to the TEN-E scenario, more significantly in the EU, and less in the total modelled region. Change in the number of price divergence hours is more significant: there are around 14% less congested hours around the EU as the effect of projects on the PCI list, and this number is more than 17% if the joint effect of already commissioned and to be commissioned PCIs are considered. Similarly, as in the TEN-E scenario total trade also increases significantly, but overall transmission usage does not, thus this is the result of more capacity and not more effective utilisation of the system.

Overall benefit increase is around EUR 700 million when the effect of the 4th list is calculated, and EUR 1,100 million when we take into account all PCIs.

Sensitivity results are similar in case of the Future Scenario as in case of the TEN-E Scenario: highest benefits can be observed when higher CO2 prices are assumed – in case of a higher pathway net benefits turn to positive -, coal and gas price assumptions have a much lower effect on the outcomes. According to the developments of the Green Deal, a higher CO2 price pathway is very much likely, as the CO2 price assumptions used in the reference case are from a former EU forecast (EUCO3232.5, see details in the first part of Section 0).

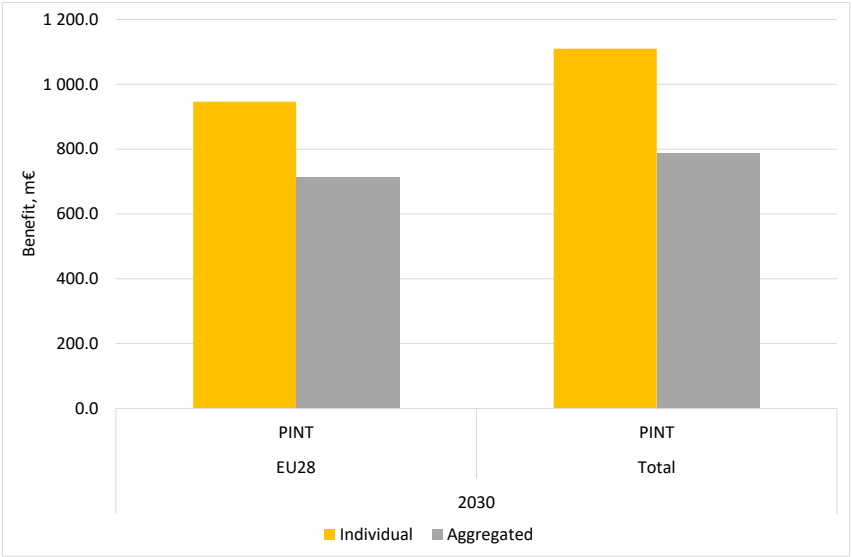
Figure 0.22 Sensitivity analyses on benefits of projects on the 4th list (Future vs. TEN-E), million EUR



Source: REKK.

From the complementarity assessment of the projects on the 4th list it is clearly visible that some projects are competing ones: the sum of the individual benefits are much smaller than the aggregated welfare gain of putting all projects into the system. Further analysis would be needed to identify these projects or project clusters, but it is already visible, that from the more than 40 projects some might bring less benefits to the system when they are realised after some others are already in place.

Figure 0.23 Aggregated individual PINT benefits compared to the full list, 4th PCI projects, in 2030 (TEN-E vs. Future), million EUR



Source: REKK.

Main messages based on modelling results

The following conclusions can be drawn from the modelling results:

- PCI projects help to meet the interconnection targets both in 2020 and in 2030:
  - According to the estimations there are six countries([437]) which cannot meet this target without the already commissioned PCI projects, PCI projects help two of these countries reach the 10% target by 2020.Without projects on the 4th list eleven countries cannot meet the 15% interconnection target in 2030. If these projects are commissioned, then this number is reduced to four.
- PCIs also help to mitigate market isolation issues – which are less and less present on the electricity market, but would still be an important issue for some of the peripheral countries without PCI projects;
- Market integration and price convergence are fostered through the past and future completion of PCIs, their contribution to the creation of the Energy Union is beyond debate;
- Significant CO2 emission reduction is visible as a result of PCI implementation, the benefits are only partly covered by the modelling:
  - Taking into account the total social cost of CO2 emissions additional EUR 22 million and EUR 183 million benefit can be considered in 2020 and 2030 respectively as a result of the implementation of the already commissioned PCIs;
  - This additional benefit is around EUR 375 million when the effect of the projects on the 4th list is modelled.
- It is important to analyse the whole European electricity system:
  - Part of the benefits arises in countries outside EU, for many projects one of the hosting countries is not a Member State;
  - Total emission reduction is lower if the whole modelled region is analysed: carbon leakage is present, but overall emission reduction is still significant.
- PCIs commissioned by 2020 might bring lower benefits in 2020 than in 2030 due to different price environment (e.g. higher assumed CO2 prices in 2030 than in 2020), and different electricity generation portfolio (basically more renewables and less fossil plants, but also somewhat higher differences between countries);
- The benefits stemming from the whole PCI portfolio increase with increase in CO2 costs:
  - According to the welfare analysis it seems that the biggest winners are countries where interconnectivity increased significantly;
  - Overall benefits are higher in the alternative scenarios, where much higher CO2 prices are assumed;
  - The already realised projects do not seem nor competing, neither complementary ones.
- Projects on the 4th PCI list also bring significant benefits:
  - Total emission reduction is lower if the whole modelled region is analysed: carbon leakage is present, but total decrease is still significant;
  - Highest benefits are mostly visible in peripheral Member States of the EU, as mostly these countries are/were less interconnected than central Member States;
  - There is a strong link between CO2 prices and benefits;
  - Higher assumed CO2 prices (that are likely based on the latest Green Deal developments), bring up expected benefits significantly. Natural gas and coal prices have a much lower effect on the results.

Overall benefits of all projects together seem lower than the sum of benefits from individual project realisations, meaning there are some competing projects from the more than 40 PCIs on the 4th list.

[437] Cyprus and Malta are not calculated.

ANNEX IV PROCEDURAL INFORMATION

This Annex outlines the process to prepare the analytical support document(s), including key outcomes of all activities carried out throughout the study. The study consisted of three tasks:

- Task 1 - Develop a methodology and draft a detailed workplan;
- Task 2 - Data collection and review of relevant evidence;
- Task 3 - Stakeholder consultation.

First, in **Task 1**, the approach and the methodology of the work were presented in the inception note by revising and finalising the evaluation framework outlined in the proposal. The research for this project started in January 2020, with the inception meeting held on 22 January 2020 at the EC premise in Brussels. The finalisation of the evaluation matrix that defines judgement criteria, corresponding indicators and potential sources of relevant data, was a key element of the structuring step. The final inception note was first submitted to the Commission on 15 January 2020, subsequently revised by the consortium and approved by the Commission on 24 February 2020.

Data was collected from available sources, such as databases, reports, and other sources (**Task 2**). The desk research was completed in February 2020. In line with the objectives of the study we implemented an extensive desk research providing insight on backward and forward-looking elements. In total, 62 documentary sources were assessed in the desk research phase after consultation with the Commission. These comprised 40 reports, studies and monitoring sources from academia, the European Commission, regulators and other organisations. 22 legal documents such as EU Directives, Regulations, Decisions and strategies have also been assessed. The portfolio analysis as well as the case studies present data, information and evidence supporting the assessment of the implementation of the TEN-E Regulation. In addition, modelling provided quantitative assessment taking into account various scenarios of the future developments.

Where desk research did not yield sufficient information, the research team relied on stakeholders to collect the data necessary. For this purpose, several consultation activities were undertaken to gather opinions of various groups of interested parties regarding the TEN-E Regulation and its main provisions in detail (**Task 3**). The procedural information for these consultation activities are presented below:

- Targeted survey: The questionnaire for targeted survey was designed and approved by the Commission It was launched by the Commission on 18 May 2020 and closed on 13 July 2020. Invitations to participate were sent to stakeholders by the Commission. Moreover, the OPC contained a link to invite all interested participants to also fill in the targeted survey. The overall number of responses received to the targeted online survey is 112;
- Online Public Consultation: The questionnaire for the OPC was designed in parallel with the one for the targeted survey. It was launched on 18 May, 2020 and closed on 13 July 2020. The overall number of responses to the OPC questionnaire is 103. In addition, 169 emails were received via the functional mailbox for the consultation;
- Interviews: This component of the stakeholder consultation strategy comprised of approximately hour long interviews with key stakeholders. An interview guide that included the interview questionnaire to all stakeholders was approved by the Commission on 1 June 2020. A total of 82 in-depth interviews were carried out between June and August 2020;
- Webinars: In line with the Inception note and the consultation strategy, the methodology for the study envisaged two one-day workshops (one in April and one in August 2020). However, due to the Covid-19 pandemic, it was agreed with the Commission that the first workshop would be transformed into a series of four webinars that took place in the first 2 weeks of June 2020. The webinars were performed through the WebEx platform while the management of the registration process was performed through the EU Survey platform. The number of participants to the webinars ranged between 211 and 304. More than 40 panellist delivered presentations, which provided different perspectives – regulators, ENTSOs, DSOs, industry associations, project promoters, NGOs, and research institutes. The discussions during the webinars were summarised in Webinar reports, which were distributed to the Commission and the evaluation team, so that the results of the webinars can feed into the answering of the respective evaluation questions. Due to the short timeframe of the back-to-back evaluation and impact assessment process, the Commission has decided that a second workshop was not anticipated in August 2020.

ANNEX V SYNOPSIS REPORT

Introduction

The stakeholder consultation strategy employed in this study is formulated following the guidance provided by the Better Regulation Guidelines and Toolbox. As tool #52 of the Better Regulation Toolbox suggests for "back-to-back evaluations and impact assessments", it includes a range of appropriate consultation activities and consists of a mix of both backward- and forward-looking elements. The stakeholder consultation strategy encompasses all activities, time and resource requirements related to the consultation of interested stakeholder groups. The strategy is in line with the intervention logic, placing the focus on relevance, effectiveness, efficiency, coherence, and EU value-added of the TEN-E Regulation.

The consultation strategy

In line with the Better Regulation guidelines([438]), the consultation strategy 'aimed to ensure that all relevant evidence were taken into account, including data about costs, about societal impact, and about the potential benefits of the initiative.'

In line with the Better Regulation guidelines, the goal of the stakeholder consultation was:

- To collect views, experience and concrete examples from stakeholders that will illustrate particular opportunities, challenges and impacts resulting from the implementation of the TEN-E Regulation with the view to fill any potential information/data gaps, and facilitate the analysis of the different evaluation criteria;
- To solicit opinions on the extent to which the TEN-E Regulation is meeting its objectives.

The scope of the consultation strategy was encapsulated in the evaluation questions. Therefore, the specific questions asked during the consultation focused on gathering stakeholders' responses and views related to the individual evaluation criteria: relevance, effectiveness, efficiency, coherence and EU value-added to fill in potential Commission data gaps.

The consultation strategy combined several consultation tools that generated the information and evidence necessary to provide well-reasoned responses to the evaluation questions. Specifically, the following methods were employed:

- Online Public Consultation (OPC);
- Targeted online survey;
- Interviews; and
- Webinars.

Online Public Consultation

The online public consultation (OPC) on the revision of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure (TEN-E Regulation) was carried out in the period 18/05/2020 - 13/07/2020([439]). In line with EU rules on better regulation, the aim of the consultation was to gather the views of EU citizens and stakeholders on the TEN-E Regulation. In particular, it aimed to collect input on what should be viewed as the priority corridors and priority thematic areas.

Approach for the OPC

EU Survey was used to manage the OPC. The questionnaire was available in 23 of the official languages of the EU. It was addressed to citizens and organisations (e.g. NGOs, local government, local communities, companies and industry associations) that have no specialist knowledge of the TEN-E Regulation. People with specialist knowledge of the TEN-E Regulation (e.g. as a professional for a national competent / regulatory authority, TSO, DSO, company project promoter, energy

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([438]) European Commission (2017), Better Regulation Guidelines, Tool #53. Retrieved from: https://ec.europa.eu/info/sites/info/files/better-regulation-guidelines.pdf.

([439]) Due to the very tight timeframe for the revision of the TEN-E Regulation and the various consultation tools applied, it was decided that the period of the consultation would be 8 weeks.

producer, NGO with specific knowledge on the subject) were invited to fill in a targeted survey. However, there was no restriction for professionals to answer both questionnaires.

This OPC questionnaire was structured as follows:

- Introduction: information about the participants;
- Part I: Relevance and EU added value (exploring participants' view on Europe's energy infrastructure needs and objectives);
- Part II: Public participation and transparency (exploring participants' view on how information on energy infrastructure projects should be shared by project promoters).

Number and distribution of the responses

Number of responses received

The overall number of responses to the OPC questionnaire is **103**. In addition, **169** emails were received via the functional mailbox for the consultation. For comparison, this is more than the public consultation performed for the previous evaluation([440]), which received 36 respondents. Also, it should be noted that the OPC coincided with other activities under the study such as the targeted questionnaire and webinars, which also gathered stakeholder perspectives on the TEN-E Regulation revision.

Distribution by type of stakeholder and country

Respondents were asked to identify which stakeholder category they or their organisation represented. They could select multiple categories and had the option to tick "other" if they did not fit into one of the existing categories. The main category of respondents was EU citizens (28 responses), followed by business associations and company/business organisations. Figure 0.1 outlines the respondents by each category.

Figure 0.1 Answer to the question 'I am giving my contribution as' (n=103)

Type of respondent	Number	Percentage
Academic/research institution	2	2%
Business association	25	24%
Company/business organisation	22	21%
Environmental organisation	2	2%
EU citizen	28	27%
Non-EU citizen	2	2%
Non-governmental organisation (NGO)	12	12%
Other	5	5%
Public authority	5	5%
Grand Total	103	100%

In terms of the distribution of responses by country, most responses were received from Belgium (31), followed by Germany (12), and Spain (9).

Main results of the OPC

Relevance

[440] Trinomics (2018), Evaluation of the TEN-E Regulation and Assessing the Impacts of Alternative Policy Scenarios. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/81f6baae-5efc-11e8-ab9c-01aa75ed71a1/language-en.

The OPC contained questions on **Relevance** from three perspectives: objectives, infrastructure categories, and PCI features.

All objectives([441]) included in the questionnaire are considered important by the respondents. According to respondents, the most important objective for trans-European energy infrastructure network is the 'Integration of renewable energy sources into the grid' (92% of the respondents consider it 'Important' or 'Important to a large extent'). The objective 'A competitive and properly functioning integrated energy market' is considered as least important (21% of the respondents consider it 'Not important' or 'Important to a small extent'), but it is nonetheless perceived as relevant as 65% of the responses are in the positive scale ('Important' / 'Important to a large extent').

The scoring on relevance of infrastructure categories are much more diverse than for the objectives. The two categories that received the highest scores on relevance from the respondents are: 'Electricity infrastructure (transmission lines and storage)' with 87% in the positive scale ('Relevant' and 'Relevant to a large extent') and 'Smart electricity grids' with 83% in the positive scale. The infrastructure categories that received more responses in the negative scale ('Relevant to a small extent' and 'Not Relevant') than in the positive scale are: 'Geological storage of CO2', 'Liquified Natural Gas (LNG) terminals', and 'CO2 networks (for transporting CO2)'. Opposition (from EU citizens) to supporting fossil fuel energy infrastructure was the most common feedback received via the functional mail of the consultation.

All features([442]) for a PCI as part of the trans-European energy network that are listed in the questionnaire are considered important by respondents. The feature that received the most responses (mostly from EU citizens) in the negative scale is 'Increase competition in the market' (32% of the respondents), but overall it is also in the positive scale with 60% claiming that it is 'Important', or 'Important to a large extent'.

77% of the respondents agree that the revised TEN-E Regulation can make an important contribution to the economic recovery in Europe through a green transition in response to the COVID-19 crisis, while 8% disagree with the statement.

EU added value

As concerns **EU added value**, the majority of respondents to the OPC (92%) support the statement that the development of TEN-E networks cannot be sufficiently achieved by the Member States alone and can therefore be better achieved through coordination at the EU level. A small share of respondents (3%) disagreed with the statement.

Public participation and transparency

Regarding **public participation**, 82% of the respondents declared that they are aware of PCI and 78% are aware that there is a public participation process with regards to PCIs. The majority (68%) consider the public participation process as useful or useful to a large extent, but 20% of the responses are in the negative scale ('Not useful' or 'Useful to a small extent').

([441]) A competitive and properly functioning integrated energy market; Increased resilience of energy infrastructure against technical failures, natural or man-made disasters, and the adverse effects of climate change and threats to its security; Consumer empowerment - making sure consumers' interests are considered in decisions related to energy infrastructure; Secure and diversified EU energy supplies, sources, and routes; Integration of renewable energy sources into the grid; Increase cross-border interconnections and deepen regional cooperation to transport energy from renewable sources where it is most needed; Giving priority to energy efficiency (putting the 'Energy efficiency first' principle in practice); Achieving the EU's decarbonisation objectives for 2030 and 2050, including climate neutrality under the European Green Deal; Increased digitalisation of the energy infrastructure (e.g. Smart Grids); Energy system integration and sector coupling (integration of the different energy sectors and beyond).

([442]) Integration of renewable energy sources into the grid; Contribution to greenhouse gas emissions reduction; Security of supply; Market integration (e.g. to improve infrastructure and increase system flexibility); Increase competition in the market; Innovation; Contribution to increase the energy efficiency of the energy system; Environmentally sound implementation, i.e. compliance with the relevant regulations especially in the area of environment; Generation of direct benefits to the local communities.

Project websites are considered to be the most useful communication channel for providing and exchanging information on PCIs (78% consider it 'Very useful' or 'Useful to a large extent'). Most respondents (54%) cannot answer if there are any improvements in the **transparency** of the planning and building process of any PCIs in comparison to other energy infrastructure projects. However, for 28% of the respondents (company/business organisations, EU citizens, NGOs), there is no improvement, or there is an improvement only to a small extent. For 14% (answers 'Yes' and 'To a large extent') there is improvement in transparency.

Targeted online survey

The targeted survey on the revision of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure (TEN-E Regulation) was carried out in the period 18/05/2020 - 13/07/2020. Its aim was to gather the views of stakeholders on the TEN-E Regulation. The survey was designed to complement other stakeholder consultation activities, notably the in-depth interviews and the online public consultation.

The survey was specifically targeted at TEN-E stakeholders, contrary to the online public consultation, which was accessible to all interested persons. Specifically, it targeted project promoters, public authorities (NRAs, NCAs, regional and local governments), other actors of the energy system (e.g. DSOs, energy suppliers), civil society (e.g. local communities, NGOs) wider industry representatives and academics or researchers. They were sent an invitation to take part by the Commission along with the invitation for the public consultation and interviews.

Approach to the targeted survey

The EU Survey platform was used to manage the targeted survey. The questionnaire was available in English only. It was targeted to stakeholders with specialist knowledge of the TEN-E Regulation (e.g. as a professional for a national competent / regulatory authority, TSO, DSO, company project promoter, energy producer, NGO with specific knowledge on the subject).

The questionnaire included questions pertaining to all five evaluation criteria, but focused primarily on the effectiveness and state of implementation of the Regulation. It was designed so that specific groups of stakeholders were asked questions of particular relevance to them, but also included more general questions that were visible to all respondents.

Number and distribution of the responses

The overall number of responses received to the targeted online survey is 112. One of those submissions was a duplicate, and was removed from the dataset. In addition, one contribution was received via email. Thus, the total number of contributions taken into consideration in the analysis is 112.

Distribution by type of stakeholder

Respondents were asked to identify which stakeholder category they or their organisation represented. The main category of respondents was Transmission System Operators (27 responses), followed by "other" stakeholders (22 responses) and industry representatives (17 responses). Figure 0.2 outlines the respondents by each category.

Figure 0.2 Answers to the question 'Please select what type of organisation you represent:' (n=112)

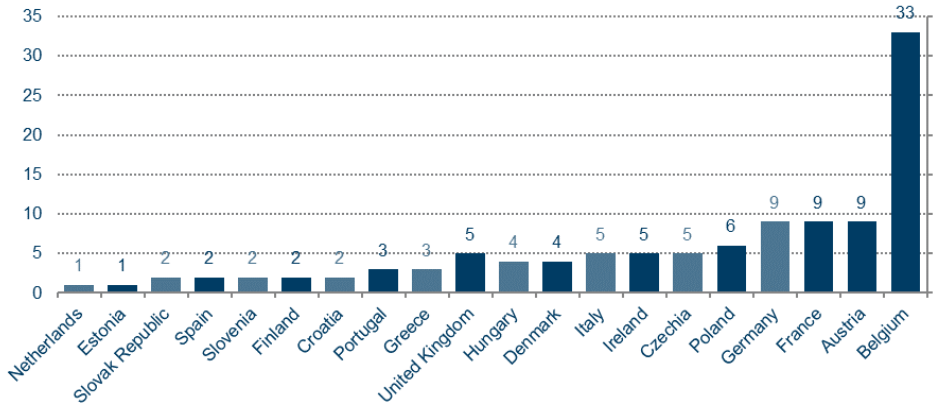
Type of respondent	Number	Percentage
National Regulatory Authority	4	4%
National Competent Authority	10	9%
Transmission system operator	27	24%
Distribution system operator	10	9%
Energy producer	10	9%
Industry	17	15%
Civil society	11	10%
Research, academia	1	1%

Type of respondent	Number	Percentage
Other	22	20%
Total	112	100%

Distribution by country

In terms of the distribution of responses by country, most responses were received from Belgium (33 respondents), followed by Austria, France and Germany (9 respondents each). The distribution per country of origin is presented in Figure 0.3

Figure 0.3 Answer to the question 'Please select the country in which you are based:' (n=112)



The overrepresentation of Belgium stems from the fact that many of the civil society organisations and industry associations that provided their input to the targeted survey are based in Brussels.

Main results of the targeted survey

Effectiveness

Respondents largely agree that the TEN-E Regulation has had a positive impact towards meeting its objectives: it has contributed to energy market integration (88%), achieved an adequate level of security of supply (77%), and contributed to competitiveness in the EU energy market (63%). Less agreement was indicated with the statement that the Regulation helped achieve the 2020 climate and energy targets, however (47%). There are no clear trends across stakeholder groups.

Permit granting

Respondents' views on the impact of the TEN-E Regulation on shortening the PCI selection process were mixed: 20% (completely) agree, while 36% (completely) disagree; others were unable to answer or had no strong opinion on the matter – there are no trends across stakeholder groups. Similar differences in views were noted about the effectiveness of the one-stop-shops. Their reasons for delays include notably environmental impact assessments and the statutory permit granting procedure. It is clear, however, that most respondents were not sufficiently knowledgeable to answer these questions.

Public consultation

Although the views about the public consultation process were also mixed, the message was more positive: respondents agreed that the process increased awareness of PCI projects (51% agree, 17% disagree), improved public participation (41% agree, 12% disagree) and increased trust (37% agree, 38% disagree). However, it seems to have a limited impact on increasing public acceptance (22% agree, 24% disagree) and improving the design of the projects (19% agree, 26% disagree). Nevertheless, most respondents agreed that the requirement for at least one public consultation is enough for increasing transparency and participation (46% agree, 20% disagree). There are no trends across stakeholder groups.

PCI selection process

Respondents largely believe that the selected PCIs are the most relevant projects to the fulfilment of the TEN-E objectives (48% agree, 26% disagree). However, they do not think that the cost-benefit assessments for the selection of PCIs are using an appropriate methodology (34% agree, 44% disagree). In general, the roles of different actors in the selection procedure is considered adequate, except for a significant wish to weaken the role of the ENTSOs (39%) and to strengthen the role of DSOs (53%) and other stakeholders such as NGOs (39% - 67% of whom represented industry or civil society). With regards to the selection criteria, the general criteria are considered appropriate (48% agree, 38% disagree), but there is a lack of knowledge about the specific criteria for electricity, gas and CO2 projects that led to limited (and mixed) views on their appropriateness.

Governance

There is overwhelming agreement among NRAs, NCAs and TSOs that the Regional Group model enables regional cooperation (83%), that it is effective that NRAs are responsible for CBCA decisions (79%) and that High Level Groups provide added value through strategic steering and political guidance as well as monitoring the PCIs in the priority regions (71%). There is a general agreement among all respondent groups that the current reporting and monitoring procedures on the PCI progress are sufficient to ensure transparency on PCI development (56% agree, 18% disagree), but not that PCIs implementation plans and the regular updates ensure timely project implementation (33% agree, 24% disagree).

CBCA / other incentives

Views on whether CBCA decision processes and outcomes enable effective investment decisions were mixed: 25% agree that it does, 17% disagree, 21% neither agree nor disagree and the rest was unable to answer. A more positive view was expressed as to whether investment incentives enable effective investments in PCIs: 54% agree and only 5% disagree, while 13% neither agree nor disagree and others were unable to answer. There are no trends across stakeholder groups.

Efficiency

NRAs, NCAs and project promoters largely disagree that the TEN-E Regulation PCI status has reduced administrative costs for project promoters: only 7% agree while 47% disagree. The aspects that trigger costs differ for each organisation – no clear trends emerge as the sample size is so small. Nevertheless, the majority of respondents believe that the benefits of the TEN-E Regulation outweigh the costs (53% agree, 14% disagree). This is especially true for TSOs (81% agree), NCAs (60% agree) and NRAs (50% agree), and less so for civil society (73% disagree).

Relevance

Respondents clearly think the TEN-E Regulation is lacking in terms of adequately addressing key issues such as the integration of renewable energy, improving energy efficiency and climate change mitigation. According to respondents, the three main (new) challenges to be addressed are greenhouse gas emission reductions / climate neutrality (mentioned by 54), integration of renewable energy sources (mentioned by 50) and energy system integration (mentioned by 47). The two least important challenges are energy financing capacity of TSOs (mentioned by 42) and market fragmentation / market integration (mentioned by 20).

Coherence

Respondents pointed towards some inconsistencies between the TEN-E Regulation and other policies or initiatives at EU level. Inconsistencies were notably identified with regards to the European Green Deal / Long Term Strategy for Decarbonisation (74% identified inconsistencies, especially among civil society, DSOs and energy producers and industry), the Paris Agreement (65% identified inconsistencies, especially among civil society, DSOs and TSOs), and the Clean Energy Package / the Energy Union (55% identified inconsistencies, especially among civil society, DSOs and energy producers).

EU added value

There is widespread agreement among respondents that the TEN-E Regulation has EU added value – the majority believe it achieved more than could have been achieved at national/regional level (79% agree, 3% disagree) and that the issues addressed by the TEN-E Regulation continue to

require action at EU level (91% agree, 0 disagree). The main EU added value identified by respondents is access to financing (mentioned by 99), followed by regional cooperation (mentioned by 84) and the implementation of projects that could not have been implemented without TEN-E (mentioned by 67).

In-depth interviews

The in-depth interviews aimed to gather the views of stakeholders on the TEN-E Regulation. In particular, they aimed to collect more detailed information than could be collected through the targeted survey and online public consultation. As such, the interviews focused primarily on the effectiveness and implementation of the Regulation, but also touched upon its relevance, coherence, and EU added value.

The interviews were designed to complement the results of the targeted survey. In reality, the two overlapped significantly, because time constraints made it impossible for the study team to wait for organisations/individuals to provide their answers to the targeted survey before conducting the interviews, although stakeholders were requested to do so. The stakeholders consulted through both activities also largely overlap, although the interviews also targeted other stakeholder (e.g. European Commission DGs) that were not asked to complete the online survey.

Approach to the interviews

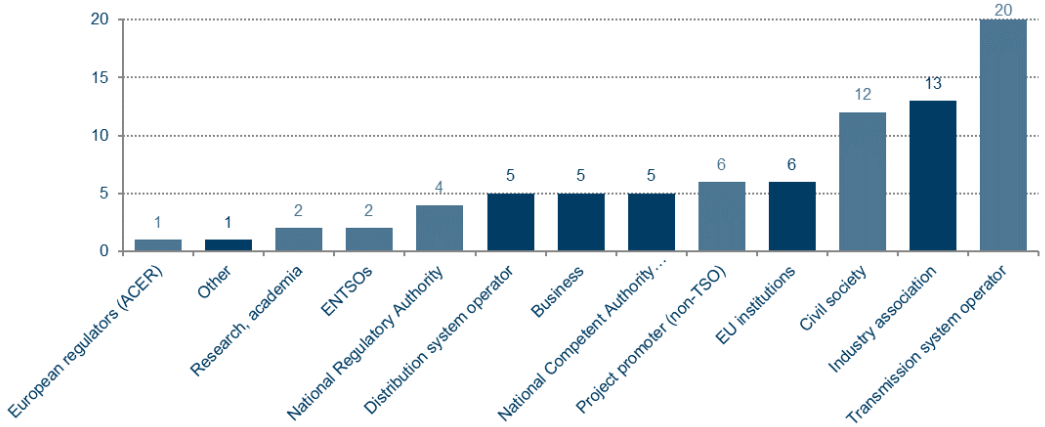
The Commission sent out an invitation to take part in in-depth interviews along with the invitation to complete the targeted online survey and the online public consultation. Stakeholders were asked to express their interest in being interviewed via email to a functional mailbox managed by the study team. Targeted survey respondents could also indicate, at the end of that survey, whether they were interested in being contacted by the study team to schedule an interview.

The interview guide was designed in such a way that the questions asked could be flexibly adapted to fit the knowledge and interests of the interviewees. It included a few key high-level questions about the effectiveness, efficiency, relevance, coherence and EU added value of the Regulation, and several more detailed ones that were asked only of interviewees who had sufficient knowledge to answer them. This helped avoid stakeholder fatigue and allowed for the other topics to be covered in more depth.

Number and distribution of the interviewees

A balanced set of interviewees, including NRAs, TSOs, civil society organisations and industry associations took part. A total of 82 interviews were conducted, as shown in the figure below.

Figure 0.4 Distribution of interviews conducted, per type of stakeholder



Main results of the interviews

Effectiveness

Interviewees of all stakeholder categories expressed positive views on the achievement of the overall objectives of market integration, security of supply and competitiveness. On the achievement of climate objectives, interviewees of all categories pointed out the fast development of climate objectives that is not reflected in the current TEN-E Regulation, considering the

circumstances at the time of inception. Views in relation to the specific objectives are more diverse. Project promoters and NCAs are the ones providing the most insights on the topic of permit granting but differ in views from expressions of strong satisfaction to no effect at all, depending on the Member State. Views on the regulatory framework stem largely from project promoters, because only few NRAs agreed to participate in an interview. Similar to permit granting, the opinions shared were positive about the idea but also mentioned the complex process. The views on financing of PCIs are aligned and strongly positive by most stakeholder types, except for several NGOs who criticise the public spending on fossil fuel projects.

Permit granting

The stakeholders displayed contrasting opinions about the effectiveness of the Regulation with respect to the permit granting process. Some of them stated that it had provided clarity and shorted the duration, while others perceived it as adding to the complexity of the process and that it had not led to reductions in the time needed to obtain a permit compared to non-PCIs. Similarly, they noted that the national procedures could lead to delays beyond the 3,5-year limit. The view of the interviewees demonstrated that the effect of the TEN-E provisions varied considerably on a case-by-case basis.

Furthermore, interviewees expressed a number of opinions about the introduction of a one-stop-shop. According to some of them it had resulted into a more streamlined permit granting process, reduced number of stakeholders involved in the procedure and shortened duration. However, other interviewed stakeholders held the view that a single authorisation is not always effective in practice as PCIs need to comply with the national and regional provisions which pertain to permit application and the one-stop shops in some Member States are not functioning as efficiently.

The opinions of the interviews with regard to the priority treatment of PCIs differed considerably. While some interviewees noted that some PCIs had gotten priority treatment as a consequence of their status, others were of the opinion that it did not make a difference and stated that at times the existing national provisions made it challenging to treat PCIs differently.

Public consultation

While some interviewees considered public consultation to be important for ensuring transparency and to increase public awareness, others considered them unnecessary due to the already existing obligations at national level to conduct such consultations. Some of the interviewed stakeholders stated that public consultations should be held earlier and expressed concerns about the lack of a clear mechanism for utilising and tracing how the input from the consultations has been used.

PCI selection process

Interviewees shared a diverse view on the criteria for selection of PCI. The assessment of sustainability is by many described as unclear. Several NGOs and industry stakeholders indicated that the weak assessment of climate impact is causing projects to be selected that do not have a positive effect on CO2 emissions. A need for revision of the PCI selection criteria considering the sustainability and climate effect is also echoed by some NRAs. TSOs do not indicate strong opinions on the sustainability criterion. Another point of concern is the TYNDPs developed by the ENTSOs, which have received criticism for not being transparent enough to enable redoing the calculations. Yet, development to implement an interlinked model is ongoing and welcomed by most interviewees.

The roles of the different actors in the PCI selection process is by some interviewees not seen as adequate. For example, questions have been raised regarding the independence of the ENTSOs, as they can prioritise electricity and gas transmission infrastructure projects over other projects at a DSO level, electricity storages, LNG terminals or CCS projects. Nevertheless, a large majority of stakeholders considers the regional group model to be appropriate and effective.

Governance

On the governance of the TEN-E Regulation, interviewees expressed their opinions on the roles of regional groups in the PCI monitoring process. The model is overall considered to adequately enable regional cooperation and appropriately align with the regional nature of the challenges. Regarding emerging technologies, NGOs, NCAs and some TSOs additionally acknowledge that a thematic approach within the current model would be fit-for-purpose. Regarding High Level

Groups, interviewees were generally not aware of the actions and the effectiveness of these groups.

CBCA / other incentives

The interviews underlined that there is room for improvement regarding the effectiveness of CBCA decisions and the prerequisite of such a decision for gaining access to CEF funding: ACER, NRAs and project promoters argue that the CBCA-CEF linkage should be revised. Additionally, according to ACER, the significance threshold of 10% is somewhat arbitrary but justified as it prevents that the number of Member States and stakeholders in CBCA decisions becomes too large. ENTSO-E emphasised that if cross-border impact depends on modelling assumptions, this provides an additional argument for applying a threshold.

Stakeholder views differ in respect to risk-based incentives. While some TSOs see an added value in these incentives in adjusting the financial risk, regulators refer to the low number of applications to illustrate the lacking need for additional risk-based incentives

Efficiency

Interviewees across all stakeholder groups indicated that generally the benefits outweighed the costs. Project promoters highlighted inefficiencies related to the PCI reporting and monitoring, the PCI selection process, permitting process, and CBCA process. NCAs generally found that the administrative burden of TEN-E is low. NRAs indicated that the CBCA process is difficult and that they experience a relatively heavy burden from it.

Relevance

In terms of objectives of the TEN-E Regulation, sustainability/decarbonisation may need to be prioritised. In view of the necessary growing shares of variable renewable energy generation, RES integration and security of supply are becoming increasingly more relevant. The flexibility needs of the system can also be addressed by energy system integration, potentially an additional objective in the Regulation. On the other hand, although market integration and competition are still relevant, these have reduced in importance. Lastly, it is worth noting that innovation is considered by many stakeholders an objective necessary at this transforming stage of the energy sector.

A revision and rebalance of the objectives of the TEN-E Regulation may be needed to facilitate the deployment of emerging technologies that are now deemed necessary to ensure that the Paris Agreement and the European Green Deal targets are accomplished. Most interviewees see the most important challenges to be greenhouse gas emission reductions, integration of renewable energy sources and energy system integration.

Coherence

Many interviewees noted that the TEN-E is a 'product of its time' and was largely in alignment with EU energy and climate objectives at the time of its entry into force. However, interviewees across a broad range of stakeholder categories largely expressed the view that the current TEN-E is not consistent with current EU climate and energy policy / legislative provisions, and that substantial revision would be required for the TEN-E to align, particularly with the objectives of the Green Deal and Clean Energy Package and the Sustainable Finance Framework (when finalised).

Most stakeholders agreed that support for fossil fuel infrastructure would not be 'Green Deal compatible' but a number of stakeholder groups (e.g. TSOs in certain Member States) emphasised to need to allow the use of conventional fuel infrastructure, such as natural gas, in a 'transitional' context to allow some regions to move towards low carbon alternative.

A broad range of stakeholders (in particular contributions from academic institutions and network companies) supported the idea of developing a more 'holistic' approach to assessing Significant Cross-Border Impacts, to allow a broader range of projects to be developed – and provided some suggestions on how to implement such an approach.

Finally, a small number of stakeholders (in particular from network operators and academia) saw opportunities for better alignment and synergy with complementary policy areas such as TEN-T and EU Digital Strategy.

EU added value

EU added value was not explicitly covered in the interviews. Nonetheless interviewees across all stakeholder group expressed the added value of TEN-E at a general level. They elaborated that TEN-E provided added value in the form of cooperation and coordination among Member States.

Webinars

Originally, a dedicated stakeholder workshop was scheduled to take place on 23.04.2020 with an audience of approximately 180 participants. The goals for this workshop were to introduce the work carried out as part of this study and to receive structured feedback from the participants. Due to the COVID-19 outbreak, the original workshop was changed into a series of four webinars, which were conducted in the beginning of June 2020. Reports for each of the webinars were prepared by the evaluation team.

The four webinars (listed below) covered various topics related to the TEN-E Regulation and its revision and were conducted through Cisco Webex Video conferencing system:

- The first webinar on 'TEN-E Infrastructure categories to ensure full consistency with the climate neutrality objectives of the Green Deal' took place on 02 June 2020. It was attended by 304 participants and 17 panellists;
- The second webinar on 'Selection procedure and criteria for Projects of Common Interest (PCIs)' took place on 04 June 2020. It was attended by 298 participants and 12 panellists;
- The third webinar on 'TEN-E Regulatory toolbox and criteria for CEF financial assistance' took place on 09 June 2020. It was attended by 284 participants and 9 panellists;
- The fourth and last webinar on 'PCI Implementation: Permitting, monitoring and involvement of stakeholders' took place on 11 June 2020. It was attended by 211 participants and 8 panellists.

The recordings of the webinars are available on the following web address: https://ec.europa.eu/info/events/webinars-revision-ten-e-guidelines-2020-jun-02_en.

ANNEX VI METHODS AND TOOLS

Online public consultation – questionnaire

The online public consultation questionnaire is in the embedded file below:

Adobe Acrobat Document

Targeted online survey – questionnaire

The targeted survey questionnaire is in the embedded file below:

TENEevaluation_final_targeted_survey.pdf

Case study template

Main messages of the case study

Summary of key take-aways for the other parts of the study (what did work and what did not work).

Introduction

Explaining the framework: please shortly describe the importance of the project within its regional group/ sector, to make the selection of the project into the PCI list and also as a case study clear for a reader who is less familiar with the PCI projects.

Main objectives of the project ((e.g. reduce bottleneck, increase capacity, access to RES)]

Main insights of the case study (e.g. CBCA, public participation, financing, etc.)

General information

Short description of the project

Please insert a map

Sector: *[Electricity, Gas, Smart grid or CO2]*
Name of case study: *[Name]*
PCI Code: *[Code]*
Project promotors:
Regional group: *[NSI EAST, NSI WEST, BEMIP, SGC, etc.]*
Project status: *[Under Consideration, Permitting, FID, Under construction, Completed, etc.]*
Hosting countries: *[List of countries]*

	Date of project launch	1st PCI list	2nd PCI list	3rd PCI list	4th PCI list
Expected date of commissioning					
Planned capacity					
Planned route					
Estimated investment cost					

[Please fill out if interesting and data is available – additional rows can also be added]

Please summarize the information of the table in a few sentences as description of the project history and implementation. Table is not necessary to be included.

Permit granting

(Facts)

Description of the process

- What were the main steps in the permitting procedure? How much time did they require?
- Did the project receive priority treatment?

(Stakeholders' view)

- What was the impact of the TEN-E Regulation on the permit granting procedure?
- How did it differ from a normal permit granting procedure (one stop-shop, streamlining, etc.)?

Public consultation

(Facts)

- Please summarize the feedback of the PCI consultations related to the project.
- Were there any other public consultations in relation to the project? If yes, please summarize.
- Summarize the media coverage of the project (most important aspects) if it is interesting.

(*Stakeholders' view)*

- How did the public consultation contribute to the public awareness, the public acceptability, and the successful implementation of the project?
- Did the PCI-status itself contribute to the public acceptance of the project?

Regulatory incentives

(Facts)

- Did any regulatory incentives apply to the project? (e.g. exemption from TPA). If yes, please describe and if possible, provide the underlying documents and reasoning for the regulatory incentive.

(Stakeholders' view)

- Did the project gain from regulatory incentives? Were they an important factor in the investment decision?

Administrative burden

(Facts)

- What are the key costs of the TEN-E Regulation regarding the project? (Important to ask for a detailed breakdown of costs of the PCI status (e.g. costs of human resources, travel, studies, consultancy, etc., but excluding the investment cost of the project itself and (costs of applying for) CEF funding)

(Stakeholders' view)

- View of stakeholders on the additional costs and benefits brought by the TEN-E Regulation;
- To what extent are the costs resulting from the implementation of the TEN-E Regulation proportionate to the benefits that have been achieved regarding to the project?

CBA: Costs and benefits of the projects

(Facts)

- Summary of the latest available CBA for the project (ENTSO-G, ENTSO-E if available, JRC for smart grid) and critical view based on other sources (e.g. CBA done by project promoter/academics).

(Stakeholders' view)

- In the stakeholders' opinion what is the main contribution of the project to the goals of Regulation
  (market integration, security of supply, competitiveness and the climate and energy targets)?
- What unintended or unexpected positive and negative effects, if any, have been produced by the TEN-E Regulation (e.g. in terms of human health, use of resources, and natural ecosystems) in relation with the project?

Cross border cost allocation (CBCA)

(Facts)

- Was a CBCA decision made? If yes what were its main characteristics?
- How were costs allocated in the CBCA (e.g. based on potential benefits, on geographical ba sis (e.g. length of pipeline))?
- Were other than hosting countries included in the CBCA?

(Stakeholders' view)

- What was the contribution of the CBCA decision to the project?

Financing of the project

(Facts)

- Did the project receive financial support through the EU CEF funds?

(Stakeholders' view)

- Did the PCI status of the project help to attract other funding?

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