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Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure?

Country Report - Ireland

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The Irish national regulatory framework (NRF) and regulatory practices for electricity and gas have many similarities, for this reason in this summary no distinction is made between electricity and gas.

The NRF in Ireland

The electricity transmission system is owned by ESB, a State-owned vertically integrated company. ESB is responsible for the funding of, and carrying out construction and maintenance on, the transmission network ("**TAO**"). Gas Networks Ireland Limited ("**GNI**"), a regulated business, is the licensed transmission asset owner and transmission asset operator for the natural gas transmission and distribution networks. GNI also holds the transmission asset owner license ("**TAO**"). A separate, independent state-owned company, EirGrid, is the certified transmission system operator ("**TSO**") in Ireland. The Commission for Regulation of Utilities (CRU) is the independent regulator of the energy (and water) sector in Ireland.

The CRU's primary mechanism for ensuring the delivery of appropriate investment in the transmission network is through its price review process. The CRU carries out a price review every five years. The regulatory system in place is a revenue cap based on rate-of-return with incentive-based regulation. As part of the CRU's annual review, existing forecast items are updated as appropriate, and the TSOs and the TAO may request revenue for additional items that were not envisaged or captured at the time of setting the five year allowance. The price control caters for the TSOs exploring innovative technologies provided expenditure is efficient. The CRU's annual decision will also confirm the tariffs for that year.

There are no statutory powers or duties aiming at encouraging innovation. Yet, there are explicit reference to innovation or linked concepts in the tariff methodology and incentives: the NRA has provided for an innovation allowance to support and trial specific new and emerging technologies for the electricity TSO. Further revenues can also be provided on case-by-case basis where TSO makes submissions to the NRA including a business case. Also for the gas TSO, the NRA has an innovation allowance to support and trial specific new and emerging technologies.

The regulatory practice in Ireland

For electricity, there are issues regarding projects, which provide benefits to the wider society as this is not a criterion in the tariff methodology. For gas, the stakeholders in general are content with the NRF and the regulatory practice in Ireland. The lack of incentives for projects with "high CAPEX, but benefits which go to the wider society" and not only to gas customers is seen as a potential barrier. The options for improvement below aim at tackling these issues.

There are explicit references to innovation in the electricity NRF in Ireland - the NRA has provided for an innovation allowance to support and trial specific new and emerging technologies. Further revenues can also be provided on case-by-case basis where TSO makes submissions to the NRA including a business case. Also for gas, the NRA has an innovation allowance to support and trial specific new and emerging technologies.

Options for improvement

The NRF seems functional for both security of supply and innovative projects. Potential options for improvement are:

(i) Adjusting the cost base or asset categories for benchmarking could mitigate possible negative consequences of the benchmarking (for the electricity TSO), but would increase the NRA's workload;

(ii) The introduction/refinement of a Social Cost Benefit Analysis could help in promoting national projects whose benefits go to the wider society (for both electricity and gas); and

(iii) Statutory reference to innovation could help ensuring a long-term and steady support for innovation for both electricity and gas.

1. INTRODUCTION

The present Country Report is a deliverable of the study "Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure?".

The key objective of the study is to analyse how the existing national regulatory frameworks (NRFs) in the EU guide and incentivise the electricity and gas transmission project promoters to undertake investments. The focus of the study is both on investments in new innovative technologies and investments to increase security of supply. The main objective of the study is to map how the regulatory frameworks in the MSs support such investments and how these frameworks ensure that the necessary investments are made.

This Country Report provides an overview of both the current legal frameworks and their implementation practices related to investments in gas and electricity transmission infrastructure. As part of this analysis, selected specific infrastructure projects in electricity and gas are discussed. Based on this research, options for improvement are formulated, both relating to the implementation practice and to legal changes.

The Country Report is based on previous study deliverables and analyses. It is divided in two main sections, Section 2 which is related to electricity, and Section 3 which is related to gas. Each of these sections examines the legal framework (Section 2.1 for electricity and Section 3.1 for gas), including specific rights and duties of relevant parties, such as TSOs and NRAs (hereafter also referred to as stakeholders), mechanisms for the financing of investment projects and the regulatory rules regarding innovation and security of supply in particular. Having studied the legal regulatory framework, Section 2.2 for electricity and Section 3.2 for gas examine the regulatory practice in Ireland, drawing specifically on stakeholder interviews, and paying particular attention to the regulatory practice related to innovation and security of supply. The functioning of the legal framework and the regulatory practice are illustrated by selected specific projects in Ireland. Lastly, options for improvement of the regulatory practice and the regulatory framework are discussed in Section 2.3 for electricity and Section 3.3 for gas.

These options for improvement are taken from a long list of best practises that the project team has compiled based on the analysis of regulatory frameworks in all Member States. We acknowledge that we have not carried out a full analysis of all the costs and benefits of the suggested options. Therefore, some of these options are conditional and that there might be reasons that we did not take into consideration not to implement them.

The focus of this report is not primarily on R&D investments and projects, but rather on "innovative" transmission infrastructure related investments. In order to define what "innovative" is in the context of this report, we have introduced the notion of "typological investments" (see Annex I and II). The goal of selecting "typological investments", which, in our understanding, are categories of investments, was to make the discussion concrete and the investments comparable across countries. The term "typological investment" relates to technical solutions that TSOs can adopt to provide the transmission capacities needed to cover the transmission demand of grid users.

Thus, a typological investment is meant to be a type of solution that can be implemented, in principle, by any TSO in situations in which these solutions are appropriate to provide the desired benefit. Hence, typological investments are not specific to a concrete location or a particular TSO. Annex I provides a list of typological investments in the electricity sector, whereas Annex II provides the same for gas.

Ultimately, these technical solutions contribute to fulfilling the objective to improve or maintain the level of security of supply. It has to be noted that the degree of innovativeness of typological investments can be quite diverse, ranging from construction of conventional assets like AC overhead lines or pipelines with conventional materials and construction methods down to novel concepts of system automation and operation based on recent R&D achievements. Innovation aims at providing the desired level of transmission capacity – determined by the objectives of security of supply (see above) – in a way that is in some way superior to the conventional way, e.g.:

i. by immediately reducing overall cost as compared to a conventional solution;

ii. by prospectively reducing overall cost in the future, subject however to a “learning curve” as to the cost level of the innovative solution;
iii. by accelerating the process of transmission capacity expansion and thus reducing social welfare loss caused by temporarily insufficient transmission capacities; or
iv. by providing improvements with respect to other criteria that are often difficult to monetarise, like environmental or public acceptance aspects.

Innovative investments, especially those whose benefits fall into category ii., iii. and iv. named above, can face certain barriers and market failures. We have identified five categories of innovative projects, which might encounter potential regulatory barriers (see also Annex III for more explanation):

a. Capital intensive projects resulting in uncertain future OPEX gains (efficiency improvements / cost reductions) are not incentivised by the regulatory framework;
b. Projects with potential significant benefits, which would benefit primarily the wider society and where the concerned TSOs are not incentivised;
c. A roll out and investment in smart grids substituting planned physical investments may provide a reduction in the regulated asset base, but might not be realised due to an increase in tariffs or regulatory disincentives;
d. Projects with few or no commercial benefits to justify the investment, but with positive social impacts;
e. Projects, which result in a lower TSO TOTEX, but bring about a shift in the CAPEX/OPEX ratio, which is not incentivised by the regulatory framework.

Our understanding of innovative investments and typological investments, and the categorisation of investment projects in relation to possible regulatory barriers are the basis for the research done in the context of the analysis of the implementation practice in this report.

2. ELECTRICITY

2.1. Legal analysis of the NRF in Ireland

2.1.1. Overview of the regulatory framework of Ireland – legal rules

The Electricity Regulation Act 1999 (the "**1999 Act**") is the principal piece of primary legislation governing the Legal Framework for electricity in Ireland.

The electricity transmission system is owned by ESB, a State-owned vertically integrated company. ESB is responsible for the funding of, and carrying out construction and maintenance on, the transmission network. Pursuant to Section 14(2B) of the 1999 Act, only the ESB may be granted a licence to act as transmission asset owner ("**TAO**"). A separate, independent state-owned company, EirGrid, is the certified transmission system operator ("**TSO**") in Ireland. Pursuant to Section 14(2A) of the 1999 Act, only EirGrid may be granted a licence to act as TSO in Ireland.

The Commission for the Regulation of Utilities ("CRU") is the independent regulator of the energy (and water) sector in Ireland and derives its primary duties, objectives and powers from the 1999 Act. The 1999 Act also establishes the SEM Committee, which takes decisions on behalf of the CRU in relation to any relevant function of the CRU that relates to the SEM (single electricity market).[1] The CRU, the SEM Committee and the Minister have duties and objectives derived from the 1999 Act. These duties and powers (as relevant to transmission network development) include:

- The principal objective in respect of their functions is to protect the interests of consumers of electricity in Ireland and Northern Ireland supplied by authorised persons;[2]
- The Minister, the CRU and the SEM Committee are required to carry out their respective functions in a way each considers is best calculated to further the principal objective, having regard to the need to secure all reasonable demands for electricity in Ireland and Northern Ireland are met; the need to secure that authorised persons are able to finance the activities which are the subject of conditions or obligations imposed by or under the 1999 Act (which includes transmission development) or the Internal Market Regulations, or any corresponding provision of the law of Northern Ireland; the need to secure that the functions of the Minister, the CRU, the Utility Regulator ("**UR**")[3], and the Department for Enterprise, Trade and Investment ("**DETI**")[4] in relation to the Single Electricity Market are exercised in a co-ordinated manner; the need to ensure transparent pricing in the Single Electricity Market; and the need to avoid unfair discrimination between consumers in Ireland and consumers in Northern Ireland;[5]
- The Minister, the CRU and the SEM Committee are also required to carry out their functions in the manner which each of them consider is best calculated, amongst other things, to promote efficiency and economy on the part of authorised persons; and to secure a diverse, viable and environmentally sustainable long term energy supply in Ireland and Northern Ireland. The CRU is also required to cooperate with other regulatory authorities at a regional level to (1) foster operational arrangements to enable an adequate level of interconnection capacity within the region and between regions to allow the development of effective competition and improvement of security of supply; and (2) to develop rules on access to cross border infrastructure including allocation of capacity and congestion management.

The 1999 Act sets up the licensing regime for the electricity market in Ireland. CRU, as regulator, is responsible for granting, monitoring the performance of, modifying, revoking and enforcing licences and authorisations under the 1999 Act. Licensable activities include interconnection, generation, transmission, distribution, operation of the SEM and supply.[6] Each activity has a separate licence in standard form.

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1 Section 8A of the 1999 Act.
2 Section 9BC(1) of the 1999 Act.
3 The UR is the regulator in Northern Ireland.
4 DETI is the executive body in Northern Ireland.
5 Section 9BC(2) of the 1999 Act.
6 Section 14(1) of the 1999 Act.

S.I. No 445/2000 European Communities (Internal Market in Electricity) Regulations 2000 (the "**2000 Regulations**"), and S.I. No 60/2005 European Communities (Internal Market in Electricity Regulations 2005 (the "**2005 Regulations**"), as amended, set out the statutory functions of the transmission system (or asset) owner and TSO, which are reflected in the licences issued by the CRU.

Ireland operates within an all-island single electricity market (the "**SEM**") encompassing Ireland and Northern Ireland. The SEM Committee was established under both Irish and Northern Irish legislation to exercise the relevant functions of the CRU and UR in relation to matters that relate to the SEM. Note that the transmission system in Northern Ireland is separate from the transmission system in Ireland. NIE Networks Limited is the transmission and distribution asset owner, and SONI Limited (a subsidiary of EirGrid plc) is the transmission system operator ("TSO") in Northern Ireland.

2.1.2. Specific legal rights and duties

Role of the TSO

EirGrid plc is the only licensed TSO in Ireland, and ESB is the transmission system (or asset) owner ("**TAO**"). Their roles in the development of the transmission network are set out in the 2000 Regulations, the 2005 Regulations and the conditions of their licences issued by the CRU.

TSO's general functions[7]

EirGrid's licence sets out its general functions, which include (insofar as they relate to the development of the transmission network):

- to operate and ensure the maintenance of and, if necessary, develop a safe, secure, reliable, economical and efficient electricity transmission system as part of an efficient, economical, co-ordinated, safe, secure and reliable electricity transmission system on the island of Ireland as a whole, and to explore and develop opportunities for interconnection of its system with other systems, in all cases with a view to ensuring that all reasonable demands for electricity are met and having due regard for the environment;
- to plan the long term ability of the transmission system to meet reasonable demands for the transmission of electricity; and
- contribute to security of supply through adequate planning and operation of transmission capacity and system reliability.

In addition, EirGrid in carrying out these functions must have regard to a number of general aims, including minimising the overall costs of the generation, transmission, distribution and supply of electricity to final customers on the island of Ireland.

Cooperation with SONI as TSO in Northern Ireland[8]

- EirGrid shall (a) upon receipt of a request from SONI as TSO, insofar as any matter is within the control of EirGrid, ensure that SONI can fulfil the conditions of SONI's TSO licence in relation to connection to the Northern Ireland transmission system and use of the All-Island Transmission Networks; and (b) upon receipt of such a request, provide such information, conduct such studies, perform or procure the carrying out of such works to the transmission system and do such other things (including, but not limited to, the carrying out of such works) as are required;
- EirGrid and SONI are also required to enter into a System Operator Agreement (approved by the CRU and UR) which governs the relationship between EirGrid and SONI as TSOs, and is designed to, amongst other things, facilitate the development, maintenance and operation of the transmission system (in Ireland) as part of efficient, economical, co-ordinated, safe, secure and reliable All-Island Transmission Networks.

[7] Regulation 8 of the 2000 Regulations (as amended), Condition 1 and Condition 3 of EirGrid's TSO Licence.
[8] Condition 5 of EirGrid's TSO Licence.

Development Plan[9]

- The TSO is obliged, in consultation with SONI as TSO in Northern Ireland, to prepare and submit to the CRU for approval a development plan for the transmission system in order to guarantee security of supply for the following five calendar years, to be revised on an annual basis and made available to the public;
- The development plan must take account of- (i) existing and planned generation, transmission, distribution and supply, (ii) forecast statements prepared by the TSO in respect of capacity, forecast flows and loading on each part of the transmission system and fault levels of each electricity transmission note;[10] (iii) interconnections with other systems, and (iv) national and regional Government development objectives;
- ESB, as TAO, is required to carry out the construction work in accordance with the TSO's development plan.[11] Under the Infrastructure Agreement (see below), the TAO must notify the TSO of the intended timeline and projected costs of any development projects.

Infrastructure Agreement between ESB and EirGrid 12

- EirGrid and ESB are required under both the 2000 Regulations (as amended) and their licences, to enter into an Infrastructure Agreement in a form approved by the CRU. The purpose of the Infrastructure Agreement is to enable the TSO to fully and effectively discharge its functions under the 2000 Regulations, and ensure that the TAO will facilitate the discharge by the TSO of its functions and ensure the performance of the TAO's own obligations, in accordance with its own duties;
- The provisions of the Infrastructure Agreement that relate to the development of the transmission network include the following: (i) a specification of which assets of the transmission system owner shall constitute the transmission system; (ii) provisions for maintenance and development of the transmission system; (iii)provisions regarding construction, connection to and use of the transmission system by third parties; (iv) arrangements for the transfer of information between the TAO and the TSO in relation to the development plan, its implementation and costs; (v) provisions regarding rights and responsibilities for de-energisation and disconnection; and (vi) the allocation of risk, for insurance or other purposes considered appropriate by the CRU, between the TSO and the TAO;
- Where the CRU is of the opinion that either the TSO or the TAO is systematically failing to comply with the terms of the Infrastructure Agreement, or with the 2000 Regulations, in a way which is likely to materially affect the public interest, or is in fundamental breach of the agreement in a way which is likely to materially affect the public interest, the CRU may issue a direction which (i) requires the TSO or the TAO, as appropriate, to comply with the Infrastructure Agreement or with the 2000 Regulations, and (ii) prescribes the manner in which the TSO or the TAO, as appropriate, shall comply with the direction so issued;
- Further, in case of delay or default by a TAO, the TSO has rapid step in rights to arrange for work to be undertaken, by direction of the CRU. The TAO is responsible for bearing those costs. The TSO also has the right to take whatever safeguarding or remedial measures it thinks fit to remedy an emergency, or where the physical safety or security of persons is threatened.

Grid Code

- EirGrid as TSO is required, in consultation with SONI as TSO in Northern Ireland, to adopt, implement and comply with a Grid Code in respect of all technical aspects relating to the connection to and operation of the transmission system,[13] to be approved by the CRU;
- Condition 29 of the TSO Licence provides that the Grid Code must be designed to (a) permit the development, maintenance and operation of an efficient, co-ordinated and economical system for the transmission of electricity in Ireland as part of efficient, co-

[9] Regulation 8 of the 2000 Regulations and Condition 8 of EirGrid's TSO Licence.
[10] TSO obligation under Section 38 of the 1999 Act.
[11] Regulation 19 of the 2000 Regulations (as amended).
[12] Regulation 18 of the 2000 Regulations, Condition 2 of EirGrid's TSO Licence, and Condition 2 of ESB's TAO Licence.
[13] Section 33 of the 1999 Act and Condition 29 of EirGrid's TSO Licence.

ordinated and economical systems for the transmission of electricity on the island of Ireland; (b) facilitate the transmission system being made available to persons authorised to supply or generate electricity in Ireland, on terms which neither prevent nor restrict competition in the supply or generation of electricity on the island of Ireland; and (c) subject to the objectives at (a) and (b), facilitate the security and efficiency of the electricity generation, transmission and distribution system in Ireland as a whole.

Transmission Use of System Charges14

- EirGrid must prepare a statement setting out the basis upon which charges are imposed for use of and connection to the transmission system, which is subject to the approval of the CRU. The CRU may give directions to EirGrid from time to time in respect of the basis for charges for use of and connection to the transmission system;
- Charges must be calculated so as to enable EirGrid to recover the appropriate proportion of costs directly or indirectly incurred in carrying out any necessary works to the transmission system, and reasonable rate of return on the capital represented by such costs. The CRU determines what will constitute an "appropriate proportion" and a "reasonable rate of return".

Undertaking of investments

The TSO is required to submit a development plan for the transmission system, to be revised on an annual basis. The TAO is then responsible under the 2000 Regulations, its licence and the terms of the Infrastructure Agreement with the TSO to carry out the construction work in accordance with the TSO's development plan. These are more fully described above.

Role of NRA

The CRU's role and duties are more generally described above in Section2.1.1. Please see the Section 2.13 below in relation to the mechanisms CRU uses in order to facilitate the development of the transmission network.

Institutional or procedural constraints on the performance of these roles

- General requirements of public law and decision making of public bodies can act as a constraint or delaying factor on the CRU's ability to discharge its statutory functions quickly;
- Complex planning issues and disputes (for example, judicial reviews) can affect the development of a transmission network project; and
- Standardised licence conditions, regulated agreements and market codes can be difficult to modify quickly. If a change is proposed in connection with a transmission, network project, this can also act as a constraint on a project's timeline (taking in account consultation periods, responses, decisions and potential judicial review of a CRU decision).

2.1.3. Mechanism for financing of investment projects

Price Review (PR4) Process

The CRU's primary mechanism for ensuring the delivery of appropriate investment in the transmission network is through its price review process. The CRU carries out a price review every five years, the current price review ("**PR4**") started in 2016 and will end in 2020. For each year of PR4, ESB and EirGrid are allowed to collect funds to operate and maintain the transmission network for that year. As part of the CRU's annual review, existing forecast items are updated as appropriate, and EirGrid and ESB may request revenue for additional items that were not envisage or captured at the time of setting the five year allowance. The CRU's annual decision will also confirm the TUOS tariffs for that year.

In the CRU's PR4 decision (CER/15/296) it noted that the scale of change the electricity system would undergo between 2016 and 2020 would require investment and innovation, and that an increase in the allowed revenue for both the TAO and the TSO was required in order to achieve this by further developing and reinforcing the electricity network, which is increasingly

14 Section 25 of the 1999 Act and Condition 5 of EirGrid's TSO Licence.

important as the system transitions to one with a high penetration of renewables. As part of the PR4 decision, the CRU granted the TSO an innovation allowance, to support and trial/demonstrate specific new and emerging technologies, with further revenues to be provided on a case-by-case basis where the TSO makes a detailed submission and business case. This business case should establish the problem that the trial is attempting to solve/ contribute to solving, the project governance structure, the project approval and evaluation milestones, how success will be defined, the overall cost-benefit or multi-criteria analysis for the proposed project and the role that the TSO will have compared to external parties.

In its annual review during the PR4 period, the CRU will calculate the TAO and TSO allowed revenue by taking into account a number of factors, including:

- a rolling retention of benefits achieved through costs lower than target levels. Where the CER deems that benefits gained have been as a result of forecasting error rather than efficiency gains, these benefits will be clawed back. At the end of the PR4 period, the TSO and TAO will be required to demonstrate that expenditure incurred during PR4 was on an efficient basis. The CER will reserve the right to clawback any expenditure that cannot be demonstrated as being efficient;
- incentives linked to system performance and network development;
- pass through of TSO ancillary services;
- incentive mechanisms to improve quality of service, continuity in supply and transmission network performance.

Relevant categories of financing mechanisms of the TSO

CRU Decision 15/276 does not identify any specific categories of projects that the CRU will consider in setting the TSO and TAO allowed revenue. As noted above in Section 2.1.2, the CRU will take into account a number of different factors in its five year price review process and each annual review when determining the TAO and TSO's allowed revenue for the operation and maintenance of the transmission system.

The allowed revenue calculation for the TSO and TAO respectively is structured as follows:[15]

- The calculation commences with the opening TSO regulated asset base and TAO regulated asset base ("**RAB**");
- Allowed Capex is then added and depreciation subtracted from the respective RABs for each successive year of the Price Review period;
- Allowed operating costs are added, together with any deferred (clawback) revenue from previous years, i.e. through the operation of a 'K' factor; and
- The next stage of the calculation is to determine the NPV of the total cash required by the TSO and TAO separately using the WACC as the basis for discounting.

Finally, the NPV of the change in the TSO RAB and TAO RAB over the Price Review period (i.e. the opening value less the discounted value of the closing RAB, with the discount rate set at the cost of capital derived in Section 7) is added to the total cash required to determine the net present value of the cash required by the TSO and TAO to finance the increase in the RAB over the regulatory period.

CRU's role in planning and developing energy infrastructure

The CRU also has a role in planning and development of energy infrastructure, which indirectly feeds into investment in the transmission system:

- Every year, the CRU holds a public consultation on EirGrid's transmission development plan. The CRU's public consultation gives stakeholders the opportunity to express their views on the future electricity transmission needs;
- The CRU and the UR in Northern Ireland approve the format of the All-Island Ten Year Transmission Forecast Statement developed by EirGrid and SONI as joint TSOs. This document includes forecast of transmission peaks, the transmission capability for new generation and the transmission capability for new demand;
- The CRU oversees and supports the implementation of the DS3 Programme;
- The CRU has a role in providing assessments of the feasibility, maturity and impact of projects put forward to the EU Commission as projects of common interest under EU Regulation 327/2013.

[15] As set out in CRU Decision Reference CER/15/276.

2.1.4. Regulatory rules with respect to innovation

Specific duties of the TSO aimed at encouraging innovation

The TSO and the TAO do not have explicit duties aimed at encouraging innovation, but may seek specific allowances from the CRU to explore innovative technologies and are then incentivised to ensure efficient expenditure of any such allowance. This is more fully explained in Section 2.1.3 above.

Specific duties of the NRA aimed at encouraging innovation

The CRU does not have any explicit statutory powers to encourage innovation. The CRU is required to discharge its general functions under the 1999 Act in a way that the CRU considers is best calculated, amongst other things, to promote efficiency and economy on the part of authorised persons and to secure a diverse, viable and environmentally sustainable long-term energy supply in Ireland and Northern Ireland. The CRU's duty to encourage innovation is therefore more likely to be considered as implicit in its general statutory functions. For example, in its PR4 price review, the CRU granted a specific innovation allowance requested from the TSO, in order to support and trial/demonstrate specific new and emerging technologies.

As noted above in Section 2.1.1, the CRU has taken into account and granted an innovation allowance to the TSO in respect of new and emerging technologies for the PR4 period. The CRU will also include in the TSO's allowed revenues the costs associated with projects such as the DS3 Programme. We are not aware of any specific features or financing mechanisms designed to incentivise investment in innovation or innovative projects, or otherwise which have the effect of limiting investment.

2.1.5. Regulatory rules with respect to security of supply

Specific duties of the TSO aiming at safeguarding security of supply

General functions, including those applicable to security of supply, are more fully described above in Section 2.1.1 and Section 2.1.2 above. The TSO must, in discharging its functions, take into account the security of the transmission system on the island of Ireland as a whole. As a result, the TSO's forecasted capital expenditure programme for the CRU's PR4 price review process (more fully explained in Section 2.1.3) had a particular focus on security of supply (as well as market integration, ensuring value for money and developing the transmission network towards reaching Ireland's 2020 renewables target and other demand drivers).

Specific duties of the NRA with respect to security of supply

See Section 2.1.1 above, with regard to legal powers and duties available to the CRU in terms of security of supply.

2.2. Regulatory practice

2.2.1. Overview over regulatory practice in Ireland

As mentioned, there are two companies with three distinct roles. In summary, the different roles and responsibilities are:

- Transmission System Operator (TSO) – EirGrid: The physical operation of the transmission system in real-time, including the procurement of system services; the planning of extensions and reinforcements to the transmission network, and associated interactions with the TAO; the offering of rights to connect to and make use of the transmission system;
- Transmission Asset Owner (TAO) – ESB Networks: The owner of the transmission network, and the party who builds additional transmission infrastructure or replaces assets at their end of life at the direction of the TSO, and maintains the existing network;
- Two revenue requirements for TSO and TAO within the single Price Review, the latest is PR4;
- Distribution System Operator and Asset Owner (DSO/DAO) – ESB Networks: Responsible for the physical operation of the distribution system; the planning and delivery of extensions, renewal and reinforcement of the distribution network; maintenance, repair and supply restoration of the existing network; the offering of rights to connect to and make use of the distribution system. There is a single Price Review for DSO, PR4.

Moreover, the NRA only looks at a high-level perspective at the projects.

Main regulatory barriers

The Irish transmission model is different from the models in most MSs: the TSO does not own its assets, the ESB as TAO (transmission asset owner) is the asset owner and therefore benefits from additional assets. EirGrid is hence the designer of the transmission grid, not the owner. Therefore, the TSO is less inclined to choose projects increasing RAB (regulatory asset base).

Nevertheless, CAPEX and OPEX are treated separately in Ireland. A TSO would not be penalized for higher CAPEX, if the project was overall a good idea and provided benefit to the consumer.

There are also mechanisms for extra funding for a project if new plans have been developed during a regulatory period and they do not fall under price control. In electricity price reviews, there is a mechanism for adjusting the capex allowance during a price review period in order to provide flexibility in response to significant new information and hence avoid to delays to necessary investment.[16]

Furthermore, benchmarking is part of the ex-post review regarding both CAPEX and OPEX. The usual risks of benchmarking, such as uncertainty about the remuneration of innovative and novel projects in particular, are hence present. The interviewees acknowledge that benchmarking can be difficult: it is unusual to find a perfect comparison and there are reasons for differences between TSOs, but the benchmarking helps the NRA as it gives you an idea of where the TSO should be compared with other TSOs.

According to some stakeholders, there are issues regarding projects, which provide benefits to the wider society as this is not a criterion in the tariff methodology. There are hence no incentives to do such projects. This could be amended if the regulation was more output-focused.

2.2.2. Regulatory practice related to innovation

Innovative projects do not yet constitute a big share of the total costs/revenues of Eirgrid, according to the stakeholders. In contrast the DSO level, there is no 'strategic innovation fund' at TSO level, but the regulator does allow specific innovative projects on a case-by-case basis. Moreover, in the PR4, the CRU has granted an innovation allowance to the TSO (which resembles more a 'R&D' allowance in our terminology) to support and trial/demonstrate specific emerging technologies, with further revenues to be provided on a case-by-case basis, where the TSO makes a detailed submission and a business case.

Examples of successful innovative projects include a wind farm project, innovative IT solutions and better modelling capabilities.

EirGrid has the so-called 'DS3 programme'. Its objective is to reach the 2020 target share of renewable energy generation (see illustrative specific projects).

In some smaller projects, EirGrid looks into how to manage the shift to a more active distribution network, given the integration of renewables and batteries. Examples of other smaller (pilot, demonstration and R&D) projects are 'power up and save schemes', Flywheel batteries and hybrid wind. Some of these projects are led by EirGrid, whereas in others EirGrid plays only a coordinating or supportive role. The investments of EirGrid are in intellectual capital, not in physical capital.

Expenditure related to IT investments are funded, if they are justified. Yet, some stakeholders sense some reluctance regarding high risk projects due to possible negative effects on tariffs and customers. But a trial phase alleviates the reluctance. Furthermore, the possibility of extra funding within a price control period offers flexibility.

[16] More information is available here: https://www.cru.ie/wp-content/uploads/2017/12/CRU17335-Consultation-on-Reporting-and-Incentives-under-Price-Review-4.pdf.

Adequacy of the NRF relating to its support for innovative investments

Although there are several possibilities in the tariff methodology to accommodate innovative investments, some stakeholders feel that the riskiness of innovation is not yet sufficiently accounted for and that there is a reluctance to burden the customer with this risk.

2.2.3. Regulatory practice related to security of supply

Security of supply projects

All of EirGrid's projects aim to ensure stable supply, although there is not a clear definition of security of supply. The regulator incentivises EirGrid to maintain system stability and system frequency.

An example of a current security of supply projects is the investigation of EirGrid in developing an interconnector with France, although the dominant driver there is the EU market integration.

Adequacy of the NRF relating to its support for security of supply investments

Stakeholders are satisfied with how the NRF supports security of supply investments. The NRF is flexible regarding network development and provides a flexible capital investment envelope. There are no upfront regulatory approvals of projects. It is hence possible to complete projects fast.

2.2.4. Illustrative specific projects

The illustrative projects described below are examples of successful innovation and security of supply projects. The first two projects are considered innovative projects, whereas the last three projects are related to security of supply. These projects illustrate how the current NRF works in practice to incentivise investments in innovation and security of supply.

DS3 programme

Description and aim

This programme is focused on system performance, system policies and system tools. It is set up to support the development of renewable generation and connect it to the electricity grid while minimizing costs and minimizing congestion on the network. Within this programme, EirGrid has changed its grid codes and introduced changes to the types of services it buys. The budget for system services in the TSO's allowed revenue for 2018 (for the whole island of Ireland) is €85.05 million, and is forecast to increase up to €235 million by 2020.

Smart wires –Smart Valve pilot project 2016

Description and aim

One of EirGrid's goals is to maximise use of existing transmission infrastructure where possible. In Waterford, a pilot project using Smart Wires' SmartValve.[17] This technology power to be pulled onto lines with spare capacity and also pushes power away from congested lines to other lines on the system with spare capacity. This product allows grid operators to manage power flows by dynamically adjusting the reactance of electricity lines, which means that system overload can be prevented dynamically and in real time. In 2016, EirGrid and Smart Wires collaborated to deliver the first installation of SmartValve on a live power system. Three SmartValve units were installed on towers at two substations on the Cashla - Ennis 110 kV line in the west of Ireland.

Celtic interconnector – Ireland-France

Description and aim

In 2009, the 'Interconnector Economic Feasibility Report' identified an interconnector with France as an opportunity for interconnection.[18] The Celtic Interconnector is a proposed electrical link, which will enable the movement of power between Ireland and France. Since 2011, EirGrid

[17] For more information, see https://www.smartwires.com/2017/12/20/eirgrid-smartvalve-pilot-project-2016/.

[18] For more information on the current stage of the project, see: http://www.eirgridgroup.com/site-files/library/EirGrid/Celtic-Interconnector-Project-Update-Brochure-2018.pdf.

has been working with the French TSO to investigate the feasibility of an electrical link between the two countries by carrying out joint studies into the feasibility of the interconnector, the project has been designated as a Project of Common Interest (PCI). These studies have indicated that if built, an interconnector between the two countries would be beneficial for electricity customers in Ireland, France and the EU.

As part of the feasibility study, potential routing between the south coast of Ireland and the north-west coast of France was considered for the Celtic Interconnector. The length of the subsea cable would be approximately 500 km; the total length of the interconnector would be approximately 600 km.

North-South 400 kV Interconnection Development

Description and aim

This project proposes the addition of a new 400 kV overhead line to the EirGrid grid, connecting the electricity grids of Ireland and Northern Ireland, the project has been designated as a Project of Common Interest (PCI).[19]

In October 2013, the European Commission designated this cross-border interconnector as a Project of Common Interest (PCI).

Dublin North Fringe

Description and aim

This project was reinforced the supply of the supply of electricity to the Dublin north city and county area. A study of EirGrid had shown that the capacity at an existing transmission station was insufficient and growth in industrial and commercial sectors was projected in the area.

2.3. Options for improvement

2.3.1. Options to improve regulatory practice

The above discussion shows that the NRF is functional for both security of supply and innovative (especially R&D) projects: there is flexibility to include extra funding within one regulatory period, an innovation allowance has been set up for the current regulatory period, a special programme is focussed on sustaining the functionality of the electricity system given the increase of renewable energy generation, and a public consultation on the TSO's development plan is held each year by the NRA. Moreover, for PR4, the CRU put in place an incentive mechanism for stakeholder engagement by the TSO: a financial incentive has been provided on the scope, quality and outcomes/impacts of the EirGrid's stakeholder engagement activities and should ensure effective stakeholder management in practice.[20] Only benchmarking was named as causing uncertainties. Another concern related to the sentiment that projects having wider societal benefits are not incentivized. Lastly, some stakeholders think that the NRF does not yet account for the riskiness of innovation in a sufficient way. Thus after consulting the stakeholders and analysing the NRF, we recommend the following options for improvement.

(i) Adjusting the cost base or asset categories for benchmarking

Possible negative consequences of the benchmarking can be mitigated by adjusting the cost base or asset categories for benchmarking for certain innovative technologies, which are more expensive, but have other benefits, such as enhancing public acceptance or increasing the implementation speed. This adjustment could be done by the NRA, although it would probably cause additional workload.

(ii) Social cost benefit analysis

The stakeholders criticized the focus on input in the current regulation and indicated that the switch to a more output-based regulation accounting for the benefits that actually accrued to the consumers is desirable. A first step in this direction would be introducing the requirement to

[19] For more information see: http://www.eirgridgroup.com/site-files/library/EirGrid/North-South-Project-Summary-Report-20-October-2015_Final.pdf.

[20] See "Reporting and Incentives under Price Review 4 – Decision", p. 29-30, https://www.cru.ie/wp-content/uploads/2018/05/CRU18087-Reporting-and-Incentives-under-Price-Review-4-Decision-Paper.pdf.

conduct a Social CBA. This could be done on multiple levels: on the level of national plan and on the project level for larger projects. On project level, the SCBA could be a requirement before approval of the final investment decision. It is important to note that the mandate of the NRA may limit the inclusion of social benefits (such as environmental benefits) in investment decisions.

(iii) Statutory reference to innovation

There are no statutory powers or duties aiming at encouraging innovation, whereas there are express references to innovation or linked concepts in the current tariff methodology. To ensure that innovative projects are still encouraged and supported in the next regulatory period, a statutory reference to innovation could be included into the regulatory framework.

2.3.2. National law mechanism(s) for implementing options

We consider that, with the exception of the following, the above mentioned changes could be implemented using legal powers already available to the NRA or others under the existing NRF.

With regard to option (iii), the suggestion to include a power or duty to encourage innovation could be included by way of a new statutory function of the CRU via an amendment to the 1999 Act.[21]

2.3.3. Impact assessment

A negative side effect of option (i) could be the additional workload for the NRA in in adjusting the cost base or asset categories for benchmarking once every regulatory period.

Also, the mandatory requirement to conduct a SCBA (option ii) on the level of the national plan or individual (innovative or larger) projects increases the work load of the TSO and of the NRA. Therefore, this option needs to be implemented in a way that keeps the additional workload manageable.

The long-term strategic perspective on innovation mentioned in option (iii) necessitates efforts and coordination between the TSO and the NRA regarding the design of this long-term perspective (e.g. the organisation of stakeholder consultations, determining the scope of the innovation needed, monitoring and evaluating of how the statutory duty is translated into the long-term perspective).

We have not encountered any specific examples of projects that have been cancelled due to the regulatory framework. Furthermore, the stakeholders are largely satisfied with the current NRF. The problems related to benchmarking are not perceived to be large. The requirement of conducting a SCBA would probably be of not much added value, since the TSO already provides a reasoning underpinning its investment plan. Furthermore, public consultations are already held, which should provide incentives for implementing socially beneficial projects. There is a financial incentive for the TSO to develop a stakeholder consultation strategy. In addition, the differentiation between a TSO and a TAO facilitates an independent view on which investments are needed and benefit the society. Lastly, innovation is prominent in the current regulatory period. For these reasons, we do not expect that any of the suggested changes will result in considerable changes to investment levels.

[21] An amendment to the 1999 Act requires a separate amendment Act. The process is as follows: A draft of proposed new legislation is called a Bill. A Bill must go through several distinct stages (including committee stage) and passed by both of the houses of parliament (the "**Oireachtas**" comprised of the Dáil (lower house) and the Seanad (upper house)). Once a Bill has gone through all the stages and has been passed by the Dáil and Seanad, the President signs it into law. It then becomes an Act and is added to the Statute Book. Some Acts come into force immediately, while others are commenced on a later date by the relevant Minister. In certain rare circumstances, the President has the power to decline to sign a Bill. The President consults with the Council of State before taking such a decision. All laws must be compatible with the Constitution.

3. GAS

3.1. Legal analysis of the NRF in Ireland

3.1.1. Overview of the regulatory framework of Ireland – legal rules

The Gas Act 1976 (the "**1976 Act**"), the Gas (Interim) (Regulation) Act 2002, (the "**2002**" Act), the Electricity Regulation Act, 1999 (the "**1999 Act**")[22] and S.I. No.16/2015 European Communities (Internal Market in Natural Gas and Electricity) (Amendment) Regulations 2015 (the "**2015 Regulations**") are the primary pieces of legislation governing the Legal Framework for gas in Ireland:

- Section 16 of the 2002 Act provides that the Commission for Regulation of Utilities (the "**CRU**") may grant or refuse to grant a natural gas licence to engage in activities, including the ownership and operation of a gas transmission and distribution system. The CRU may revoke a licence under Section 9(1)(g) of the 1999 Act. The 2002 Act also sets out the CRU's powers regarding security of supply of natural gas;
- The 1976 Act (as amended) sets out the functions of Ervia (formerly known as Bord Gais Eireann). Under the 1976 Act, Ervia shall operate, develop and maintain a system for the transmission and distribution of natural gas being a system that is both economical and efficient and appears to Ervia to be requisite for the time being, and carry out its obligations under the 1976 Act and Directive 2009/73/EC having regard to the need to ensure the safety and security of the transmission, distribution and supply of natural gas.[23] Gas Networks Ireland Limited ("**GNI**"), a regulated business within the Ervia group, is the licensed transmission asset owner and transmission asset operator for the natural gas transmission and distribution networks. In 2016, the CRU certified GNI, as Ireland's gas transmission system operator, as "effectively unbundled" for the purposes of Directive 2009/73/EC.

The 2015 Regulations transpose the provisions of Directive 2009/73/EC into Irish law. The 2015 Regulations include the rules for unbundling of gas transmission systems and gas transmission system operators, and the procedure for certification and designation of gas transmission system operators by the CRU.

3.1.2. Specific legal rights and duties

Role of TSO

GNI, as TSO, is obliged to submit to the CRU on an annual basis a ten-year network development plan with respect to investment in its gas transmission network system (the "**NDP**").[24]The primary purpose of the plan is to allow the CRU to assess the medium-term investment plans of GNI as the gas transmission system operator as regards consistency with the EU ten-year development plan under Article 8(3)9b) of Regulation (EC) 715/2009.GNI's plan must (a) be based on existing, and forecasted, supply and demand, having consulted all the relevant stakeholders, and (b) contain efficient measures in order to guarantee the adequacy of the gas transmission system and security of supply. In particular, GNI is required to:

(i) indicate to market participants the main infrastructure with respect to the gas transmission system that needs to be built or upgraded over the subsequent 10 years;
(ii) contain all the investments already decided and identify new investments which have to be executed in the subsequent 3 years; and
(iii) provide for a timeframe for all investment projects.

GNI holds the transmission asset owner licence ("**TAO**"). The general function of the TAO business is to facilitate the discharge by the TSO of its functions, cooperate with the TSO in carrying out its statutory functions, and provide the TSO with the resources (including financial resources) and services necessary to enable the TSO to fulfil its responsibilities with respect to the operation of the transmission system.[25]

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22 The 1999 Act establishes the CRU and sets out its general functions, which includes powers in respect of the downstream elements of the gas sector.
23 Section 8 of the 1976 Act.
24 Section 11 of the 2015 Regulations and Condition 11 of the TSO licence.
25 Condition 2 of the TAO licence.

Undertaking of investments

As noted above, the NDP submitted by GNI to the CRU on an annual basis will include details of any infrastructure projects to be undertaken by GNI for the purposes of building or upgrading the transmission network for the following ten years, and identify any new investments, which have to be executed in the following three years.

Role of NRA regarding investment projects undertaken by the TSO

The CRU is responsible for setting the level of revenue that GNI is allowed to recover from its customers, in order to discharge its obligations under its TSO and TAO licences (the obligations relating to transmission network development are described in more detail Section 3.1.1 above). Please see Section 3.1.3 in relation to the mechanism for financing such infrastructure projects.

Institutional or procedural constraints on the performance of these roles

- Local planning authorities and An Bord Pleanala ("**ABP**") are primarily responsible for granting planning consent for developments in Ireland. The council or ABP (as applicable) will run the planning process by which plans are publicised and stakeholders are given an opportunity to comment. There are appeal mechanisms in respect of planning decisions;
- Transmission infrastructure projects are deemed to be strategic in nature and of national importance. As a result, much of the transmission permitting falls under the procedures outlined in Planning and Development (Strategic Infrastructure) Act 2006, which includes provisions for rigorous environmental assessment and full public consultation. ABP will determine if a proposed development will fall within the scope of the 2006 Act. If so, an application is made directly to the Strategic Infrastructure Division of ABP.

3.1.3. Mechanism for financing of investment projects

The CRU's primary mechanism for ensuring the delivery of appropriate investment in the transmission network is through its price review process. The CRU carries out a price review every five years, the current price review ("**PC4**") running from 2017 to 2022.[26]

In determining the allowed revenue for GNI, the CRU imposed incentives that are designed to encourage GNI to operate, maintain and invest in the gas network appropriately and as efficiently as possible:

- Capex incentives are in place to increase efficient capital expenditure. When GNI completes a project within or under a budget, or can avoid carrying out a project in its entirety, PC4 provides that GNI will receive a financial reward. If GNI goes over budget, but the excess is justifiable, the increase may be allowed but a penalty may be applied;
- Some pass-through items are linked to incentive mechanisms in order to incentivise GNI to reduce costs in the areas over which they have some control e.g. In the case of commercial rates 25% of any over or underspend is incurred by GNI.[27]

As part of PC4, the CRU also approved funding of up to €20 million for innovation over the PC4 term (with €17.5 million approved initially and up to €2.5 million to be approved in year 3 of PC4 based on innovation progress). GNI is required to report annually on the outputs and outcomes of the innovation funding and benefits (or otherwise) of innovation projects to gas network customers. The purpose of the funding is to assist with the decarbonisation of the Irish economy, provide value to gas network users, and to ensure that the gas network will continue to be utilised to the benefit of gas customers.[28]

Relevant project categories

There are no specific categories of projects typically accommodated within the price control process. Transmission network developments projects will be identified in GNI's NDP submitted to the CRU (as updated from time to time) and will in turn be considered as part of the five year

[26] CRU Decision Reference CER/17/260 and CER/17/259.
[27] CRU Decision Reference CER 17/260.
[28] CRU Information Note CER/17/258.

price control review, and the annual review of GNI's allowed revenue during the PC4 period. By way of example, projects identified in the 2017 NDP include:[29]

- Completion of pipe support remediation works;
- Service exchange of 2 turbine cores at Brighouse Bay Compressor Station and various upgrade works at compressor station sites;
- Replacement of 95,747 meters as part of the domestic meter replacement programme since 2012;
- Replacement of 1,223 meters as part of the industrial & commercial meter replacement programme since 2012;
- Extension of the gas network to Listowel Co. Kerry, and completion of the gas networks within Nenagh Town Centre, Co. Tipperary and Wexford Town, Co. Wexford; and
- Twinning of Southwest Scotland onshore system between Cluden and Brighouse Bay (United Kingdom).

3.1.4. Regulatory rules with respect to innovation

Specific duties of the NRA aimed at encouraging innovation

The CRU does not have any specific powers or duties aimed at encouraging innovation, but as noted above the CRU has considered and granted funding or innovation as part of the development of the transmission network through the PC4 price review process.

Specific duties of the TSO at encouraging innovation

There are no specific TSO or TAO statutory or licence duties aimed at encouraging innovation.

3.1.5. Regulatory rules with respect to security of supply

Specific duties of the TSO aiming at safeguarding security of supply

- GNI, as TAO, is required to comply with the provisions of a Natural Gas Emergency Plan prepared in accordance with Section 19B of the 2002 Act. The Natural Gas Emergency Plan must include, amongst other things: (1) measures to ensure that supplies for household customers and, in so far as it is possible, small and medium sized enterprises, and other customers that cannot switch their gas consumption to other energy sources, are protected in the event of a natural gas emergency; and (2) measures to protect the security of the national electricity system in so far as that system is dependent on natural gas;
- In carrying out its TSO business, GNI may not prevent, restrict or distort competition to any appreciable extent in any market relating to the supply, distribution, transmission or storage of natural gas;[30]
- GNI is required, when setting its operating security standards in accordance with its TSO licence, to take into account (amongst other factors) the need for maintenance to the transmission system without interruption of the supply of natural gas.[31]

Specific duties of the NRA aiming at safeguarding security of supply

Section 19A of the 2002 Act provides that it shall be a function of the CRU's role to (amongst other things):

- protect the security of supply of natural gas, including measures to protect the security of the national electricity supply;
- establish policies to ensure adequate levels of security of supply;
- ensure that the supply of natural gas to household customers, small and medium sized enterprises, and other customers that cannot switch their gas consumption to other energy sources is protected, at least in the event of:
    - a partial disruption of national gas supplies during such period as may be specified from time to time by the Commission;
    - extremely cold temperatures during a peak period (which period may be specified from time to time by the Commission);

[29] https://www.cru.ie/wp-content/uploads/2017/12/CRU17341-GNI-NDP-2017.pdf.
[30] Condition 30 of the TSO licence.
[31] Condition 13 of the TSO licence.

- periods of exceptionally high gas demand during the coldest weather periods statistically occurring every 20 year.

The carrying out those duties, the CRU may take such measures it considers necessary in relation to security of supply and specify minimum security of supply standards to be complied with by "energy undertakings" which includes GNI in its capacity as a licensed natural gas undertaking engaged in the transmission (and distribution) of natural gas.

3.2. Regulatory practice

3.2.1. Overview over regulatory practice in Ireland

Information about the general regulatory framework in Ireland

There is one TSO and one DSO for gas with separate Price Controls. The Latest Price Control PC4, Gas Networks Ireland is the licensed TSO and DSO, there are sections on innovation in each of the PC4 decisions available here.[32]

There is funding for innovation of up to €20 million over the PC4 term of 5 years. The purpose of the funding is to assist with the decarbonisation of the Irish economy and to ensure that the gas network will continue to be utilised to the benefit of gas customers. The fund has been used to build a grid injection facility for biogas, and to undertake a study on the impacts of compressed natural gas on the Irish gas network for instance.

Main regulatory barriers

Even though innovation is supported, it is not seen as part of the TSO's core business. Under PC4, the CRU has introduced a new innovation allowance related to OPEX. There is no CAPEX allowance yet. Thus, some assets might not be included in the RAB.

Innovation is still new for the CRU and, as innovation puts pressure on tariffs, there is a lack of clarity of how to cope with this. The NRF could play a role in helping the energy market decarbonise, e.g. by expanding allowances focussed on the greening of the gas network.

The barrier "high CAPEX, but benefits of the project go to the wider society" is indicated to be relevant as the approval of projects where the benefits go to the wider society and not only to gas customers is perceived to be difficult. An example are projects related to CNG, where the benefits of reducing emissions and increasing air quality are not taken into account. A social cost benefit analysis is not standard for all projects. It is important to note that the mandate of the NRA may limit the inclusion of social benefits (such as environmental benefits) in investment decisions. There is an ongoing study by the Ministry to analyse how to extend or amend the CBA used for projects to include broader benefits (not solely NPV calculation).

In general, however, no other major barriers are perceived. Although OPEX and CAPEX are treated separately, this not perceived as a barrier for security of supply projects, especially in the case that the higher CAPEX costs can be justified.

3.2.2. Regulatory practice related to innovation

Innovative projects

Whereas the current share of innovative projects is not perceived as high by stakeholders, the TSO is moving towards undertaking a larger share of innovative projects in the future.

In addition to the innovative projects mentioned in Annex II, some of the stakeholders suggest adding the connection between energy and transport sectors ("sector coupling") as an additional category. The TSO is currently investing in CNG and in the long term hopes to invest in CCS and hydrogen. In addition, there is interest to undertake power-to-gas demonstrations.

[32] See: https://www.cru.ie/wp-content/uploads/2017/06/CER17260-PC4-CER-Transmission-Decision-Paper.pdf and https://www.cru.ie/wp-content/uploads/2017/06/CER17259-PC4-CER-Distribution-Decision-Paper.pdf.

The majority of the innovation allowance is used for the Causeway project and there is limited funding available to cover other studies, e.g. a power-to-gas study. There is also an interest for feasibility studies for CCS and hydrogen.

Thus, despite supportive tariff methodology and other provisions, the funding for these kind of projects is perceived to be scarce.

Three following innovative projects were mentioned in the interviews:

- The Causeway Study: this study researches the impact of CNG on the Irish Gas Network. The funding came jointly from the Innovation Allowance (€12.83m) and the Transport fund of "Connecting Europe Facility" (€5.9m);
- Green connect: This is a new project that builds on the Causeway Study. If the TSO receives funding, the project will start next year;
- Potential future CCS projects: There is a gas field that is almost depleted that could be suitable for storage. The project is currently in the pre-feasibility stage.

Adequacy of the NRF and/or regulatory practice relating to its support for innovative investments

The interviewees think that the regulatory practice has proven supportive of innovation in general, but that improvements are possible, i.e. in relation to funding.

3.2.3. Regulatory practice related to security of supply

Security of supply projects

A very high percentage of the share of projects are considered security of supply projects. In addition, security of supply projects are more "traditional" and the responsibilities of the NRA and TSO are clearer.

The projects are usually very large capital projects. Yet, the interviewees indicate that big infrastructure projects will decrease over time and that innovation will make up a far bigger share of projects.

Regarding gas, the interviewees would regard the following projects as security of supply infrastructure investment projects:

- Gas storage and LNG facilities;
- More pipelines, better used pipelines;
- Cyber security and transmission network infrastructure.

In addition, the current Irish security of supply model supports floating LNG as system for security of supply, not strategic storage. More European countries move to floating energy. The Department of Communications, Climate Action, and Environment took the lead, collaborated both with TSOs/CRU and requested the Electricity TSO and Gas TSO to work collaboratively on the study with department of energy oversight.

There are two security of supply PCI projects, one of which will be discussed in Section 3.2.4 below:

- The Twining of Southwest Scotland Onshore System (SWSOS) between Brighouse Bay and Cluden (PCI 5.2). The pipeline runs from the UK to Ireland and will be commissioned by the end of the year. It is financed partly by the regulatory allowance (about two-thirds-60 million);
- Reverse flow (PCI 5.1.1). Physical reverse flow at Moffat interconnection point between Ireland and the UK. The feasibility study is currently going on and should be completed by the end of the year, after which a CBA will be conducted.

Adequacy of the NRF and regulatory practice relating to its support for security of supply investments

The stakeholders seem to be happy with the regulatory framework in terms security of supply projects and no issues were reported.

Moreover, also third party PCIs are also supported by the regulator.

3.2.4. Illustrative specific projects

Two projects have been discussed in-depth: the Causeway study as an example of an innovative project, and the Twinning project as an example of a security of supply project. They illustrate how the current NRF incentivises innovative and security of supply investments and what possible improvements could be made to the NRF to overcome the barriers faced in these two projects.

Causeway study[33]

Description and aim

The Causeway study is considered an innovative project. The project aims at demonstrating the validity of CNG as a viable alternative to diesel for Ireland's transmission operators. Deployment mechanisms will be studied and disseminated across EU member states, informing further integration of CNG for Transport across Europe. Therefore, this project lines up with the requirements of the Alternative fuels directive re: establishment of CNG injection facilities along the TEN-T Core road network.

The study includes a "Vehicle Fund" of € 700,000 to incentivise customers to use CNG vehicles and thus to create a demand for CNG. The fund also gave an indication of the mood and demand of CNG. The Vehicle Fund is fully subscribed, indicating that there is an appetite for CNG vehicles.

Approval process

Although the Regulator does not consider wider social benefits of projects, which can be a barrier to projects getting approval, Causeway was still approved as the European funding helped strengthen the economic assessment.

The European funding (see below) helped strengthen the economic assessment as it gave reassurance to the regulator of the importance of the project. The original project was approved under PC3, the scope was smaller. After the TSO received the funding from PC3, it was decided to expand the project and to apply for EU funding, which was successful. The TSO also secured funding under PC4.

Financial mechanisms

This project was funded through the innovation allowance approved in PC3 and PC4. It received an upfront OPEX allowance to cover the costs of the project in order to de-risk it. The project does not appear on the RAB. Moreover, the projects received European funding from the Connecting Europe Facility (CEF).

Possible improvement to the (approval) process for such projects

A more structured regulatory approach is required for innovative projects, which accounts for the benefits to wider society, such as decarbonisation and air quality improvements etc. The role of national regulatory authorities in relation to innovation and resultant benefits in terms of decarbonisation and sustainability needs to be defined. A simplified and concise applications process with clear criteria linked to wider energy / climate targets should also be facilitated at national level.

The reason for the lengthy approval process of these kind of projects is the lack of a mandate for innovative projects on part of the regulator. The regulator carried out a stakeholder consultation as it felt the need consult stakeholders before making a decision. The regulator could have a more specific mandate for innovation, so that the regulator is more comfortable with approving such projects.

Moreover, even though there are innovative projects, innovation is not seen as a core element of the business. As part of the fourth price control process, GNI sought an innovation fund of €25m for projects including Biogas Purification, Power-to-Gas, Low Carbon Heating Solutions, Carbon Capture and Storage (CCS) and Research. While the CRU has provided GNI an innovation allowance of up to €20m, €12.8 of it has been spent on the Causeway project, so

[33] Note on terminology: Internally, the TSO refers to the project as the "Causeway Project." The project was approved for European funding as the "Causeway Study." They are the same project.

that for other projects the maximum possible funding amounts to €7.2m.[34] This might help to continue some of its innovative projects and start some new projects, it may not be sufficient to carry out work in all the areas for which funding was requested.

Benefits of facilitating the approval of such projects encompass further deployment of biogas with sustainability and decarbonisation benefits, an allowance for wider deployment of CNG other than on Core TEN-T networks, which would help decarbonise transport etc.

Twinning project

Description and aim

The Twining project is considered a security of supply project. The goal of the investment was to remove a single point of failure on the interconnector system, adding redundancy and improving Ireland's security of supply position.

Approval process

There was nothing special about the approval process – it went smoothly. The project was approved because of the provision of EU funding via the CEF and due to the fact that there is a clear security of supply benefit to Ireland. There were no amendments to the key features of the project. The process was as expected for the level of funding which was committed.

Financing mechanism

This investment was not treated differently from other investments. The project has PCI status, which increased the credibility of the project. However, the CBA at national level would not have been enough to approve the project. The presence of EU funding helped in getting the project approved.

Possible improvements to the (approval) process of such projects

Any provisions to fast track the process would be welcomed by the stakeholders, however, they acknowledge the requirements to make a robust case for the investment due to the level of funding required.

3.3. Options for improvement

3.3.1. Options to improve regulatory practice

The above discussion shows that the NRF is functional for both security of supply and innovative projects: there is flexibility to include extra funding within one regulatory period and an innovation allowance has been set up for the current regulatory period. A concern is, however, that projects having wider societal benefits are not incentivized. Furthermore, the lack of a mandate for innovative projects on the part of the regulator and limited funding for innovation are seen as issues.

(i) Social cost benefit analysis

Stakeholders criticized the focus on input in the current regulation and indicated that the switch to a more output-based regulation accounting for the benefits that actually accrued to the consumers is desirable. A first step in this direction would be introducing the requirement to conduct a Social CBA. This could be done on multiple levels: on the level of the national plan and on project level for larger projects. On project level, the SCBA could be a requirement before approval of the final investment decision. It is important to note that the mandate of the NRA may limit the inclusion of social benefits (such as environmental benefits) in investment decisions.

(ii) Statutory reference to innovation

There are no statutory powers or duties aiming at encouraging innovation, whereas there are express references to innovation or linked concepts in the current tariff methodology. To ensure that innovative projects are still encouraged and supported in the next regulatory period, a statutory reference to innovation could be included into the regulatory framework.

[34] The gas innovation fund (https://www.gasnetworks.ie/business/renewable-gas/innovation-fund/q-and-a/) is the mechanism to allocate the allowance.

3.3.2. National law mechanism(s) for implementing options

We consider that, with the exception of the following, the above mentioned changes could be implemented using legal powers already available to the NRA or others under the existing NRF.

With regard to option (ii), the suggestion to include a power or duty to encourage innovation could be included by way of a new statutory function of the CRU via an amendment to the 1999 Act.[35]

3.3.3. Impact assessment

The mandatory requirement to conduct a SCBA (option (i)) on the level of the TYNDP/the national plan or individual (innovative or larger) projects increases the work load of the TSO and of the NRA. Therefore, this option needs to be implemented in a way that keeps the additional workload manageable.

The long-term strategic perspective on innovation mentioned in option (ii) necessitates efforts and coordination between the TSO and the NRA regarding the design of this long-term perspective (e.g. the organisation of stakeholder consultations, determining the scope of the innovation needed, monitoring and evaluating of how the statutory duty is translated into the long-term perspective).

We have not encountered any specific examples of projects that have been cancelled due to the regulatory framework. Furthermore, the stakeholders are largely satisfied with the current NRF. In addition, public consultations are already held in the case of many important transmission infrastructure projects, which should provide incentives for implementing socially beneficial projects. The requirement of conducting a SCBA would probably be of not much added value, since the TSO already provides a reasoning underpinning its investment plan. Lastly, innovation is prominent in the current regulatory period. For these reasons, we do not expect that any of the suggested changes will result in considerable changes to investment levels.

[35] An amendment to the 1999 Act requires a separate amendment Act. The process is as follows: A draft of proposed new legislation is called a Bill. A Bill must go through several distinct stages (including committee stage) and passed by both of the houses of parliament (the "**Oireachtas**" comprised of the Dáil (lower house) and the Seanad (upper house)). Once a Bill has gone through all the stages and has been passed by the Dáil and Seanad, the President signs it into law. It then becomes an Act and is added to the Statute Book. Some Acts come into force immediately, while others are commenced on a later date by the relevant Minister. In certain rare circumstances, the President has the power to decline to sign a Bill. The President consults with the Council of State before taking such a decision. All laws must be compatible with the Constitution.

ANNEX I: TYPOLOGICAL INVESTMENTS – ELECTRICITY

Generally, the term typological investment relates to technical solutions that TSOs can adopt to provide the transmission capacities needed to cover the transmission demand of grid users. Thus, a typological investment is meant to be a type of solution that can be implemented, in principle, by any TSO in situations in which these solutions are appropriate to provide the desired benefit. Hence, typological investments are not specific to a concrete location or a particular TSO. In the following, we have listed a selection of typological investments for the electricity transmission sector, that are differentiated in 7 categories that can be considered innovative as compared to conventional solutions. For each of these categories we have provided a number of examples of solutions, based on our existing knowledge, a literature review and interviews. The list might not be completely comprehensive, but should give an idea of our understanding of the different types of typological investments, we are interested in.

Category	Examples of solutions
New transmission lines based on innovative technology or change of technology of existing lines	• New HVDC lines (→allow to control the power flow; less expansive for long distance transport; undergrounding less complex); • Replacement of HVAC by HVDC lines (→less complex and less expensive; more compact design); • Underground cables or GIL (→ more expensive than OHL but can help improving public acceptance and accelerate the authorisation process); • Design of overhead line poles (→can help improving public acceptance and accelerate the authorisation process); • Replacement of conventional overhead line conductors by high-temperature conductors (→more expensive than conventional ones but can allow to provide additional capacity at a lower cost level and more quickly than by building completely new lines).
Introduction of dynamic capacity rating with the aim of utilising existing transmission lines or transformers at higher levels	Spectrum of technological options ranging from a differentiation of rating levels according to fixed time intervals (e.g. seasonal or time-of-day) down to online monitoring of equipment temperature and adaptation of capacity rating in real-time operation.
Installation of power flow control components in order to better adapt power flow patterns to capacities and topology of the existing grid.	• Phase-shifting transformers; • Semiconductor-based FACTS elements (including HVDC converters).
Investment into components contributing to ancillary services provision (reactive power / voltage control, short-circuit power, momentary power reserves and black-start capability)	• Purely phase-shifting generators (→offer operational flexibility and can serve to improve cost efficiency); • FACTS elements (→ see above).
New or extended power system control and automation technology with the aim to lower the risk of disturbances threatening security of supply	• Improvements in observability and controllability based on conventional sensor and actor devices; • Wide-area measurement systems (aiming at synchronously measuring power phasor angles at the grid nodes to improve observability); • Real-time dynamic security assessment tools (aiming at observing stability phenomena beyond static voltage/current measurements).

Category	Examples of solutions
Partial automation of system operation processes aiming at better utilisation of existing grid capacities	Automatic switching of network devices (in connection with adaptive protection schemes) or of generation-side or demand-side flexibilities in case of grid component outages in order to reduce the demand for (n-1) capacity reserves.
Improvement of approaches to curative congestion management providing the possibility to operate systems closer to their technical limits and/or to improve security of supply	• Generation-side flexibilities (especially renewables); • Demand-side flexibilities (DSM/DR); • Storage components; and • Technologies coupling the electricity sector with other sectors (gas, heat, traffic).

ANNEX II: TYPOLOGICAL INVESTMENTS – GAS

Typological investments are meant to be those type of investments whose aim is to promote innovation in the gas transmission systems while ensuring or enhancing the level of security of supply of a region. Hence, by definition, they can be implemented independent of a specific TSO and location.

In the following table, we offer a resume of the typological investments for the gas transmission system we have deemed as innovative compared to "conventional" solutions.

The investments are broken down into four categories each accompanied by examples that emphasise their importance and impact on the gas system.

Category	Examples of solutions
Increased need for flexibility for market development and security of supply.	• (Power-to-gas) Usage of excess pipeline capacity as "energy" storage of excess wind or solar energy by utilizing electrolysis (an efficient utilization of the excess of electricity produced by non-programmable sources of energy); • Increase withdrawal and injection capacity in storages by incentivising investments supporting flexibility (support of gas market liquidity and security of supply level); • Allowance of higher pressure in selected pipeline/routes (increase of flexibility of the supply side).
Incentivise and facilitate upgrade of biogas to the transmission system.	• Investments in upgrade of biogas to transmission system (support of gas market liquidity and security of supply).
Digitalisation of operations, through e.g. drone inspections and artificial intelligence (AI), resulting in a safer and cost-efficient operation.	• Drone inspections and AI in combination with modern SCADA systems can serve as input to reliability based operation and maintenance (lower maintenance cost and reduction of unforeseen/unplanned shutdowns).
In order to support security of supply and add liquidity to the gas market, there is a need to build interconnectors in Europe.	• More reverse flow systems could be considered to increase flexibility in the supply routes (reduction of dependency and power of trading of the large gas suppliers); • Enhancement of available gas supply in situation of supply crisis; • possibility of arbitrage a price convergence between markets to support the development of the internal market.

ANNEX III: POTENTIAL REGULATORY BARRIERS FOR PROJECTS

Regardless of the character of a project (e.g. projects enhancing security of supply or applying innovative technologies, which this questionnaire is focussing on) there might be potential regulatory barriers for implementing projects in general but maybe also barriers for special kind of projects. To give you an impression what kind of barriers we have in mind, we have listed some examples of such barriers in the following. It should be noted that there might be different or even more or less barriers in the regulatory framework of your country.

Type	Description / Explanation
Higher TSO CAPEX but lower expected OPEX within the TSO	the investment upfront is more costly, but has a potential of lowering the operational costs in the future. However, because of its innovative and more risky character the lower OPEX is not guaranteed. If not allowed to put the costs in case of a failure in the tariffs, TSO would not invest in innovative solution.
Higher TSO CAPEX, but benefits go to the wider society, instead of the TSO	This is a situation where higher investment, including in new technologies, is needed on the part of a TSO but benefits in terms of RES integration, RES curtailment or CO2 avoidance benefit other players in the society, while the TSO is only faced with the cost increase. Projects in regulatory frameworks, which do not distribute adequately the benefits to the TSO that bears the costs and takes the risk, are less likely to happen. This could also apply to cross-border investments involving several TSOs.
Investments in smart grid elements /technology aimed at replacing planned grid investments	Investments in smart grids and other smart elements that actually reduce the need of physical construction of lines for example due to a better interactive/intelligent grid management of balancing tools (battery storage) may provide a reduction in the regulated asset base, however with a slight increase of tariffs, might not be realised.
Investments in security of supply – projects without commercial benefits	Projects that ensure security of supply will in some cases never bring enough commercial benefits such as a pipeline would be going to be used only in case of emergency. If the security of supply (e.g. diversification of the sources for gas) is not put into tariffs, a TSO is most likely not willing to invest.
Lower TSO TOTEX but shift in the CAPEX/OPEX ratio	In some member states CAPEX and OPEX are treated differently in the regulatory regimes. Depending on the incentives set by doing so, technical solutions/projects with higher CAPEX might be preferred by the TSOs even if they result in higher total costs.

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