Support in the development of the framework for evaluation, identification, selection, eligibility and support of Cross-Border Projects in the field of renewable energy under the Connecting Europe Facility (CEF)

Final Report

ENER/C1/2018-554
July 2019

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Luxembourg: Publications Office of the European Union, 2019

ISBN: 978-92-76-11949-4
Doi: 10.2833/666975
Catalogue number: MJ-04-19-637-EN-N

EUROPEAN COMMISSION

DIRECTORATE C
Renewables, Research and Innovation, Energy Efficiency

European Commission
B-1049 Brussels

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Final Report

15 July 2019

Prepared for:

European Commission, DG ENER, C1

Service request: ENER/C1/2018-554
Framework contract SRD MOVE/ENER/SRD/2016-498 Lot 2

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TABLE OF CONTENTS

1 Introduction 3

2 Task 1 Methodologies as requested in Art 7 (2) and ANNEX IV of the CEF regulation 6

2.1 Introduction to the methodologies 6
2.2 Subtask 1.1 Added value of the cooperation project 9
2.3 Subtask 1.2 Cost-benefit analysis 9
2.3.1 General approach to the CBA and required steps 9
2.3.2 Presentation of the socio-economic and energy market context 10
2.3.3 Definition of objectives 11
2.3.4 Project identification 12
2.3.5 Technical feasibility & Environmental sustainability 12
2.3.6 Cooperation mechanism involved 12
2.3.7 Added value of cooperation 15
2.4 Economic analysis (overall social welfare) 17
2.4.1 Introduction 17
2.4.2 Overall Methodology 17
2.4.3 Monetisation and quantification 18
2.4.4 Overview of indicators for economic analysis 19
2.4.5 Scenario definition, input data and boundary conditions 21
2.4.6 Counterfactuals 23
2.4.7 Detailed description of the indicators (simple approach vs. detailed approach) 24
2.4.8 NPV assessment 42
2.4.9 Significance of societal benefits 45
2.5 Subtask 1.3 Methodology for grants for works (based on financial analysis) 48
2.5.1 Methodological approach 48
2.5.2 Assessment of commercial viability 49
2.5.3 Quantification of amount of grants for works 54
2.5.4 Calculating co-financing rates 57
2.5.5 Assessment of financial sustainability 58
2.5.6 Sensitivities and risk assessment 60
2.6 Application procedure for small-/medium-scale c-b RES projects and/or small/medium grants (summary) 63
2.7 Subtask 1.4 Detailed eligibility, selection and award criteria 66
2.7.1 Objectives which need to be addressed by the applicant 67
2.7.2 Eligibility criteria 68
2.7.3 Award and selection criteria 74
2.7.4 Evaluation matrix for award criteria (grants for works) 82

3 Task 2 Process and templates 85

3.1 Subtask 2.1 Detailed selection process 85
3.1.1 Selection process for grants for pre-feasibility studies 85
3.1.2 Selection process for receiving the status as c-b RES project 86
3.1.3 Selection process for grants for studies and grants for works 92

3.2 Subtask 2.2 Standard application format and comparison grid 98
4 Case studies 99
4.1 Case study 1: Joint CSP project between Portugal and Germany 99
4.1.1 Stage I: Application for pre-feasibility studies 99
4.1.2 Stage II: Application for CB-RES project status 104
4.1.3 Stage III: Application for grants for technical studies 107
4.1.4 Stage IV: Application for grants for works 107
4.1.5 Final Evaluation 110
4.2 Case study 2: Luxemburg supports a district heating project in Bulgaria 113
4.2.1 Stage I: Application for a pre-feasibility study 113
4.2.2 Stage II: Application for CB-RES project status 117
4.2.3 Stage III: Application for grants for technical studies 117
4.2.4 Stage IV: Application for grants for works 120
4.2.5 Final Evaluation 120
4.3 Case study 3: The Netherlands open their technology-neutral RES auction scheme for projects in Romania 120
4.3.1 Stage I: Application for TA / pre-feasibility studies 121
4.3.2 Stage II: Application for CB-RES project status 123
4.4 Case study 4: Austria and Slovenia set up a joint support scheme for innovative electric vehicle charging 124
4.4.1 Stage I: Application for pre-feasibility study 124
4.4.2 Application for Stage II: Application for CB-RES project status and for Stage III: Application for grants for technical studies 124
4.4.3 Stage IV: Application for grants for works 127
5 Task 3 Project pipeline 128
5.1 Summary: Member States' positions 128
5.2 Summary: Associations' responses 129
5.3 Summary: Technological focus 129
5.4 Summary: Sectors 131
6 Task 4 Workshop 132
6.1 Summary 132
6.2 Detailed report of the meeting 132
6.3 Agenda 138
6.4 List of participants 139
7 Conclusion 144

1 INTRODUCTION

The Renewable Energy Directive (2009/28/EC) defined national RES targets for each Member State and, against this background, allowed Member States to organise RES support nationally. This governance setup implied two challenges: first, the target was set considering GDP (for a fairer distribution of the cost for target achievement), leaving some Member States with higher targets than others while not having the respective renewable energy sources (RES) available. Second, the national RES policies could continue in a largely isolated manner, leaving the European RES policy landscape fragmented. To address this, the Cooperation Mechanisms were introduced, allowing Member States to use each other's RES potentials after entering into an agreement, potentially resulting in the more cost-effective use of European RES potential and cost savings for Member States (and ultimately consumers) in their national RES target achievement. These benefits have been repeatedly demonstrated (e.g. in the Impact Assessment of the renewed Renewable Energy Directive) and in various reports.

However, Member States have hardly made use of the Cooperation Mechanisms and renewables development continues to be mostly driven through national support schemes and national plans that remain largely un-coordinated. In several cases where cooperation was investigated in the past (e.g. on wind energy cooperation between the United Kingdom and Ireland), projects did not materialise. Exceptions are the Joint Certificate Scheme between Sweden and Norway (since 2012), mutually opened PV auctions between Germany and Denmark (2016) and Statistical Transfers between Luxemburg and Lithuania and Luxemburg and Estonia (2017). Key barriers for the use of the Cooperation Mechanisms have been regulatory complexities and administrative burden; first mover risk; difficulty in quantifying the costs and benefits of cooperation; preference for reaping the benefits of renewables' deployment nationally (jobs); political acceptance of using national taxpayers/consumers' money to fund projects abroad; uncertainty on cooperation design options beyond the 2020 period.

The "Clean Energy for all European package" puts renewed emphasis on the value of cooperation between Member States in the field of RES deployment through the continuation of the Cooperation Mechanisms and the opening of support schemes as defined in the REDII. The Directive also states that the Commission shall support Member States' ambition level through an enabling framework, including the enhanced use of Union funds, for the purpose of "enhancing regional cooperation between Member States and between Member States and third countries". Note that "regional cooperation" is understood in this project as "cross-border cooperation" and thus includes cooperation between Member States located in different regions.

The Commission is responding to this renewed focus on cross-border RES cooperation with a new CEF funding line: The Commission's proposal for the new Connecting Europe Facility (CEF) includes a category for cross-border projects in the field of renewable energy (c-b RES projects). On 8 March 2019, the European Parliament and the Council reached a common understanding on the proposal for a revised Connecting Europe Facility (CEF) Regulation for 2021-2027. 15 % of CEF Energy (or 1.2 billion Euros, depending on the final agreement reached on the overall MFF amount) will be earmarked for this new element, subject to market uptake. If that amount is reached, the Commission shall increase it to 20 % of the CEF Energy budget, also subject to market uptake.

This funding line shall provide support for:

- Grants for pre-feasibility studies for EU Member States and project promoters to assess and develop jointly beneficial Cooperation Mechanisms,
- Grants for technical studies, i.e. more detailed studies undertaken only once a cooperation or project was granted the status of a c-b RES project,
- Grants for works for a limited number of c-b RES projects,
- Actions related to renewables as an ancillary element to projects eligible in the field of digital and/or transport under the new CEF-Programme for the future CEF-programme.

The funding line shall also provide for possible blending with other EU programmes including the proposed new InvestEU Fund.

A delegated act with further details on the selection criteria and process is to be presented by the European Commission shortly after the MFF is adopted. Moreover, the Commission needs to develop and publish the methodologies to assess the costs and benefits of any proposed cooperation/project and the contribution to the general objectives as specified in Annex Part IV of the proposed CEF regulation by the same date.

The objective of this assignment has been to assist the European Commission in developing a methodological framework for handling applications for c-b RES projects under CEF. This framework specifies methodologies for evaluating c-b RES project applications and includes, in particular, a fully developed cost-benefit assessment (CBA) methodology. Moreover, it supports the definition of specific criteria and processes for the identification, selection, eligibility and support of c-b RES projects. Eligibility and award criteria need to be defined for the different stages of this process, i.e. (1) for awarding the status of a c-b RES project, (2) for awarding grants for studies, and (3) for awarding grants for works. The outcome of the assignment supports the European Commission in its preparation of the delegated act of the CEF regulation with all necessary details mentioned above.

The following tasks were implemented in the course of the assignment:

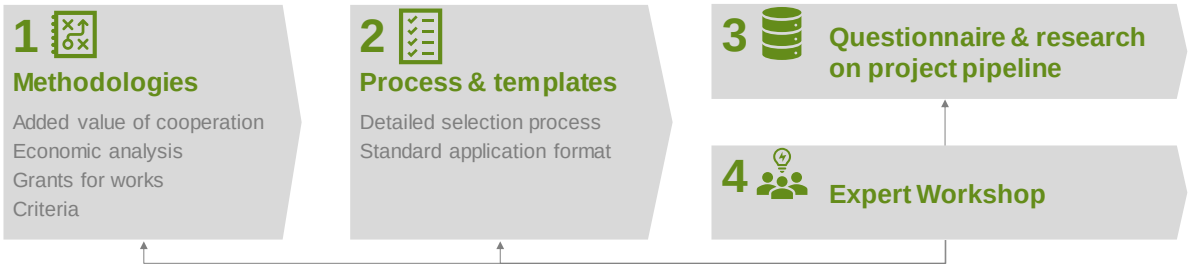

Figure 1 Overview of project tasks

- Task 1: Methodologies as requested in Art 7 (2) and ANNEX IV
  - Subtask 1.1 Added value of the cooperation project (compared to a similar project implemented by one Member State)
  - Subtask 1.2 Cost-benefit analysis (incl. project finance and social welfare perspectives)
  - Subtask 1.3 Methodology for grants for works (to determine whether and how much EU support will be paid)
  - Subtask 1.4 Detailed eligibility, selection and award criteria
- Task 2: Process and templates
  - Subtask 2.1: Detailed selection process (including stakeholder consultation)
  - Subtask 2.2: Standard application format and comparison grid
- Task 3: Potential project pipeline
- Task 4: Workshop

Interactions between the tasks include the input by stakeholders on the project pipeline which has fed into the design of methodologies and processes. Likewise, the stakeholder workshop implemented on 3 June 2019, provided valuable input to further refine tasks 1 and 2.

There are several points of particular attention and challenges that have been addressed in the course of the project and which are included in the report. These include among others:

- There is a wide range of project types which is in principle eligible for support, including all RES technologies as defined in the REDII, all project sizes, and all cooperation mechanisms (in particular joint projects and joint support schemes). In addition, applicants can not only be private project promoters (e.g. project developers) but also Member States and subnational

legal entities. Member States can also apply for grants to support joint support schemes instead of specific physical assets.

- Since the potential projects are very different in size and nature, the CBA, the evaluation, selection and award process has to be sufficiently flexible. This necessarily limits the level of comparability between the evaluations. Nonetheless, each project will be subject to a thorough and fact-based assessment, ensuring that each project is assessed on the same basis of rules.

- The transaction costs incurred for project promoters need to be limited as much as possible to make the funding line attractive for them. This means that a flexible approach regarding the requirements for applications per project/grant size and application stage needs to be implemented.

- On the other hand, conducting a CBA – as prescribed the CEF regulation – always implies certain transaction costs. We try to build the CBA methodology as much as possible on existing CBA guidelines of the European Commission, namely the Guide to Cost-Benefit Analysis of Investment Projects by DG REGIO (2014).[1]

The proposed design aim to address these issues and underlying trade-offs. The report is structured along the requested tasks. It adds in chapter 4 four individual case studies to illustrate a range of potential projects applying for the c-b RES status and for CEF funding:

- Case study 1, providing a detailed walk-through the process (which is not repeated in such detail in the subsequent case studies): A joint CSP project between Portugal and Germany driven by a technological rationale
- Case study 2, focussing on the application of a joint project and the heating sector: A district heating project as a physical project, but policy-driven due to envisaged statistical RES transfers between Bulgaria and Luxemburg
- Case study 3, elaborating on the specificities of a joint support scheme: Opening of the technology-neutral Dutch support scheme to projects in Romania
- Case study 4, exploring an option for a project in the transport sector: A joint support scheme for innovative electric vehicle charging, involving Austria and Slovenia

This project and the final report aim to support the work on the delegated act. The report shows the results from the project running from 9 January 2019 until 21 June 2019. Any references made to the CEF regulation refer to the political agreement of 8 March 2019 which at the point of finalizing this report has not been formally adopted. This report is not directly a guide for applicants. Various detailed elements discussed in this report may change in delegated act. In addition, the CBA-guideline will likely be published by the European Commission (e.g. in the form of a staff working document) and thus parts of the guideline may change as well.

[1] Guide to Cost-Benefit Analysis of Investment Projects by DG REGIO (2014), available at https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf.

2 TASK 1 METHODOLOGIES AS REQUESTED IN ART 7 (2) AND ANNEX IV OF THE CEF REGULATION

2.1 Introduction to the methodologies

In task 1 the project partners developed methodologies for assessing c-b RES projects. Art 7 (2) of the proposed new CEF regulation requires that the selection criteria need to be defined as well as details of the selection process and the methodologies for assessing the individual projects.

We structure task 1 into 3 subtasks including:

- Subtask 1.2 Cost-benefit analysis[2]
- Subtask 1.3 Methodology for grants for works
- Subtask 1.4 Detailed eligibility, selection and award criteria

The proposed methodology reflects the various application stages that projects pass, from pre-feasibility studies to receiving grants for works (see for an overview Figure 2, see for a detailed discussion of the selection process task 2).

Figure 2 Overview of application stages (source: Navigant)

The application stages and its related benefits for project promoters include:

- **Pre-Status: Application for and awarding of early feasibility study:** The CEF regulation includes the possibility of projects / applicants to receive funding for studies at a very early stage of a project. Such studies may help to further develop and sharpen the project idea and to create momentum among the required stakeholders for a c-b RES project. The amounts to support such early studies will likely be limited (e.g. max 150.000€) and will be smaller than amounts for detailed technical studies or grants for works.
- **Application and award of status as c-b RES project:** The status as a c-b RES project under the CEF regulation would make projects eligible to receive funding for detailed technical studies (e.g. feasibility studies for project promoters and other eligible entities to prepare concrete projects emerging from cross-border cooperation). In addition, project with this status are generally eligible to receive grants for works, as they provide high EU added value and significant overall cost savings.
- **Detailed technical studies after receiving c-b RES project status:** The status as a c-b RES project provides eligibility for support for detailed technical studies.

[2] Note that we integrate subtask 1.1 now into subtask 1.2 (the CBA) as the added value will be shown as part of the CBA.

- **Application for and awarding of grants for works:** This stage includes potentially the main actual objective of applicants, the awarding of grants for works that otherwise (even when considering payments from national support schemes) would not materialise because they would not be economically viable.

The early feasibility studies (pre-status) can be skipped, and project promoters can apply for several stages at the same time in case they want to quickly advance in the process. For instance, they may apply for the c-b RES project status and at the same time for the grants for technical studies or even for grants for works. However, as in any application process, the outcome of the application is open. To avoid the risk of high sunk costs, we recommend for project developers to apply for grants for works only once the c-b RES status has been given.

The following basic project setups may be eligible for funding under CEF:

The common understanding on the proposal for a revised Connecting Europe Facility (CEF) Regulation for 2021-2027 includes several indications on which project types may be eligible for funding as a c-b RES project.

- Eligible technologies are in principle those defined as renewable energy technologies in the REDII (Article 2), i.e. “wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas.” In addition, the recitals of the new CEF regulation mention additional “illustrative examples”, including “combinations thereof; their grid connection and additional elements such as storage or conversion facilities”.

- Renewables generation may be related to the electricity, heating & cooling and transport sectors, as “eligible action is not limited to the electricity sector and can cover other energy carriers and potential sector coupling for example with heating and cooling, power to gas, storage and transport”.

- Projects may, but do not necessarily have to have a physical link to more than one Member State and they may or may not have a physical direct cross-border impact. A c-b RES project is formally defined in the new CEF regulation as “a project selected or eligible to be selected under a cooperation agreement or any other kind of arrangements between at least two Member States or arrangements between at least one Member State and a third country or countries” as defined in the following Articles of Directive (EU) 2018/2001 (REDII)

    - Article 8 Statistical transfers between Member States
    - Article 9 Joint projects between Member States
    - Article 11 Joint projects between Member States and third countries
    - Article 13 Joint support schemes

Any other kind of arrangement may include a bi- or multilateral agreement settling financial flows between Member States around a cooperation on renewables that would not have the form of a statistical transfer, joint tender or joint project. It could be for example integrated into a broader bilateral agreement that covers more than RES.

Eligible entities are Member States themselves and/or “legal entities established in a Member State including joint ventures; legal entities established in a third country associated to the Programme or overseas countries and territories; legal entities created under Union law and international organisations where provided for in the work programmes. Natural persons are not eligible”.

There is no limitation as to how small or large projects may be in order to participate. We define “small to medium scale projects” as up to 50m€ investment volume and large-scale project as above 50m€ investment volume.

In addition, either individual projects may apply or multiple projects (e.g. a joint support scheme implemented by more than one Member State).

In sum, the range of potentially eligible projects is very large, resulting from the idea to provide as much flexibility as possible to allow for innovative approaches providing the largest added value.

The methodology is structured around the subtasks as described above and is based on the following principles:

Subtask 1.2 CBA

- The CBA is based on existing guidelines by DG Regio[3] and ENTSO-E[4] but is specifically adapted to the context of c-b RES projects.
- An important aspect in a CBA is whether and to which extent modelling and monetisation can be used to inform and substantiate the CBA. The key challenge at hand is to develop a CBA methodology which is sufficiently detailed and solid, which is applicable to a wide range of project scopes (from single large-scale projects to support frameworks for a series of smaller projects) and which, at the same time, implies manageable transaction costs for the involved parties.
- The CBA is implemented in a differentiated approach: in the early application stages (with still limited benefits) the requirements for the CBA a very light, ensuring a lean application process for project promoters. In the later stages, the CBA requirements become more comprehensive, as more benefits (i.e. subsidies) are involved and more scrutiny on the project selection and the efficient and effective use of subsidies is required.
- The CBA is also differentiated according to the size of requested support: throughout the process smaller projects will be subject to less stringent requirements than larger projects, thereby tailoring the CBA to the available capacities of project promoters and ensuring that the transaction costs relative to the project size do not increase excessively for small and mid-sized projects.

Subtask 1.3 Methodology for grants for works

- This methodology will enable the European Commission to determine whether a project needs to receive CEF funding and, if so, what the size of the grant needs to be. This will be determined by assessing the commercial viability and examining the financial sustainability of the project as well as by quantifying the amount of grants.
- The first module employs a common Discounted Cash Flow (DCF) analysis which yields the Financial Net Present Value (FNPV) of the project under market conditions. If the FNPV of a project turns out to be negative, the project would not be commercially viable and is hence eligible for grants for works in this aspect.
- The second module builds on the cash flows examined in the first module but considers the exact financing structure of the project and assesses whether the project can cover its cash outflows at all times. If this is not the case, the project is not financially sustainable and hence not eligible for grants for works.
- Finally, costs eligible for EU funding are selected from the previously modelled costs. The difference between eligible costs and the project's revenues equals the financing gap. This gap would in turn be the amount of grants needed to be awarded by CEF, keeping in mind the general maximum co-financing rate of up to 50%.

Subtask 1.4 Detailed eligibility, selection and award criteria:

- Based on and consistent with the methodology outlined above, this subtask's aim is to develop detailed criteria to assess eligibility of projects (eligibility criteria); to select applicants

[3] Guide to Cost-Benefit Analysis of Investment Projects by DG REGIO (2014), available at https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf.

[4] 2nd ENTSO-E Guideline For Cost Benefit Analysis of Grid Development Projects, available at: https://tyndp.entsoe.eu/Documents/TYNDP%20documents/Cost%20Benefit%20Analysis/2018-10-11-tyndp-cba-20.pdf.

(selection criteria); and to award projects the status of c-b projects and/or award grants for works, technical studies or for pre-feasibility studies (award criteria).
- It furthermore proposes to what extent these criteria need to be further specified in the delegated act and/or can be detailed in the work programme and calls.

2.2 Subtask 1.1 Added value of the cooperation project

The aim of subtask 1.1 is to develop a methodology for assessing whether a c-b RES project provides benefits compared to a similar project implemented by one of the participating Member States alone. While developing the CBA guidance it became apparent that the added value of the project will ultimately be derived from the CBA. As a result, and to ensure an integrated view on this aspect we have integrated subtask 1.1 into subtask 1.2 (see section 2.3).

2.3 Subtask 1.2 Cost-benefit analysis

The aim of subtask 1.2 is to develop a methodology for a CBA (i.e. a CBA guideline) to assess whether the potential overall benefits of cooperation outweigh its costs (short, mid and long-term).

The political agreement on the CEF regulation of 8 March 2019 states that "the project specific cost-benefit analysis pursuant to point 3 of Part IV of the Annex shall be compulsory for all supported projects, shall be performed in a transparent, comprehensive and complete manner and shall provide evidence concerning the existence of significant cost savings and/or benefits in terms of system integration, environmental sustainability, security of supply or innovation."

In the following sections we describe the general CBA approach and the basic CBA steps (as adapted for the specific context of c-b RES projects). In section 2.4, we will provide details on the economic analysis (i.e. the system-level CBA) and scope for quantification and modelling. In section 2.5 we provide details on the project-level financial analysis.

2.3.1 General approach to the CBA and required steps

There are several elements to be addressed when conducting a CBA in the context of c-b RES projects, as shown in Figure 3. The CBA guidance is largely based on the Guide to Cost-Benefit Analysis of Investment Projects by DG REGIO (2014).[5] In particular, the general structure of the CBA, thus the 9 application elements, is aligned with the DG REGIO guideline. However, we adapt the guideline to the specific context of c-b RES projects in the CEF regulation. Among other things, we introduced the additional application elements "cooperation mechanism" and "added value of cooperation", in addition to the DG REGIO guideline. Moreover, we tailored the individual CBA elements to the specific scope of projects in the CEF c-b RES context.

[5] Guide to Cost-Benefit Analysis of Investment Projects by DG REGIO (2014), available at https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf.

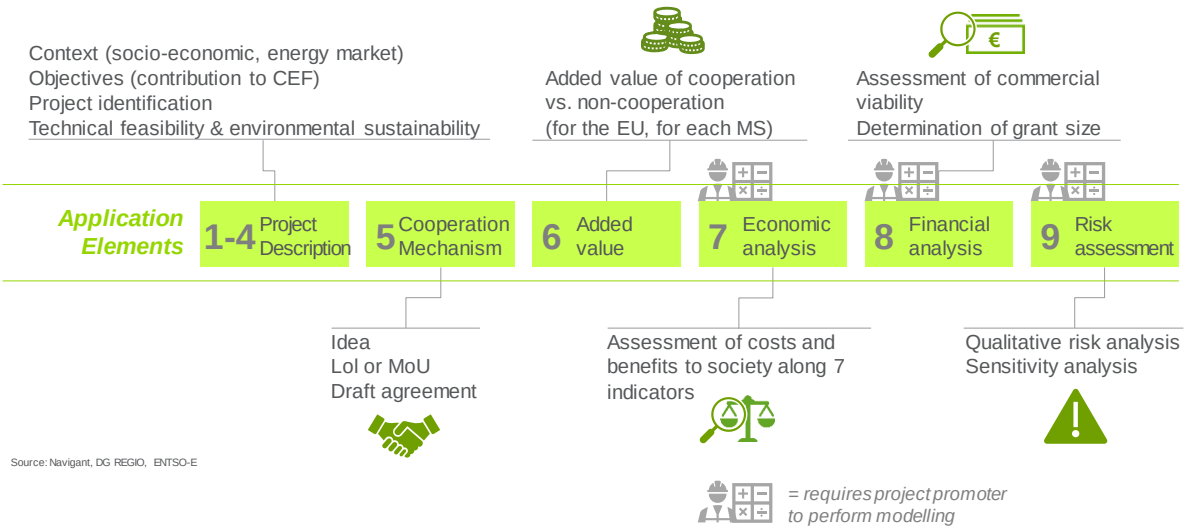

Figure 3 Overview of elements to be included in CBA

Figure 4 provides a high-level overview of the application steps and the required level of detail in each of the application stages. As mention in the introduction to this methodology, the general tendency is that the further the application process towards grants for works progresses, the more detail is required.

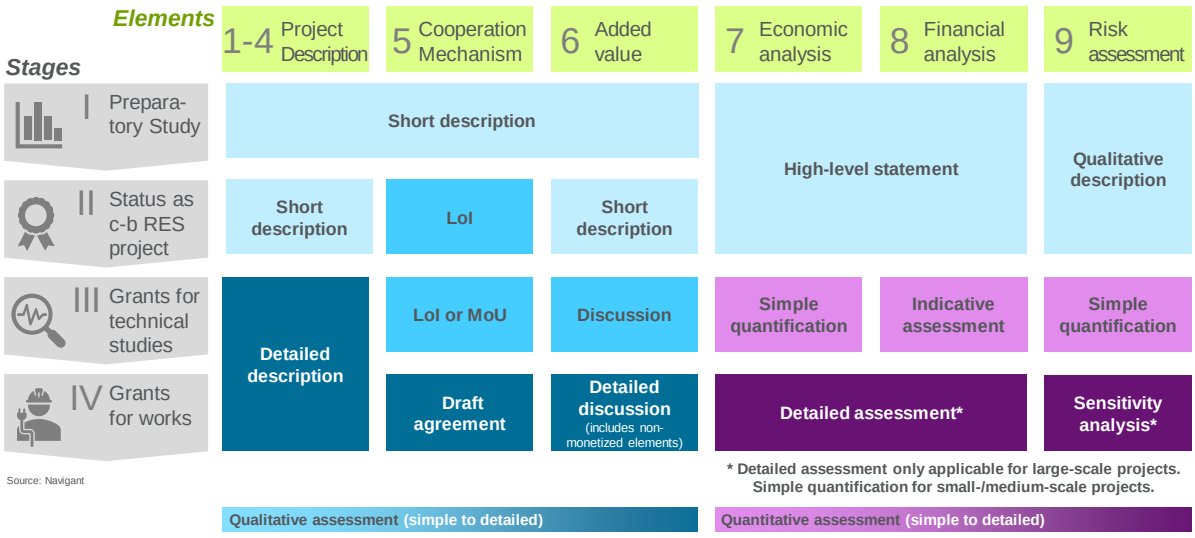

Figure 4: Overview of the different levels of detail per application element required throughout different application stages (source: Navigant)

2.3.2 Presentation of the socio-economic and energy market context

All applications will be defined by the context and boundaries of the RES-related provisions in the CEF regulation. However, their specific implementation context will differ strongly. The presentation of the context helps the project evaluator to understand which direct and indirect impact the project can potentially have, which is further elaborated in the economic analysis. The presentation should include the following elements and be stated for all involved Member States, even if the CBA is elaborated by a project developer:

- Socio-economic trend of Member State, e.g. GDP, Income.
- Key energy indicators of Member States

  - Total primary/final energy consumption,
  - Energy mix (RES share, sectors, etc.),
  - Energy intensity of the economy
  - GHG intensity of the economy

- High-level summary of status quo and target setting (as stated in the NECPs): energy security, internal energy market, energy efficiency, GHG reduction (incl. RES targets), innovation and competitiveness.
- Existing (RES) energy market conditions
  - Structure of the market: Degree of market liberalisation, competition in the sector, and market entry
  - Wholesale market trends (prices)
  - RES capacities
  - RES potential
  - High-level characterisation of grid and other relevant energy infrastructure (depending on the sector the project relates to).

The context helps to situate the c-b RES project and allows to identify whether the subsequent objective and proposed project is suitable for this context.

2.3.3 Definition of objectives

The applicant must explain what the project seeks to contribute to the energy system of the host country (where the installation is located), the other participating Member States and the European energy system. These aspects are later reflected in the detailed economic analysis. The objectives shall refer to the objectives mentioned in the CEF regulation (Article 3 and ANNEX IV):

General objectives of the CEF programme that may be referred to by the project promoter:

- Build, develop, modernise and complete the trans-European networks in the fields of transport, energy and digital and to facilitate cross-border cooperation in the field of renewable energy, taking into account the long-term decarbonisation commitments, increasing European competitiveness, smart, sustainable and inclusive growth, territorial, social and economic cohesion, access to and integration of the internal market and with emphasis on synergies among transport, energy and digital sectors;

Energy-specific objectives that may be referred to by the project promoter:

- Contribute to the development of projects of common interest relating to further integration of an efficient and competitive internal energy market, interoperability of networks across borders and sectors, facilitating decarbonisation of the economy, promoting energy efficiency and ensuring security of supply, and to facilitate cross-border cooperation in the area of energy, including renewable energy;

Objectives specific to the c-b RES funding line that project promoters should always make reference to:

- Promote the cross-border cooperation between Member States in the field of planning, development and cost-effective exploitation of renewable energy sources as well as facilitate their integration through energy storage facilities and with the aim of contributing to the Union’s long term decarbonisation strategy

Objectives referred to in the recitals of the CEF regulation:

- enable cost-effective deployment for renewables in the Union, achievement of the Union's binding target of at least 32% renewable energy in 2030 as referred to in Article 3 of [recast of

Directive 2009/28/EC as proposed by COM(2016) 767] and contribute to the strategic uptake of innovative renewables technologies.

2.3.4 Project identification

The application needs to include a high-level description of the project. This should include

- Information and data about the project's
  - Technology
  - Size
  - Specific engineering features and / or technical characteristics
  - Type of output and services envisaged (electricity, heating, which markets will be served, etc.)

- Bodies responsible and/or necessary for the project implementation (e.g. the project developer, the Member State, TSO, DSO).

2.3.5 Technical feasibility & Environmental sustainability

This step includes a detailed description of the following elements:

- The technical design of the project

- An implementation schedule (providing a clear picture of where the project stands in its development and implementation).

- Demand analysis: how large is the demand for the project's output? This is especially important when the output of the project includes services beyond energy production (e.g. balancing products or contributions to ancillary services).

- High-level environmental considerations, including climate change considerations and environmental impact considerations in line with outcome of the Environmental Impact Assessment (if applicable)[6]

- Compliance with applicable Directives on Environmental Impact Assessment (EIA)/Strategic Environmental Assessment (SEA) and similar sector-specific legislation has to be demonstrated[7]

2.3.6 Cooperation mechanism involved

In this section the scope, legal embedding and maturity of Member State cooperation need to be described. In this context it is important to note that the projects receiving funding from CEF in this context need to be embedded into a cooperation agreement between Member States as defined in the RED II. These include:

- **Article 8 Statistical transfers between Member States:** Member States may agree on the statistical transfer of a specified amount of energy from renewable sources from one Member State to another Member State, based on an agreed transfer price. Such arrangements may have a duration of one or more calendar years and shall be notified to the Commission not later than 12 months after the end of each year in which they have effect. The information sent to the Commission shall include the quantity and price of the energy involved. Statistical

[6] EIA is a self-standing procedure needed only for a certain range of projects. However, results of an existing EIA need to be integrated into the CBA.

[7] See EIA Directive (85/337/EEC)/SEA Directive (Directive 2001/42/EC). In particular, wind power projects may require an EIA, as they are listed in Annex II of the directive, depending on the outcome of a screening procedure by national authorities taking into account project characteristics, location and potential impact.

transfer is likely not to be related to specific projects nor does it have to be related to new projects (can be existing ones), although the details of such an agreement can be fully defined by the involved Member States. This implies that the use of Statistical Transfer according to Article 8 will most likely not be used in the context of c-b RES projects, but rather Joint Projects and Joint Support Schemes as those focus on new projects and their resulting energy output.

- **Article 9 Joint projects between Member States:** Member States may implement joint projects, i.e. new projects, and subsequently share the costs and benefits of such a project. There might be multi-project arrangements and single-project arrangements. A likely case is to use this Cooperation Mechanism for single projects.

- **Article 11 Joint projects between Member States and third countries:** Member States may also implement projects (including the distribution of costs and benefits) with Third countries. However, such projects can only relate to the electricity sector, a physical link needs to be established with that third country and interconnector capacity needs to be actually booked to ensure an infeed of electricity into the EU electricity system.

- **Article 13 Joint support schemes:** Member States may also decide to join or partly coordinate their national support schemes and agree on the distribution of costs and benefits resulting from this cooperation. Typically, such an arrangement would include a multi-project approach, but it might also be used for a large single project. Ultimately, the distinction between joint projects and joint support schemes is not very clear cut.

The detailed approach to distribute costs and benefits between the Member States is not subject of this project, but the Cooperation Mechanisms are an important element to bear in mind when implementing RES projects eligible for CEF funding[8]. Ultimately, only cooperation projects with a net societal benefit will be eligible for funding in the first place. The funding shifts some of the support costs from Member States to the EU budget, thus incentivizing Member States to cooperate. In addition, the support will fill the funding gap, in the case of commercial non-viability of the project.

The project promoter needs to identify the **cooperation mechanism to be applied**. In addition, he/she needs to make high-level statements on the envisaged set up of the cooperation and may provide general thoughts on the distribution of costs and benefits between the involved Member States (according to their thinking at the time of submitting the proposal).

Moreover, the status of the cooperation agreement needs to be clearly described, including the following possible range:

- A short description is required at the stage of the preparatory studies, including the statement from the project promoter that the involved Member States are informed about the envisaged project. This does not yet entail any form of agreement or commitment by Member States, but only shows that the promoter has an idea of the envisaged format and relevant countries are aware of the planned project. Ideally already at this stage, the involved Member States have exchanged on the cooperation. Again, this does not entail a binding commitment yet (in particular in terms of a definite agreement on the project by any of the involved parties), but project promoters may report on the status of the exchange giving more details on the planned cooperation. Member States may be asked to sign a confirmation that an exchange has taken place.

- A Letter of intent (LoI) signed by one or more Member States is required for the application to be awarded the status of a c-b RES project. The format should be very flexible, but it should be signed by one (or ideally all) of the participating Member State(s) (and Third Countries, if applicable; however, a Third Country by itself would not be sufficient). The LoI should always be signed by an official from the Ministry mainly responsible for the implementation of a cooperation mechanism (i.e. usually the Ministry of Energy, of Environment, of the Economy,

[8] See on more details for instance, here: https://res-cooperation.eu/

or the like). The LoI should clearly state the general willingness to cooperate on a certain project or within a certain context (e.g. a certain technology) by the respective Member State(s). If applicable at this stage, the LoI may already include a more detailed description of the (common) understanding of the project concept (e.g. in terms of capacities and eligible technologies), the type of cooperation envisaged and the cross-border nature of the project.

- A Memorandum of Understanding (MoU) signed by the involved Member States (and Third Countries, if applicable) would be necessary for the application for grants for technical studies. Compared to a LoI, all involved parties need to have signed (i.e. agreed on) this document. The following general outline should be addressed in the MoU:

    - I. Objective of the cooperation
    - II. Specification of the cooperation (e.g. joint project or joint support scheme), e.g.
        - Capacity (amount of MW installed)
        - Eligible technologies
        - Selection procedure for cooperation project / specific project description in case project is already identified
    - III. High-level statement on renewable energy target accounting, including envisaged distribution of RES statistics for target contribution purposes (but distribution rule does not have to be agreed yet)
    - IV. High-level statement on envisaged sharing of costs and benefits
    - V. High-level statements on envisaged monitoring, proof and verification

- In case the MoU is seen to be too demanding at the stage of grants for technical studies, the European Commission may adapt the requirement in an updated work programme and only request the LoI mentioned above at this stage, however provided by all involved Member States.

- A fully fletched draft cooperation agreement is required at the stage of applying for grants for works. This draft agreement would be detailing the MoU and providing a draft contractual framework for the subsequently legally binding cooperation project for all involved parties. The following general structure should be included into the cooperation agreement:[9]

    - I. Objective and definitions of the agreement
    - II. Rights and obligations of the parties, including
        - for host and off-taking Member States,
        - in terms of the distribution and performance of necessary tasks
    - III. Specification of the cooperation (e.g. joint project or support scheme), e.g.
        - Maximum capacity/volume (amount of MW installed or MWh to be transferred)
        - Eligible technologies
        - Selection procedure for cooperation project / specific project description in case project is already identified
    - IV. Renewable energy target accounting, including
        - Distribution of RES statistics for target contribution purposes
        - Notification to the European Commission and minimum requirements in this context
    - V. Financing arrangements, including
        - Financial commitments (e.g. financial support)
        - Network integration (e.g. grid costs)
        - Payment procedure
    - VI. Responsibilities of the contractual parties (risk sharing), including
        - Compensation and sanctions in case of non-compliance with any obligation under the agreement
        - Responsibilities of host and off-taking Member State

[9] See also https://res-cooperation.eu/images/pdf-reports/2014_Cooperation_under_the_RES_Directive_Case_study_Joint_Projects_Netherlands_Portugal.pdf for a detailed template for an agreement for joint projects, which serves as a comprehensive starting point in this respect.

- VII. Monitoring, proof and verification
- VIII. General provisions

2.3.7 Added value of cooperation

The project promoter (a project developer or a Member State) needs to describe the added value of the envisaged cooperation project. The added value of a cooperation project will to extent possible be derived from the economic analysis (see section 2.4). The economic analysis will focus on elements that can be monetised and it will result in an economic net present value, at least for most indicators. However, the value of cooperation will in many cases go beyond those elements that can be monetised.

The CEF regulation mentions seven elements that need to be considered in the CBA of the cooperation project.

- (a) costs of energy generation
- (b) system integration costs
- (c) cost of support
- (d) greenhouse gas emissions
- (e) security of supply
- (f) air and other local pollution
- (g) innovation

As described in section 2.4.4, indicators a-f are quantifiable and can be monetised. However, in some instances the monetisation is related to significant effort which is not required for all application stages. Other elements, especially innovation, will hardly be monetised without creating excessive transaction costs or basing it on questionable assumptions. In addition, there are other benefits of cooperation that are very relevant for c-b RES projects but cannot be monetised in practical terms, such as policy coordination, policy convergence, regulatory innovation and local job creation.

Thus, in this part of the application the project promoter should elaborate on the more qualitative benefits of cooperation that cannot be captured in the monetisation of the economic analysis. This includes high-level statements on indicators a-f (which will be further detailed in the economic analysis) but also a discussion of the elements innovation, policy coordination/convergence, policy innovation and local job creation. These qualitative elements will reappear in the final project assessment and may even outweigh disadvantages of a project in the economic analysis.

Here we discuss three indicators which are likely to be addressed in a qualitative manner by the applicants: innovation, policy coordination and local job creation. All other indicators are described in more detail below in section 2.4.

Innovation: This indicator aims at assessing the degree to which the project contributes to the strategic uptake of an innovative renewable energy technologies. The scope of this indicator is not limited to innovation in the RE technology directly applied by the project. Rather, the indicator should employ a broad perspective on innovation throughout the whole value chain fostered by the c-b RES project, incorporating e.g. process innovation in the manufacturing of the respective RE technology. However, only advanced technologies will be considered, reaching the demonstration and deployment stage.

A qualitative assessment of the indicator is performed by describing the project's innovative elements and their alignment with research roadmaps on national and EU level. For example, the Integrated Strategic Energy Technology (SET) Plan[10] could be considered as an EU-wide strategic roadmap covering research and innovation to accelerate the energy transition. In particular, a project's contribution towards the SET key actions 1 & 2 on renewables could be outlined, thus technological leadership through highly performant RE technologies and their system integration, as well as a

[10] EC – Integrated SET Plan Progress in 2016

reduction of the cost of key technologies. In addition, a project's contribution to achieving the technology-specific strategic targets of the SET should be emphasised, e.g. cost-competitive substructures for offshore wind power used in deeper waters. National research targets that should be taken into consideration are outlined in each country's NECP within the dimension research, innovation and competitiveness.

Furthermore, the assessment is accompanied by a semi-quantitative assessment of the project's contribution to advancing the current technology readiness level (TRL)[11] of the employed technologies. Only projects that reach a TRL of 7 to 9 will be considered:

- TRL 7: system prototype demonstration in operational environment
- TRL 8: system complete and qualified
- TRL 9: actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies)

Policy coordination, policy convergence & regulatory innovation: Next to support cost savings, policy coordination is among the main motivations for supporting cross-border RES cooperation. A fragmented policy and regulatory landscape in Europe are currently barriers for the further deepening of the internal energy market. In many areas, a top-down harmonisation of policies and regulations is not feasible and thus regional cooperation may enable a gradual shift towards more coordinated and aligned policies. If a project manages to trigger policy alignment towards good practices or innovative policy approaches, it clearly provides added value. This value is difficult to monetise, thus, a project promoter providing specific value in this regard should describe in detail how the project results in

- A change of regulation towards best practice due to the project implementation
- Extent of alignment between support schemes or other regulatory conditions and reduction of cross-border distortions.

In addition, the description of this element should include a range of indications on the intensity of cooperation (i.e. the cross-border dimension). These can include:

- Number of Member States involved
- Likelihood and magnitude of cross-border payments
- Coordination requirement between government entities throughout the project

Local job creation: Although the labour market impact of a project is readily monetised by labour cost included in the CAPEX and OPEX of a project, project promoters in addition may want to qualitatively substantiate a project's impact on local job creation.[12] It should be noted though that shifting jobs from one member state to another does not constitute an added value of cooperation. Rather, project promoters may want to highlight the longer-term impact of project implementation on a countries industry structure, e.g. through support to the building up of a renewables sector or shifting jobs from carbon intensive sectors to low-carbon industries. In addition, a potential benefit could be realised by project implementation in a region with high structural unemployment.

The qualitative summary of the added value as later assessed in the economic analysis and the detailed description of additional benefits should provide a characterisation of the overall added value of the project and support the case of projects that specifically have benefits in areas which are harder to monetise.

[11] EC – Horizon 2020 - Technology Readiness Levels

[12] Economic analysis of investment projects commonly concentrates on the primary market impact of projects, thus in case of c-b RES projects the energy market. Reasoning is that under a general equilibrium setting and efficient secondary markets, indirect impacts onto secondary markets are already captured by a project's direct inputs and. E.g. in case of the labour market, the impact is captured through employment cost in CAPEX and OPEX. Thereby, double counting is avoided. If secondary markets are distorted, shadow prices may be applied instead of market prices, e.g. in case of structural unemployment. In addition, in case of inefficient secondary markets additional welfare effects, e.g. through economies of scale, can be attributed to the project. However, indirect impacts are usually in the range of sensitivity of the standard model capturing direct impacts only. See also DG Regio – CBA Guideline; EIB – CBA Guideline

2.4 Economic analysis (overall social welfare)

2.4.1 Introduction

The purpose of the economic analysis is to assess whether projects applying for CEF funding create value from a wholistic, societal perspective, thus whether the socioeconomic benefits generated by the project outweigh its costs. Finding an answer to this question requires exploring various types of impacts of a project. Therefore, this chapter presents the outline of a methodology that is as rigorous as needed to yield robust results but is at the same time as simple as possible to avoid overly complex application procedures. As presented in section 2.3.1, we will apply a staged approach:

- No quantitative analysis is required for the application for pre-feasibility studies (stage I) and the application for c-b RES status (stage II). Rather a high-level statement is required for each of the CBA elements, i.e. a rough characterisation of what each element is expected to look like when assessed in detail. However, if applicants want to strengthen their argumentation already at this stage, they are free to substantiate their reasoning by means of quantification. This may increase the likeliness to score better on certain elements.
- A simple quantification is required for the application for grants for studies (stage III).
- A detailed quantification is required for the application for grants for works (stage IV), at least for applications beyond the thresholds of certain investment or grant sizes.[13]

Nevertheless, the basic structure of the economic analysis will remain the same for all stages. Reasoning is, that project developers will be familiarised with the methodology of the CBA right from the start of the application process – beginning with qualitative descriptions in the first stages, refining their line of argumentation in the following stages and eventually ending up with a full-fledged, monetised economic assessment of the project. In the following sections, we will only discuss the methodology for quantification, not the qualitative part of the application (this has already been discussed in section 2.3.6).

The focus is on individual projects, not joint support schemes, even though the latter are briefly discussed as part of the methodology. In practice, the approach for joint support schemes may need to be further adapted. Some specificities are discussed in in section 2.5.3.2.

2.4.2 Overall Methodology

The quantification and monetisation of various socioeconomic impacts of RES projects is not trivial, especially if diverse technologies, scales, geographies, etc. need to be assessed. Whilst comparability is necessary for a ranking amongst applicants, the methodology has to account for a diverse set of applicants in need of an economic analysis approach suitable to their specific project. Consequently, common principles and procedures for an economic analysis are outlined as the base for different approaches with an increasing level of complexity fitting to different types of projects and application stages.

The proposed methodology for the economic analysis will broadly follow the principles anchored in the Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014 issued by DG REGIO and the 2nd ENTSO-E Guideline for Cost Benefit Analysis of Grid Development Projects used for the evaluation of TEN-E projects. It is adapted to the specific context and requirements of the c-b RES projects, e.g. in terms of providing sufficient level of detail while limiting transaction costs for project promoters.

[13] For grants for works, we suggest a large-scale RES project with investment costs of above 50 mio. EUR, as a threshold for the applicability of detailed quantification approaches. Instead of specific investment size, also a grant size could be chosen as a threshold for the applicability of a simplified economic analysis procedure for grants for works. Grant size as a threshold has the advantage that application efforts are matched with the expected outcome for the project promoters, however, grant size is only estimated at the end of the process.

The quantitative economic analysis is structured along **four layers**:

- **Indicators** which present the economic, social and environmental viability of a project. Seven indicators such as cost of energy, security of supply or air and other local pollution are included, in line with the requirements of the CEF-regulation (see chapter 2.4.4). For each indicator, the cost or benefit of the project under consideration should be quantified and if possible monetised.

- **Approaches** to quantify and monetise each indicator. Different approaches with an increasing complexity of analysis for each indicator create a balance between required rigor and reduction of transaction costs. If a project is small and/or in early application stages, a simple approach may be used (see chapter 2.4.7).

- **Scenarios** describing future developments in the energy sector and the economy as a whole. The scenarios provide a coherent framework for the analysis of the indicators throughout the lifetime of the project (see chapter 2.4.5);

- **Counterfactuals** represent a state of the system in which the project under consideration is not implemented (see chapter 2.4.6). Instead, according to the CEF regulation, a similar project would be implemented by only one Member State. The net value of the project is then the difference between the socioeconomic welfare of the system with the c-b RES project and the welfare of the counterfactual without cooperation.

2.4.3 Monetisation and quantification

The socioeconomic impact of a project is assessed through quantification, where possible. Moreover, the monetisation of these impacts does not only allow for comparability of the individual indicators of the economic analysis against each other but also for comparability throughout a set of diverse projects. Therefore, in 2.4.7 approaches to quantify and monetise these indicators are outlined. Quantification often relies on a set of assumptions, which should be clearly stated, and uncertainties addressed by providing ranges instead of spurious precise figures.

However, quantifying and monetizing the impact of a project is not an easy task. Rather, it requires comprehensive, state-of-the-art modelling of energy and power markets and connected infrastructure such as power networks, at least for larger projects and their system impacts. The complexity of this task becomes obvious with a view onto the selection process of TEN-E projects. Here, modelling tasks are performed centrally by ENTSO-E, utilizing their system model, adapted to the input by each individual project promoter. Thereby, a common simulation methodology is applied, and consistent and comprehensive results for the assessment of TEN-E projects are obtained. This illustrates the significant transaction cost with which each individual c-b RES project promoter is confronted in taking on the modelling tasks himself. However, market and network simulations are necessary to give a robust assessment of the projects' impacts. The transaction cost could be reduced if promoters would be provided with access to a suitable modelling tool and scenario data that could be tweaked to their respective project.[14] This would not only substantially lower the efforts needed, but also ensure the application of a coherent modelling methodology.

Monetisation of benefits is usually based on market prices, however, if no market for these benefits are available or market results are distorted, shadow prices may be used. These shadow prices reflect the willingness to pay or the willingness to accept a certain benefit or cost, as further explained in the DG-REGIO CBA Guideline.

The aggregation of individual indicators of the economic analysis can be summarised as follows. Using the outlined approaches, the indicators are forecasted and monetised based on the underlying scenario for certain base years, reflecting the short, medium, and long-term impact of the project. The annual benefit or cost cash flows throughout the entire life cycle of the project can be interpolated

[14] A suitable modelling tool should provide similar capabilities as the METIS model used by the European Commission for evidenced-based policy making for the electricity and gas sector.

between these base years and aggregated to the net present value using the discounted cash flow method. By comparison of the system including the project and the system including only its counterfactual, a single value is obtained – the socioeconomic benefit of realizing the c-b RES project.

Important parameters to consider for the monetisation of benefits are the assessment period, the discount rate and a potential residual value of the project at the end of the lifetime. The assessment period needs to be aligned with the financial analysis and should reflect the technology-specific project lifetime. The residual value of the project at the end of the assessment period is treated as being zero. Although the social discount rate may differ between countries, a unique discount rate of 4% is used in compliance with the recommendation of the European Commission to ensure a fair assessment across projects.

2.4.4 Overview of indicators for economic analysis

The purpose of this economic analysis is the quantification and preferably monetisation of the socioeconomic effects, thus costs and benefits from a system perspective, of the c-b RES projects compared to their respective counterfactuals. The indicators adopted for this purpose reflect each project's added value for society – in terms of economic, social and environmental viability**.** Furthermore, the proposed new CEF regulation explicitly states seven indicators, to be taken into account in the cost-benefit analysis. These indicators, incorporated in our economic analysis, are briefly explained in Table 1.

Table 1: Indicator explanations – Note that in the actual assessment always a 'delta' evaluation is made against a counterfactual case.

Indicators of the Economic Analysis	Description
(a) costs of energy generation	Full-life cycle cost from promoter perspective. Expressed as NPV (LCOE in simplified version) to allow for first comparability between projects of various sizes.
(b) system integration costs	Cost to the energy system, including grid development, operations, market efficiency and market-based socio-economic welfare.
(c) cost of support	Economic incentives to project developer beyond normal market revenues, including direct subsidies, specific exemptions and others.
(d) greenhouse gas emissions	Systemwide GHG emissions are assessed and their monetised impact is evaluated. Accounts for GHGs according to IPCC definition.
(e) security of supply	Contribution to limiting the quantity of Energy Not Supplied (ENS), as well as increasing resilience/margin in the energy system.
(f) air and other local pollution	Systemwide emissions of air pollutants, other than GHGs, are assessed and their monetised impact on land, soil, water, air is estimated.
(g) innovation	Enhancing European technical leadership, in either public domain or patented and marketed.

These indicators try to capture all impacts, positive and negative, of the project on the socioeconomic welfare. Whilst indicator (a) – "costs of energy generation" reflects the direct costs of project implementation, in terms of CAPEX and OPEX, all other indicators capture the wider societal impact of the project. That is, the project's impact on the energy system (market and grid), as well as the environment or society, e.g. through pollution or innovation. In particular, indicator (b) – "system integration costs" represents the benefit and costs of integrating additional renewables capacity into the energy system. The scope of this indicator reflects broader system operational cost in terms of e.g. welfare benefits on the energy market due to the RES market value or possible grid integration cost due to the increased share of renewables. Therefore, the employed definition of system integration costs is in contrast to the more specific, commonly applied understanding of RES system integration costs, focusing only on grid development and redispatch costs. In addition, indicator (c) –

"cost of support" covers additional costs to society through support mechanisms, disregarding the source of support, may it be national or European funding. The projects impact on supply security is captured by (e), thus the impact on societal cost of energy supply distortions. Indicators (d) and (f) represent the projects impact on negative externalities, global and local environmental pollution. Lastly, indicator (g) represents the societal of innovation generated by the project.

The economic analysis builds upon **general principles which are applicable for all of the indicators:**

- The suggested reference scenarios are used consistently throughout the quantification of all different indicators.
- The economic analysis employs a system perspective. Thus, the systemwide costs and benefits are assessed, e.g. consumer and producer surplus, or system operation cost. In contrast, a project-specific perspective only considers revenues and cost that can be directly attributed to the project itself.
- Indicators should be monetised if possible. Only monetised indicators are assessed on a comparable base and can be subsumed into a single socioeconomic welfare figure. Non-monetised indicators can still be used in the evaluation based on weights and thresholds but have a higher degree of subjectivity. Most indicators mentioned in the CEF regulation for c-b RES CBA can be monetised. For some of the indicators, promoters have the option to assess the project's impact qualitatively/quantitatively without monetisation or to monetise the benefit (indicators with optional monetisation are innovation and security of supply; reasoning is given below). Therefore, project promoters have the option to include these additional, monetised benefits into the economic analysis, if they deem those two indicators crucial for their respective project (however, they can also present non-monetizable indicators, as explained in section o and below). Furthermore, there are other indicators that may be relevant for the CBA but difficult to monetise, such as the benefit of policy convergence (see section o). We suggest including such non-monetised indicators in the CBA as part of a multi-criteria assessment and keep them clearly separated from the calculation of the socioeconomic welfare. This approach has the disadvantage that the net benefit (the economic net present value) calculated in the economic analysis does not reflect all costs and benefits and that it reduces the comparability of projects. However, the advantage is that a multi-criteria assessment allows the reflection of costs and benefits that cannot be monetised in practical terms.
- The economic analysis as outlined in the following is based on assessing the difference between the reference case with the c-b RES project and a counterfactual case (a similar project implemented by only one Member State). As such all indicators represent 'delta' assessments. Also, all indicators can in principle be either positive or negative, or respectively a benefit or a cost.
- As described in section 2.3.1, the level of detail required in the economic analysis increases with the application stages, reflecting that project promoters apply for increasing amounts of grants. For the application for prefeasibility studies (stage I) and the c-b RES status (stage II), no quantification is required.[15] For the application for grants for studies (stage III) a simple quantification approach is sufficient. For the application for grants for works (stage IV), a detailed approach is required, at least if the investment size surpasses certain thresholds. Moreover, some detailed quantification approaches are optional, even for projects above the investment size threshold. Thereby, comprehensive modelling tasks are only required if the project promoter wants to duly justify a significant benefit in the respective benefit indicator. The mapping of the different approaches to the four application stages is depicted in Figure 5. Details on the simple versus detailed approach are provided in section 2.4.7.

[15] As stated above, quantification may be applied at this stage in case it helps to strengthen the argument in favour of the project.

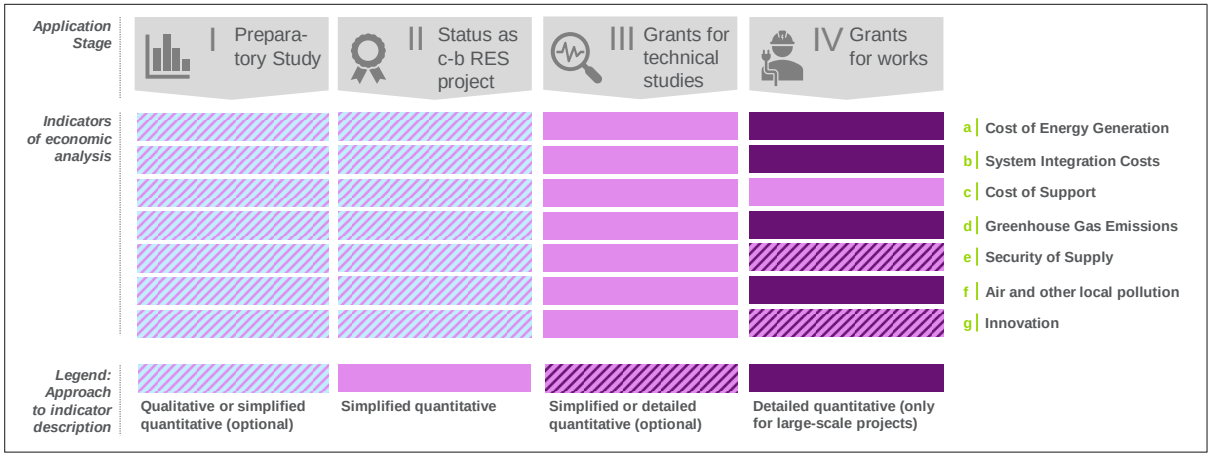

Figure 5: Overview of the indicators of the economic analysis and the applicability of different approaches to describe these indicators throughout the four application stages

2.4.5 Scenario definition, input data and boundary conditions

For the socio-economic assessment, a set of clear scenarios is needed. Scenarios provide a vision of the future development of the energy sector and the overall economy. Each individual scenario describes a self-contained, consistent picture of the future development up to a mid-/long-/very long-term time horizon, where no certain predications are possible. Overall, the set of scenarios describes the framework within which the future is likely to occur. Consequently, scenarios cannot be categorised as likely or unlikely, rather all scenarios need to be treated equally. With a view onto the economic analysis, scenarios ensure that uncertainties in future developments are properly addressed and projects are not evaluated against overly optimistic or pessimistic assumptions. Therefore, it is recommended that projects are assessed against multiple scenarios. However, an increased robustness of the assessment has to be balanced against an increased burden for the project promoters that comes with a higher number of scenarios. Moreover, the application of a common scenario set ensures that the projects are assessed against a common baseline and in a consistent manner. In contrast, counterfactuals which are thoroughly explained in the next section, are used within the framework of a single scenario to assess the impact of a certain policy tool – such as c-b cooperation on RES development.

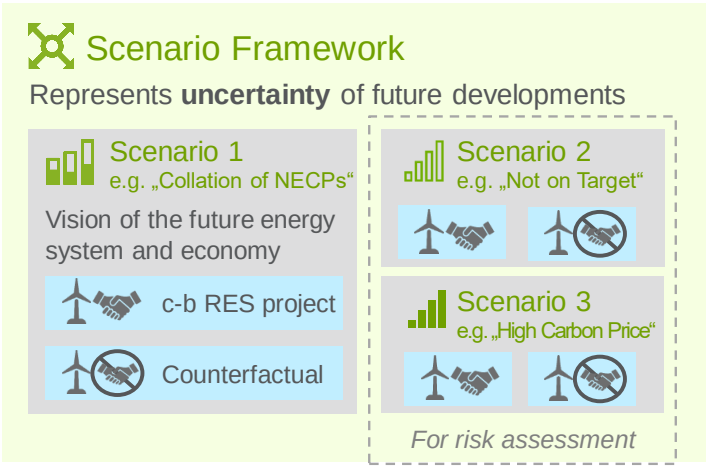

Figure 6: A scenario framework is used to describe the uncertainty of future developments (source: Navigant)

A complete framework of scenarios could be proposed by the European Commission in context of the c-b RES process. These should include the following:

- Key reference for the medium-term time horizon (2030) is the collation of the final NECPs, which will be quantified jointly in PRIMES.[16]
- Moreover, for a long-term time horizon (2050) scenarios should be in line with the long-term strategy for a climate-neutral Europe presented in the "A Clean Planet for All" vision.[17]

Important considerations when developing a scenario framework for this process are the following:

- Time horizon: The minimum time horizon to be considered by the project promoters is 15 years, starting with the first year of operation of the project. Beyond that, the time horizon of the analysis should be aligned with the technology-specific economic lifetime of the asset. The scenario framework should provide quantification of the scenarios for certain base years (e.g. 2025, 2030, 2040, 2050) to which project developers can then refer to in their modelling tasks.

- Regional scope: The scenarios cover the entire EU28. Guidance is needed in case a more regional model is used by the promoter. This would make the assessment simpler but should not distort the accuracy.

- Integrated energy view: It is advised that the scenarios are based on insights across electricity, gas, mobility, heating, residential use and industry. The three options listed above can be said to be integrated scenarios. An alternative is to take scenarios from the TEN-E process developed by the ENTSOs, though it can be argued that while these are detailed for the power and gas sector, still miss relevant sector coupling aspects.

- Level of detail – time: It is common to develop scenario data sets with hourly time steps (cfr. TYNDP processes). This may not allow to capture benefits in e.g. ancillary service delivery.

- Level of detail – regional: Scenario quantifications can be at country level but could also have deeper granularity (cfr. EUROSTAT NUTS regions)

- Level of detail – probabilistic: Especially for future energy scenarios with high levels of variable infeed, uncertain demand projections and potentially with a focus on security of supply benefits, it may be appropriate to perform probabilistic assessments. The scenario descriptions and data sets need to provide appropriate guidance for this. See below the benefit description on Security of Supply. Also, other indicators such as system integration or emissions could be done in a more probabilistic manner with various yearly time series to provide min-average-max indicator values (cfr. ENTSO-E TYNDP)

- Adequacy level: Long-term energy projections are often inherently adequate. This means the system (grid and supply) is developed sufficiently to ensure reliability, and assumes markets and policies are efficiently organised to deliver on this. This optimistic viewpoint often leads to an evident outcome that new project proposals (such as that of a c-b RES project) can hardly prove any security of supply contribution.

Scenarios also define technological boundary conditions, such as future cost reductions. Common reference for the scenario framework should be the input data used for PRIMES.[18] Deviations from these technology assumptions need to be clearly stated by project promoters and justified. Likewise, a working principle is that promoters can use more detailed scenarios in their assessment but need to be in line still with the overall scenario boundaries of the common framework.

[16] See EC – Energy modelling. The most recent PRIMES modelling results need to be taken into account by the project promoter. If a Member State foreseeable deviates drastically from the NECP, this could be reflected through an additional scenario, see sensitivity analysis, ch.0.

[17] See EC – 2050 long-term strategy

[18] See E3Modelling, Ecofys, Tractebel – Technology Pathways in Decarbonisation scenarios

2.4.6 Counterfactuals

The final agreement of the CEF regulation defines as one core eligibility criterion that any project qualifying as c-b RES project shall "provide cost savings in the deployment of renewables and/or benefits for system integration, security of supply or innovation **in comparison to a similar project or renewable energy project implemented by one of the participating Member States alone**".

This counterfactual leaves room for interpretation. A similar project could e.g. mean a similar RES project or a similar energy project. Project size and technology could be different or equal. A project implemented by one Member State alone could be a project in the contributing or in the host Member State.

The actual counterfactual (what would the involved Member States do without the cooperation project?) will differ from case to case. To give an example: Without the cooperation, contributing Member States might apply the same RES technology in their country (e.g. use PV in Germany instead of Spain, coping with lower irradiation). In other cases, the contributing Member State would use a different technology in the non-cooperation case (e.g. wind energy instead of CSP). Therefore, it is important to allow for different types of counterfactuals. This approach also has drawbacks, however: if each applicant uses a different counterfactual, project applications become less comparable. Furthermore, it is impossible to determine whether the described counterfactual is "real" or whether the applicant just chose a counterfactual that maximises the net benefit of the project.

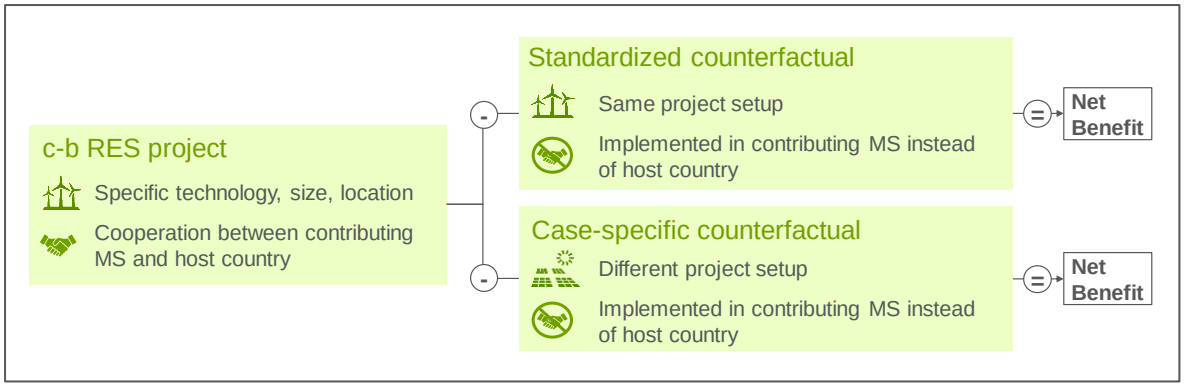

Figure 7: Two types of counterfactuals (standardised, case-specific) can be used to assess the c-b RES project (source: Navigant)

Against this background, we suggest an approach that uses two types of counterfactuals, as illustrated in Figure 7:

1. **Standardised counterfactual that aims for comparability of c-b RES projects**

To increase comparability of applications, we provide guidance how the CEF standard counterfactual of a "similar project or RES project implemented by one Member State alone" should be defined for the economic analysis. Project promoters may deviate from this definition, but they need to explain why. We suggest the following default definition:

- The standard counterfactual is a project (or support scheme) of the same technology scope and size implemented in the contributing Member State (instead of the host country). Using this narrow definition allows to determine the costs and benefits of relocating the project through cross-border cooperation.

- If the c-b RES project expands over several host countries (e.g. in case of a cross-border auction), this counterfactual shall be determined for each of the contributing Member States.

In some cases, this standard counterfactual cannot be applied, e.g. if the same technology is not applicable in the contributing Member State (for example offshore wind or CSP). Also, this

counterfactual may not always fit the concept of a specific cooperation case. In these cases, the applicant is free to come up with a case-specific counterfactual.

2. Case-specific counterfactual defined by applicant

Project promoters need to explain what would happen in each of the involved Member States without the c-b RES cooperation project:

- Would they apply the same or a different technology for RES target achievement if implemented nationally?

- Would they use a different project set-up, e.g. would they use less innovative features?

Possibly, applicants can also apply both counterfactuals.

No matter which counterfactual is chosen, all indicators of the economic analysis need to be analysed, in line with the CEF regulation:

- (a) costs of energy generation
- (b) system integration costs
- (c) cost of support
- (d) greenhouse gas emissions
- (e) security of supply
- (f) air and other local pollution
- (g) innovation

The innovation effect of the standard counterfactual is by definition the same as for the c-b RES project, since the standard counterfactual assumes the same technology and project set-up as the c-b RES project. If the project promoter claims innovation benefits, a case-specific counterfactual needs to be chosen.

The standard counterfactual is less subjective than the case-specific counterfactual, but it still leaves room for interpretation. This is particularly true for system integration costs and security of supply, which depend on where the counterfactual projects would be located, which is not known. Therefore, the applicant needs to make some assumptions or use average values.

As explained earlier, the c-b RES project can be an (individual) joint project or a joint support scheme, referring to the types of cooperation mechanisms introduced in the Renewable Energy Directive. In case of a joint project, the c-b RES project and the counterfactual can be described more specifically. In case of a joint support scheme, estimates based on average values need to be used.

2.4.7 Detailed description of the indicators (simple approach vs. detailed approach)

As illustrated before, an approach to quantify the indicators of the economic analysis has to assure a robust and thorough assessment whilst it may not overburden the project promoters with respect to the scale of the project and application stage. Consequently, two approaches are described for each indicator, a detailed approach assuring a comprehensive assessment of costs and benefits, and a simplified one, to provide an initial assessment of the costs and benefits without performing any exhaustive modelling tasks. For small- and medium-scale projects, the simplified approach can be applied throughout the application for indicators that would otherwise require more extensive modelling. Table 3 provides a summary of the approaches.

Comparison of benefit/cost indicators addressed in CEF regulation, DG Regio guideline, and EIB guideline

There are different guidelines available and this guideline draws on them. We suggest a very detailed and comparably technical guideline in order to ensure it can be applied in a comparable way across project applicants. For instance, DG REGIO's CBA guideline provides a high-level overview on the applicable benefits for energy sector projects. The EIB guideline to economic analysis is more detailed than its DG REGIO equivalent, but the quantification methodologies outlined for energy sector projects are in some respects not yet sufficiently detailed for many RES projects. In particular, the quantification of the security of supply benefit described by EIB focuses on the gas sector. In the following, we provide an extensive description of the assessment approaches of the individual benefits. Therein, we aim at providing a suitable tool for the project developer on how to operationalise the economic analysis. **Error! Reference source not found.** compares the indicators required by the CEF regulation with the indicators described by the DG REGIO and EIB guidelines to highlight differences and show commonalities.

Table 2: Comparison of benefit/cost indicators addressed in CEF regulation, DG Regio guideline, and EIB guideline

Indicators required by CEF regulation	DG Regio CBA guideline	EIB CBA guideline
(a) costs of energy generation	Capital cost, O&M cost	Capital and other expenditures
(b) system integration costs	Market integration Reduction of energy costs for substitution of the energy source Improved energy efficiency	Economic value of electricity
(c) cost of support	Not addressed	Not addressed
(d) greenhouse gas emissions	Variation of GHG emissions	Greenhouse gas emission costs
(e) security of supply	Increase of security and reliability of energy supply Increase and diversification energy supply to meet increasing demand	Security of supply costs
(f) air and other local pollution	Variation of air pollutant emissions	Residual airborne pollution costs
(g) innovation	Not addressed	Not addressed

The comparison shown in **Error! Reference source not found.** highlights that all the potential energy project benefits and costs which are addressed in the DG REGIO and the EIB guideline are reflected in the methodology developed here. Beyond those indicators we also address the indicators innovation and cost of support which are rather specific to the goals of the CEF regulation.

It is important to have in mind that the CEF regulation does not specify any criteria for a CBA of transport (TEN-T) projects. However, common practice is the application of the DG REGIO CBA guideline, which provides sector-specific guidance for energy, transport and other sectors.[19] The overall methodology (the CBA elements) is the same for all project types. Differences are found in the sector-specific costs and benefits (indicators) associated with a project and considered in the analysis. Main benefits of a transport project are for example travel time savings and vehicle operation cost savings as well as environmental benefits similar to the ones considered for energy projects, thus a reduction of GHG emissions and air pollution.

[19] See e.g. EC - 2017 CEF Transport SESAR call

Table 3 Overview of indicators for the economic analysis: simple vs. detailed quantification approaches (Application stages: I – preparatory studies, II – c-b RES status, III – grants for technical studies, IV – grants for works; Threshold for large-scale projects: 50 mio. EUR CAPEX)

Indicator		Simple quantification approach	Detailed quantification approach
(a) costs of energy generation	Description	High-level LCOE approach, i.e. discounted cash flow analysis (incl. investment cost, O&M, cost of capital).	Detailed calculation of the NPV of the plant's lifetime cost: higher level of granularity of input data (technology-specific, site-specific)
	Applicability for application stages	I (preparatory studies) – optional for all projects II (c-b RES Status) – optional for all projects III (grants for tech. studies) – mandatory for all projects IV (grants for works) – mandatory for small-/medium-scale projects (<50 mio. EUR CAPEX)	I (preparatory studies) – not applicable II (c-b RES Status) – not applicable III (grants for tech. studies) – not applicable IV (grants for works) – mandatory for large-scale projects (>50 mio. EUR CAPEX)
(b) system integration costs	Description	The project's impact on the energy market is roughly estimated, grid integration costs are neglected (no market or grid modelling)	Systemwide benefits/cost of integrating the RES project into the system are estimated through detailed market and grid modelling. Effects on operational cost of the regional system, including balancing, grid, adequacy are captured. Assessment aligned with project-specific TEN-E CBA.
	Applicability for application stages	I (preparatory studies) – optional for all projects II (c-b RES Status) – optional for all projects III (grants for tech. studies) – mandatory for all projects IV (grants for works) – mandatory for small-/medium-scale projects (<50 mio. EUR CAPEX)	I (preparatory studies) – not applicable II (c-b RES Status) – not applicable III (grants for tech. studies) – not applicable IV (grants for works) – mandatory for large-scale projects (>50 mio. EUR CAPEX)
(c) cost of support	Description	Total support cost estimated through expected energy output and benchmarks of applicable, national support measures (e.g. tax exemptions, average auction results) in hosting country and cooperating member state. Also, other non-repayable support measures are considered.	
	Applicability for application stages	I (preparatory studies) – optional for all projects II (c-b RES Status) – optional for all projects III (grants for tech. studies) – mandatory for all projects IV (grants for works) – mandatory for all projects	

Indicator		Simple quantification approach	Detailed quantification approach
(d) greenhouse gas emissions	Description	Based on assumed annual full-load hours and system emission equivalents. Monetisation is done in line with scenario-specific carbon prices.	Based on market and grid modelling (b) the change in generation mix and respective GHG emissions. Considered emissions are CO2, N2O, CH4, F-gases which can all be translated to CO2 equivalent emissions. Monetisation is done in line with scenario-specific carbon prices.
	Applicability for application stages	I (preparatory studies) – optional for all projects II (c-b RES Status) – optional for all projects III (grants for tech. studies) – mandatory for all projects IV (grants for works) – mandatory for small-/medium-scale projects (<50 mio. EUR CAPEX)	I (preparatory studies) – not applicable II (c-b RES Status) – not applicable III (grants for tech. studies) – not applicable IV (grants for works) – mandatory for large-scale projects (>50 mio. EUR CAPEX)
(e) security of supply	Description	Simple capacity contribution estimate of the project and estimate of the contribution to lower import dependency, assessment of the status quo of supply security via SAIDI	Additionally, to simplified approach: similar to market and grid modelling (b) but with probabilistic approach to account for uncertainties such as generation unit outages. Expectancy of energy not served (EENS) is monetised. Assessments in line with ENTSO-E's state-of-the-art pan-European mid-term adequacy forecast methodology and in line with TEN-E CBA.
	Applicability for application stages	I (preparatory studies) – optional for all projects II (c-b RES Status) – optional for all projects III (grants for tech. studies) – mandatory for all projects IV (grants for works) – mandatory for small-/medium-scale projects (<50 mio. EUR CAPEX)	I (preparatory studies) – not applicable II (c-b RES Status) – not applicable III (grants for tech. studies) – not applicable IV (grants for works) – optional for large-scale projects (>50 mio. EUR CAPEX; only if security of supply is deemed to be a significant project benefit)
(f) air and other local pollution	Description	Similar to (d), based on assumed annual full-load hours and system emission equivalents. Monetisation via unit economic costs of respective pollutant.	Similar to (d), based on market and grid modelling (b) the change in generation mix and respective pollutant emissions is assessed. Considered pollutants are NOX, SO2, non-methane volatile organic compounds (NMVOC), CO, precursors of ozone, heavy metals, etc. Monetisation is achieved via unit economic cost of pollutants.
	Applicability for application stages	I (preparatory studies) – optional for all projects II (c-b RES Status) – optional for all projects III (grants for tech. studies) – mandatory for all projects IV (grants for works) – mandatory for small-/medium-scale projects (<50 mio. EUR CAPEX)	I (preparatory studies) – not applicable II (c-b RES Status) – not applicable III (grants for tech. studies) – not applicable IV (grants for works) – mandatory for large-scale projects (>50 mio. EUR CAPEX)

Indicator		Simple quantification approach	Detailed quantification approach
(g) innovation	Description	Qualitative assessment (no quantification/monetisation) by mapping of innovation to European and national research roadmaps and statement on how it may advance TRL of applied technology.	Additionally to simplified approach (optional): monetisation of the effects of innovation on various target groups is possible based on estimation of the size of the benefit group and the marginal social value of the innovation to the benefit group, e.g. the shadow profits obtained by businesses through the innovation.
	Applicability for application stages	I (preparatory studies) – optional for all projects II (c-b RES Status) – optional for all projects III (grants for tech. studies) – mandatory for all projects IV (grants for works) – mandatory for all projects	I (preparatory studies) – not applicable II (c-b RES Status) – not applicable III (grants for tech. studies) – not applicable IV (grants for works) – optional for large-scale projects (>50 mio. EUR CAPEX, only if innovation is deemed to be a significant project benefit)

The assessment approaches are, in general, independent of the employed technology type but may differ between sectors[20]. Whilst described approaches focus on projects in the electricity sector, short comments on the approaches for c-b RES projects in other sectors will be given as well. Likewise, the description of the approaches concentrates on single projects as c-b RES projects. A short comment on the applicability of these approaches for Joint Support Schemes and projects with a multitude of projects is given at the end of each indicator description.

It should be noted that for some of the indicators additional monetisation approaches are outlined, as an option to amend the analysis. However, project promoters do not necessarily have to adhere to these detailed approaches since they may be overly complex with respect to a specific project. However, they give the project promoter the possibility to enhance the analysis, capture a broader spectrum of socioeconomic benefits that feeds into the (monetary) net present value of a project.

(a.1) Cost of energy generation – simplified approach

Applicability: **Stage I (preparatory studies) – optional for all projects**
Stage II (c-b RES Status) – optional for all projects
Stage III (grants for technical studies) – mandatory for all projects
Stages IV (grants for works) – mandatory for small-/medium-scale projects

The cost of energy generation indicator represents the project's inputs, thus the lifecycle cost of the project. A simplified approach to assess the cost of energy generation is based on the LCOE. LCOEs are typically seen as a simple means to compare costs of energy production, since all types of costs over the plant lifetime are covered. This is especially useful for comparing variable RES infeed to make plants with different annual full-load hours comparable (e.g. PV vs wind, or wind at two different sites). Moreover, this measure is commonly used by project developers, and can be provided throughout different stages of project development in different levels of detail.

To calculate the LCOE, the total present cost is compared to energy production of the plant throughout its lifetime. Simple assumptions can be taken for the total energy yield in case of variable renewable infeed based on known resource measurements and an assumption of no curtailment. For dispatchable sources this assumption of full-loud-hours needs to be verified in the detailed assessment based on proper market modelling.

However, there are also several risks for misinterpretation:

- The number of full-load hours may not be simple to estimate upfront. E.g. for dispatchable RE sources such as bio-mass or bio-gas.
- The number of full-load hours may have substantial variation across years. E.g. hydro power
- The LCOE is often interpreted as the average market break-even price.
- The LCOE is dependent on financing costs – variations in the LCOE can therefore not directly be attributed to either cost or revenue side.

Caution is needed when interpreting various LCOE figures. One cannot always conclude that a lower LCOE is necessarily better, neither for the promoter perspective nor from societal perspective. The LCOE captures no information on the point in time the energy is provided, the location or the flexibility to adapt. To give a simple example a CCGT's LCOE may be higher than that of a baseload plant, but still it may be economically as viable.

LCOE comparisons may only be sensible for a first level review of similar projects in the same region. Therefore, the c-b RES project and its counterfactual can be compared based on the LCOE taking into account the note of caution mentioned earlier. This approach is technology-neutral and suitable for any type of RES project.

[20] Storage used in combination with RES technologies can be assessed in the same manner as a sole RES asset – from a system perspective only the output characteristic of the RES asset will change.

(a.2) Cost of energy generation – detailed approach

Applicability: Stage I (preparatory studies) – not applicable
Stage II (c-b RES Status) – not applicable
Stage III (grants for technical studies) – not applicable
Stages IV (grants for works) – mandatory for large-scale projects

The cost of generation is monetised as the NPV of the lifecycle cost of the c-b RES project. This approach does not require a complete scenario definition as it looks purely at the project perspective. The NPV calculations are based on the financial modelling of the project developers. In contrast to the financial modelling, however, only the cost side of the project is taken into account. Neither the revenue stream nor any system impact is considered for this indicator, since they are covered by indicator (b).

The cost assessment should reflect the granularity of the project developer's financial modelling. Therefore, the cost assessment needs to consider any type of cost that can be readily quantified, from construction to cost for measures to reduce the environmental impact.

Cost types and other factors to consider are: (i) Investment cost, replacement costs and residual value: capital cost of all fixed and non-fixed assets and other expenditures related with initial stage (development) of the project, end-of-lifetime value (amortisation or residual value); (ii) Operating costs: fix and variable cost for operating, maintaining and related services during operation phase; (iii) Lifetime of the plant including replacements, lifetime extensions and modernisations; (iv) Financing conditions: e.g. share of external and equity-based, cost of capital, country specific and technology specific (risk surcharge). Furthermore, project costs need to incorporate costs for any environmental integration measures, defined as the outcome of the EIA procedure.[21] Costs of financing are included into the economic analysis since these have a significant influence on the viability of RES assets and between-country differences in financing cost may be a major value driver for c-b RES projects.

Labour costs are included in a project's CAPEX and OPEX. Consequently, the project's impact onto the labour market, is captured through these direct project inputs and monetised through market prices of labour. Therefore, an employment effect of project implementation is captured within this indicator. However, labour markets may be distorted, and market wages may not reflect the social opportunity cost of labour. In this case, shadow wages can be applied to reflect the real opportunity cost of labour and highlight differences between the project and its counterfactual.[22] In addition, project promoters have the opportunity to outline a project's impact on local job creation under application element 6, the added value of cooperation (section 2.3.7). Therein, the support to a country's shift towards low-carbon industry sectors and capacity building with the RES sector can be qualitatively described.

A detailed description of the cost types related to RES project development are outlined in 2.5.2. Additionally, therein the methodology is laid out, how to calculate the project's financial NPV as the sum of the discounted cash flows throughout the plant's lifetime. It should be noted that in the financial analysis, specific WACCs deviating from DG REGIO's 4% may be chosen to reflect market realities. In the economic analysis however, a single EU-wide social discount rate is employed.

It is advised that reference costs for RES projects are provided in the process and that any substantial deviation in CAPEX or OPEX by the project applicant is clearly motivated. Cost benchmarks for this purpose can be derived from literature LCOE values and expected lifetime energy outputs from the plant at the project site.

For the scope of this economic assessment the benefit or cost of the c-b RES project is calculated as the delta in cost NPV, compared to its counterfactual. This approach is technology-neutral and suitable for any type of RES project.

[21] See EIA Directive for applicability of EIA.

[22] For an overview of applicable shadow wages in Europe see DG Regio – CBA Guideline.

The above outlined approach is applicable for c-b RES projects that are individual projects, e.g. put forward by project developers. In case c-b RES projects are support schemes covering multiple projects, project promoters (usually Member States) will have to provide estimates based on the total MW-amount that is to be supported and cost benchmarks for the projects applying to these support schemes.

(b.1) System integration cost – simplified approach

Applicability: **Stage I (preparatory studies) – optional for all projects**
Stage II (c-b RES Status) – optional for all projects
Stage III (grants for technical studies) – mandatory for all projects
Stages IV (grants for works) – mandatory for small-/medium-scale projects

Complementing the cost of generation indicator, accounting for project inputs, the system integration cost indicator is used to represent the project outputs. Therefore, this indicator accounts for the project's energy output and its market impact, including everything that is captured as a project revenue from the project developer's perspective.

A rough estimation of the c-b RES project's system integration cost or benefit can be achieved by solely quantifying the market impact without taking into account grid related system integration cost. Instead of a thorough market modelling, the project's impact on energy markets is quantified by valuation of the project's expected annual energy output at average market prices (minus the project's marginal cost).

For example, the social welfare gain (as additional producer rent) on power markets is estimated through the expected annual energy production of the RES project, monetised through its average market value, derived from the average day-ahead price. This approach is likely to overestimate the benefits of RES projects since they often produce at times of lower market prices. Therefore, market prices should be adapted to the relative market value of the respective RES in the market region.[23] A similar approach can be applied for gas projects. Welfare gains through heating and cooling projects can be assessed by comparing the expected annual energy output valued at the project's marginal generation cost vs. the annual energy output valued at the cost of the status-quo heating or cooling assets (using literature values).

(b.2) System integration cost – detailed approach

Applicability: **Stage I (preparatory studies) – not applicable**
Stage II (c-b RES Status) – not applicable
Stage III (grants for technical studies) – not applicable
Stages IV (grants for works) – mandatory for large-scale projects

The system integration cost and benefits of a c-b RES project are assessed via market and grid modelling. These systemwide effects of integrating the RES project into the regional system are changes in system operation cost, including market efficiency and balancing as well as cost for infrastructure development (internal capacity needs and interconnection capacity needs).

In the following a modelling approach for the assessment of projects in the electricity sector is described, similar to the methodology developed by ENTSO-E for the cost-benefit analysis of TEN-E projects (CBA guideline 2.0).

1. The system operational costs can be quantified and monetised by means of a market dispatch optimisation module. This model covers a wide system in terms of market capacities and fixed infeed profiles (demand, variable RES, heat demand driven CHP, possibly must-run units). The module's objective function is to dispatch flexibility sources so as to minimise operational costs.

[23] For market value factor estimations see e.g. Hirth, Lion (2013): "The Market Value of Variable Renewables", Energy Policy 38, 218-236.

- Flexible sources include: thermal generation, curtailment of vRES, demand response, storage
- Operational costs include: fuel costs, CO2 costs, activation costs for DR.
- Reasonable operational aspects are to be considered. This includes start-up cost categories for thermal plants, maintenance schedules (assumed reduced availability or optimised profile), and possibly must-run assumptions to take into account grid operation aspects.
- Time granularity is typically hourly level. Full-year profiles are used.
- Regional scope of the model is to include all countries where reasonably an operational impact is expected due to this project. Best practice is to use a pan-European zonal model.
- Market constraints are modelled as NTC between zones/countries

The described approach for system modelling is similar to the assessment of Socio-Economic Welfare gains for TEN-E infrastructure projects (see ENTSO-E CBA2.0 section 2.2 for general description).

In addition, the analysis can be enhanced through similar approaches as are applied in grid planning studies, electricity price forecasts, adequacy assessments or others. Relevant approaches to enrich the analysis are described in the following.

2. Probabilistic modelling:
    - mainly to capture climatic aspects (wind, solar, hydro, temperature-load correlations);
    - This item is already covered in latest TEN-E based CBAs.
3. Flow-based modelling:
    - in line with presently developing market functioning (CORE);
    - capturing bottlenecks also within zones;
    - This item is already covered in latest TEN-E based CBAs.
4. Complemented internal redispatch optimisation:
    - relevant presently for particular countries;
    - This item is already covered in latest TEN-E based CBAs.
5. Sub-hour modelling:
    - in case detailed vRES and load profiles are available as well as detailed parameters for thermal plants under fast ramping / cycling conditions. In theory this allows to capture an ideal market view up to including intraday rescheduling.
    - This item may become more prominent especially when addressing the benefit of storage projects (in TEN-E PCI context) or that of distributed energy resources (in general).
6. Analysis of balancing service and other system service needs:
    - This is mainly relevant to assess whether different capacity levels need to be reserved for FCR and a/mFRR/RR. This may be especially relevant for specific RES projects, especially large-scale centralised (e.g. offshore wind).
    - Alternative benefit is that with the c-b RES project the system need can be addressed in a more cost-effective manner. Note this is not intended to assess revenue streams for a c-b RES project in a specific market, but to quantify whether the inherent capability of the unit avoids an alternative costlier unit in the energy system (e.g. OCGT/CCGT).
    - Although, this item may deserve further consideration in some cases, it is difficult to propose a straightforward methodology to quantify these benefits. That is since the sizing of balancing service capacity reserves is either fixed at synchronous area level (e.g. FCR) or depends on detailed local adequacy assessments (e.g. aFRR). However, quantification of these benefits is facilitated by the further development of market design mechanisms for these system services. Respective markets will be fully developed amongst others by further integration of balancing areas, stronger joint procurement of system services through system operators, a common approach for auctioning these services and least cost dispatch of available resources, as well as a more optimal sizing of products (dynamic at shorter time levels). All these efficiency measures are in line with the implementations of the Electricity Balancing guideline.

- In addition, there are many very local ancillary service products for frequency management (i.e. very fast response) or other system needs such as black-start capability or reactive power management. No simple common method exists to measure the social welfare contribution of the c-b RES project.
- It is important to keep emphasizing the main principles of the assessment: it needs to be in line with the suggested reference scenarios, and it needs to measure social welfare, thus systemwide consumer and producer surplus as well as system operation cost, not only project-specific revenues and cost. Not taken into account here are however effects such as environmental impacts, which will be quantified in the other indicators of the economic analysis

7. Capital investment for supply:
   - An additional element which could be considered which drives the cost of energy (electricity) generation besides operational costs is the capital investment for supply. When assessing the two cases, a check can be made whether other units in the system are considered reasonably similarly economically viable. If in the case with the c-b project a set of units has substantial lower full-load hours, the CBA could conclude that these units are taken out of the mix (not commissioned or earlier decommissioned).

Described methodology, building on the CBA guideline by ENTSO-E is suitable for projects in the electricity sector. Likewise, a methodology for projects in the gas sector is available by ENTSO-G.[24] Heating and cooling projects, however, need a different approach to assess the benefits and cost of system integration. Main benefit of these projects is the replacement of conventional assets used for heating and cooling in the building or industry sector. Therefore, the existing, local heating and cooling structure has to be modelled on a high level by taking into account the settlement structure and present shares of existing heating/cooling technologies. Based on the methodology and values given by European Commission JRC[25] the investment and operational cost of existing technologies can be estimated. By comparison of the c-b RES projects lifetime cost (see indicator a) to the cost of present technologies for the same time period, the system integration cost/benefit of the project can be assessed. In addition, the power market impact of large-scale cogeneration units can be modelled according to the previously described methodology. The benefit of additional electricity generation through small-scale cogeneration units can be assessed through valuation of at average market prices. Likewise, projects within the transport sector, e.g. biofuel production, need a different approach to estimate the benefit of integrating the project into the energy market. Here a simple estimation of potential benefit is given by valuation of the expected output valued at market prices.[26]

The outlined assessment approach is also applicable for RES projects with storage. Storage will alter the output characteristics of a RE source, i.e. shifting generation from low price to high price time intervals and thereby change the market impact of a project, e.g. by further decreasing system operational costs. Nevertheless, the same type of models can be used. Considering sector coupling projects, the assessment is slightly more complicated, since for a full consideration of all impacts modelling of all affected sectors is necessary, e.g. both the power and the gas sector in case of a Power-to-Gas (PtG) project. However, it is reasonable to limit the analysis to the project's primary sector, e.g. the power sector in case of a wind power project with a connected PtG-plant. Benefits and costs affecting the secondary sector can be estimated by a simple valuation of the project's output at market prices, e.g. the PtG-output times the average gas prices.

Above approaches to monetise the system integration cost can be used to compare the project to its counterfactual. For each case the operational costs of the full system are assessed. The delta between both cases is the welfare gain, thus the impact on societal cost for energy (electricity) generation.

The contribution of the c-b RES project to socioeconomic welfare can only be assessed in comparison to its counterfactual – welfare gains are calculated as the delta. In principal, this approach

[24] 2nd Entso-G CBA Methodology (2017)

[25] EC JRC (2016) - Cost-benefit analysis for the potential of high-efficiency cogeneration in Cyprus

[26] Economic appraisal for biofuel projects is further explained in EIB – CBA Guideline

can be used to compare the reference scenario, i.e. system with the c-b RES project, with two possible counterfactuals:

- Take out the c-b RES project from the reference case, include the counterfactual project.
- Take out the c-b RES project from the reference case. The counterfactual is thus the reference case with no project at all.

In case c-b RES projects are support schemes covering multiple projects, the applicability of the described modelling approach is dependent on whether the support scheme is site specific or not. A site-specific support scheme could be the tendering of a single off-shore site and is thereby comparable to the development of an individual RES project. The described modelling approach can be easily applied in this case. In the case of a non-site-specific support scheme, on the other hand, reasonable assumptions regarding the project sites would have to be made to apply above given grid modelling approach. Alternatively, grid modelling is performed on a higher aggregation level, where no assumption on project locations have to be made, or grid modelling is neglected at all and only the high-level market impact of additional RES capacity is assessed.

(c) Cost of support

Applicability: **Stage I (preparatory studies) – optional for all projects**
Stage II (c-b RES Status) – optional for all projects
Stage III (grants for technical studies) – mandatory for all projects
Stages IV (grants for works) – mandatory for all projects

Cost of support of a project is estimated from a societal perspective, considering all types of transfer from the state/consumer to the project promoter. Thus, not only the potential c-b RES project's grant size needs to be considered, but rather the total amount of support should be considered that is needed to make the project economical viable. Support measures that should be taken into account for this indicator are, thereby, not limited to direct RES generation support schemes. Rather, tax exemptions, investment aid and other non-repayable support is applicable as well and feeds into this indicator.

If national support schemes for RES exist, these can be used as a benchmark to estimate the support cost, although the project may not be able to profit from these support schemes if it is applying for c-b RES status. These support schemes may differ from country to country. This approach gives an initial estimation of the actual cost of support as calculated in the gap analysis outlined in section 2.5.3.

Annual costs of support are estimated through the expected annual energy output of the c-b RES project, valued at the average per-MWh-support – the energy output figures have already been used in quantification of indicator (a.1) cost of energy generation. Based on this monetised annual cost of support, the NPV is calculated taking into account the lifetime of the plant. The project benefit in terms of cost of support is calculated as the difference between the cost of support in the reference case and the counterfactual case.

This approach is not sector-specific and suitable for any project type, provided that the respective technology is eligible for other support schemes in the respective country.

It should be noted that other CBA guidelines (DG REGIO, EIB) argue that subsidies should not be taken into account in an economic analysis since they only represent a transfer payment, not an economic cost as such. These transfer payments from one on group in society to another do not represent a benefit for the society. However, since the CEF regulation requires the inclusion of this indicator we use a differentiated approach – the cost of support is quantified and fed into the selection process, i.e. award and selection criteria, but will not be considered in the calculation of the socioeconomic net present value, as described in ch. 2.4.8.

In case the c-b RES project is a support scheme the cost of support can be estimated as the total volume of the support scheme. However, projects applying for the respective support are eligible for additional support, e.g. through c-b RES grants, all applicable support scheme volumes have to be

added up – as before, a societal perspective is employed, and the overall sum of support given to the individual projects under the Joint Support Scheme need to be subsumed.

(d.1) Greenhouse gas emissions – simplified approach

Applicability: **Stage I (preparatory studies) – optional for all projects**
Stage II (c-b RES Status) – optional for all projects
Stage III (grants for technical studies) – mandatory for all projects
Stages IV (grants for works) – mandatory for small-/medium-scale projects

A simplified approach to estimate GHG emissions is based on the quantification of indicator (b.1) system integration cost, in particular the estimation of the project's lifetime RES production. Instead of a model-based approach to estimate systemwide emissions, the quantification is based on the assumption that the project replaces other generation units in the merit order. Therefore, avoided GHG emissions are estimated as the project's annual RES production times the difference between the system's average emission factor and the project's emission factor. Furthermore, the avoided GHG emissions can be monetised using carbon prices in line with the employed scenarios.

The described approach is suitable for projects in the electricity sector. Projects in the gas sector can be evaluated based on the emission equivalent of the natural gas amount they are replacing with their own production. To assess heating and cooling projects, however, it is necessary to quantify the emissions of the present heating/cooling assets through technology specific emission factors. By comparison to the expected emissions of the project itself, a benefit is calculated as the difference between status quo and the project. Emission savings through projects within the transport sector can be estimated by comparison of the emission factor of the renewable fuel to its fossil equivalent. The difference in emission factors times the annual renewable fuel output of the project equals the expected emission savings.

The socioeconomic welfare is quantified through comparison of the reference case with its counterfactual, thus as the delta of both monetised GHG emission savings figures.

(d.2) Greenhouse gas emissions – detailed approach

Applicability: **Stage I (preparatory studies) – not applicable**
Stage II (c-b RES Status) – not applicable
Stage III (grants for technical studies) – not applicable
Stages IV (grants for works) – mandatory for large-scale projects

The GHG emissions assessment utilises the market modelling already employed for the quantification of indicator (b). The c-b RES project' systemwide effect on GHG emissions is quantified through the model and monetised through a suitable carbon price, fitting the respective scenario.

Based on market and grid modelling the dispatch of generation units and respective GHG emissions can be assessed. To do so, technology-specific emission factors are employed. The scope of the assessment should be in line with the definition of GHGs used by the IPCC[27], thus incorporate both natural and anthropogenic GHGs. A monetisation of the emission figures is achieved via scenario-dependent carbon prices. These carbon prices need to be in line with the suggested scenario framework to ensure consistency across project evaluations. Noteworthy is that carbon prices can deviate from the expected price level of the EU ETS – instead of distorted carbon market prices, shadow prices should be used to account for the total societal cost of carbon.[28] Moreover, shadow carbon prices are applicable for all sectors, including those not covered by the EU ETS.

[27] Greenhouse gases: natural: water vapour (H2O), carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), ozone (O3); human-made GHGs: halocarbons and other chlorine- and bromine-containing substances, sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs)

See e.g. IPCC (2013) – Annex III: Glossary. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press.

[28] Reference values for the shadow cost of carbon emissions are given by EIB – Economic Analysis Guideline or the latest results of energy system modelling, commissioned by the EC in PRIMES.

Described approaches in (d.1) to quantify the GHG emission reductions from projects in the gas or heating/cooling sector can are applicable here as well, with a higher granularity on the input data of the estimation.

The potential socioeconomic benefit of the c-b RES project is assessed through comparison of the reference case with its counterfactual. The delta between monetised emission figures equals the potential benefit.

In case the c-b RES project is a support scheme above described approach is applicable within the limitations outlined under (b.1) – assumptions regarding individual projects' sites may have to be made, or the system modelling is limited to a high-level market modelling approach. However, quantification and monetisation of the indicator is possible, independent of the chosen approach.

(e.1) Security of supply – simplified approach

Applicability: **Stage I (preparatory studies) – optional for all projects**
Stage II (c-b RES Status) – optional for all projects
Stage III (grants for technical studies) – mandatory for all projects
Stages IV (grants for works) – mandatory for small-/medium-scale projects

The security of energy supply indicator aims to capture the impact of a project on energy supply externalities, thus whether a project improves the initial level of supply security or not. Supply security refers to the availability, reliability and adequacy of energy supply – and thereby also import dependency.

A simplified approach to assess the c-b RES project's contribution to supply security is based upon a semi-quantitative, high-level assessment of sector-specific security of supply indicators, the projects contribution to a reliable generation capacity, and the relative share of the project's energy output in the amount of imported energy supply of the respective country and sector.

It is assumed that a project will have a higher contribution in a country with a lower initial level of supply security. Therefore, by comparison of supply security indicators for the proposed project site and the counterfactual site a potential benefit can be declared. With a view onto the electricity and gas sector, the system average interruption duration index (SAIDI) – as an indicator of a need for reliable capacity – can be compared for the project site and the counterfactual project site. A higher SAIDI indicates a greater need for an improvement of the supply security.[29] Furthermore, the projects addition to the level of guaranteed capacity in the country can be taken into account. The project's contribution to the net generating capacity can be quantified e.g. through literature values of a technology-specific percentage share of the project's total capacity, own estimations by the project promoter or based on ENTSO-E methodology (a methodology for quantification is outlined in ENTSO-E's former scenario outlook and adequacy forecasts prior to 2015[30]). Moreover, the project's contribution to supply security in terms of import dependence can be semi-quantitatively assessed by estimating the share of energy imports in the primary energy consumption of the respective sector and country. In combination with a quantification of the share of imported primary energy supply for the respective sector, a statement about the projects contribution to supply security can be derived. Countries with a higher import dependency would profit more of a c-b RES project, that lowers energy imports.

(e.2) Security of supply – detailed approach

Applicability: **Stage I (preparatory studies) – not applicable**
Stage II (c-b RES Status) – not applicable
Stage III (grants for technical studies) – not applicable
Stages IV (grants for works) – optional for large-scale projects

[29] CEER - Benchmarking Report on the Continuity of Electricity and Gas Supply
[30] Entso-E – Scneario Outlook & Adequacy Forecast

As mentioned earlier it is likely that any European suggested scenario which is used to quantify the impact of a project is inherently adequate already, meaning that supply could meet demand at any time. In other words, it is not clear right from scratch whether a c-b RES project does provide a significant security of supply benefit and thereby justifies the effort for a comprehensive analysis of its security of supply contribution. Furthermore, literature suggests that supply security contributions of individual generation projects (in the power sector) are likely to be negligible and no straightforward assessment methodology exists.[31] However, within the TEN-E process, a CBA for large-scale transmission and storage projects is performed (based on the ENTSO-E CBA guideline), including an assessment of the project's security of supply contribution. Thereby justification is given, that large-scale energy sector projects may have a substantial impact on supply security. Consequently, we use a two-folded approach to assess the security of supply contribution of a project. On the one hand, we employ a simplified approach, as already described above, that is applicable for any project. In addition, in the following, we describe a detailed approach – inspired by the ENTSO-E CBA – that is only applicable for large-scale projects and only if the project promoter deems the project's security of supply contribution as a highly relevant and significant project benefit.

This high-level, simplified approach can be enhanced by the promoters through a comprehensive modelling approach and monetisation, as outlined in the following. Any approach to accurately assess a project's impact on supply security has to be highly sector-specific, since carrier-specific infrastructure plays a crucial role for security of supply. Therefore, in the following a modelling-based approach for supply security assessment in the power sector is exemplified. Other sectors will be shortly addressed thereafter.

With respect to the power sector security of supply is often referred to as system adequacy, thus the power system's ability to meet demand at all times. Security of supply can be quantified through market and grid modelling, in a similar fashion as applied for indicator (b), but with a probabilistic approach accounting for uncertainties in the system. The described approach for the assessment of supply security and system adequacy is in line with pan-European mid-term adequacy forecast (MAF) methodology by ENTSO-E.[32] However, other suitable approaches to assess the security of supply are at hand. In particular, grid contingency analysis gives insights to security of supply without the need for market modelling but taking into account very local grid reliability issues. Moreover, the MAF methodology can be enhanced by applying the more advanced approach flow-based market coupling.

The system modelling is done with a market simulation engine (optimal unit commitment and economic dispatch), minimizing system operational cost whilst representing generation capacity, transmission capacities in terms of net transfer capacity (NTC) between market nodes, and flexibility resources, such as flexible generation, flexible demand, and storage, for a time span of a year in hourly resolution. In contrast to the methodology applied in (b), the modelling does not only rely on deterministic forecasts, thus a set of pre-defined scenarios, but also accounts for stochastic uncertainty which may affect supply security.

The deterministic scenarios describe the future development of generating capacity and planned outages, transmission capacity, and the level of demand. Examples for the stochastic contingencies in line with best practices are: Temperature-sensitivities for demand; RES power production, in particular wind and PV production, with spatial and time correlations; Hydro power production based on climatological variations (dry, wet or normal years); Unscheduled outages of thermal generation units and relevant AC, HVDC interconnectors; Maintenance schedules of generation plants and grid asset.

These uncertainties are modelled via Monte Carlo simulations, thus the stochastical combination of different characteristics for the aforementioned categories of contingencies. Consequently, the simulation has to be performed not only once for every scenario, but rather numerous times for each combination of different contingency characteristics.

Output of these simulations are quantifiable metrics, so called adequacy indices: adequacy margin (MW); loss of load expectancy (LOLE, in h/year), as the average number of hours per year in which

[31] WB – Guidelines for Economic Analysis of Power Sector Projects

[32] https://www.entsoe.eu/outlooks/midterm/

the demand of an area cannot be met by generation and import, or alternatively a confidence interval for a specific LOLE value; expectancy of energy not served (EENS, in MWh/year), as the average energy not supplied per year due to the demand exceeding generation and import capacities.

The probabilistic indicators LOLE and EENS are calculated as the average of the different Monte Carlo simulations and are in best practices measured at a confidence level of 95%. A monetisation of the EENS can be achieved by valuing the energy amount with the value of lost load (VOLL). Useful VoLL estimations are given by a recent ACER/CEPA study.[33] It is emphasised there is not a single Euro/kWh VoLL figure, as this depends among others on type of user, time of year, time of day, region, total duration of outage.

Aside from monetised benefits, an additional scoring may be given to c-b RES projects if the LOLE or EENS is substantially reducing an identified adequacy risk (e.g. reduction of LOLE below regulatory limit such as 3hr/year).

The c-b RES projects contribution to security of supply and thereby socioeconomic welfare is estimated in comparison to its counterfactual. Therefore, the monetised EENS values are calculated for the reference case and its counterfactual; the delta is the potential benefit.

Similar methodologies for supply security quantification and monetisation exist for the gas sector by ENTSO-G. Likewise, EIB outlines a method for the macroeconomic assessment of supply security contribution of gas sector projects.[34] An assessment of the security of supply in the heating and cooling sector needs to assess the technology-specific availability of the present technologies in comparison to the level of supply security guaranteed by the c-b RES project. For projects in the transport sector, a security of supply benefit is achieved through lower import dependence on the fuel itself as well as the biomass raw material, e.g. imported soy beans. This benefit can be quantified by using a lump sum supply security on the expected market revenues of the project.[35]

If the considered c-b RES project includes storage assets, the same assessment approaches can be used as for a sole RES project. In general, storage will increase the security of supply contribution of a project, e.g. by increasing its secure capacity contribution. To fully reflect the benefits of storage, also system services that can be provided by storage (but most probably not by the RES alone), such as frequency regulation, should be considered. Further explanation is given in the description of indicator (b.2) system integration. Similarly, the same line of argumentation holds for sector coupling projects. Whilst these projects present additional, flexible demand in the primary sector of the project, e.g. the power consumption of a PtG-asset, they provide an additional generation unit in the secondary sector, e.g. the gas output of PtG-unit. To limit the assessment effort, the impact on additional sectors can be treated through high-level estimations.

In case the c-b RES project is a support scheme, the described high-level approach to assess the security of supply is applicable nonetheless. If a detailed model-based approach should be employed, the same limitations as described under indicator (b.1) needs to be considered - assumptions regarding individual projects' sites may have to be made.

[33] ACER - STUDY ON THE ESTIMATION OF THE VALUE OF LOST LOAD OF ELECTRICITY SUPPLY IN EUROPE

[34] EIB – Economic Appraisal of Investment Projects

[35] A reference value for the supply security premium can be found in EIB – Economic Appraisal of Investment Projects.

(f.1) Air and other local pollution – simplified approach

Applicability: Stage I (preparatory studies) – optional for all projects
Stage II (c-b RES Status) – optional for all projects
Stage III (grants for technical studies) – mandatory for all projects
Stages IV (grants for works) – mandatory for small-/medium-scale projects

Air and other local pollution should be monetised to represent their external cost and impact on socioeconomic welfare. Local pollution refers to the scope of impacts, which is limited to a certain region for most air pollutants compared to GHG with a global impact.

A simplified approach to estimate air and local pollution is based on the quantification of indicator (b.1) system integration cost, in particular the estimation of the project's lifetime RES production. Instead of a model-based approach to estimate systemwide emissions, the quantification is based on the assumption that the project shifts up other generation units in the merit order. Therefore, avoided pollutant emissions are estimated as the project's lifetime RES production times the difference between the system's average emission factor and the project's emission factor. Pollutant-specific emission factors can be derived from the system generation mix and technology-specific emission factors. The avoided emissions can be monetised using pollutant-specific unit economic cost factors.

(f.2) Air and other local pollution – detailed approach

Applicability: Stage I (preparatory studies) – not applicable
Stage II (c-b RES Status) – not applicable
Stage III (grants for technical studies) – not applicable
Stages IV (grants for works) – mandatory for large-scale projects

Similar to indicator (d) green-house gas emission, the detailed assessment of air and other local pollution is based on the market modelling employed for the quantification of indicator (b). Thus, the systemwide air and other local pollutant emissions are quantified in the model through technology-specific emission factors model and monetised with suitable pollutant-specific unit economic cost.

In particular, based on the market (and grid) modelling the dispatch of generation units and respective pollutant emissions can be assessed. To do so, technology-specific emission factors are employed. The scope of the assessment should be in line with the definition employed by EEA[36]. A monetisation of the emission figures is achieved with pollutant specific unit economic cost.

Emission factors should reflect full life cycle emissions of the respective Technology. Values may be taken from EMEP/EEA air pollutant emission inventory guidebook[37]. Economic unit cost as a monetary value reflecting the pollution cost can be taken from ExternE studies[38], NEEDS study[39], EIB, EEA.[40]

By comparison of the reference scenario with its counterfactual the change in pollutant volumes and consequently in socioeconomic welfare is estimated. The benefit is calculated as the difference between both cases.

The quantification approach can be adapted to projects in other sectors than the electricity sector similar to methods outlined under indicator (d.1) – GHG emission.

In case the c-b RES project is a support scheme above described approach is applicable within the limitations outlined under (b.1) – assumptions regarding individual projects' sites may have to be

[36] Air pollutants: carbon monoxide (CO), sulphur dioxide (SO2), nitrogen oxides (NOX), fine particulate matter (PM2.5), non-methane volatile organic compounds (NMVOCs); and ammonia (NH3), heavy metals

See EEA (2016) - EMEP/EEA air pollutant emission inventory

[37] https://www.eea.europa.eu/publications/emep-eea-guidebook-2016
[38] http://www.externe.info/externe_d7/
[39] http://www.needs-project.org/
[40] EEA (2011) - Revealing the costs of air pollution from industrial facilities in Europe

made, or the system modelling is limited to a high-level market modelling approach. However, quantification and monetisation of the indicator is possible, independent of the chosen approach.

(g.1) Innovation – simplified approach

Applicability: **Stage I (preparatory studies) – optional for all projects**
Stage II (c-b RES Status) – optional for all projects
Stage III (grants for technical studies) – mandatory for all projects
Stages IV (grants for works) – mandatory for all projects

The innovation indicator aims at assessing the degree of innovation provided by the project compared to the state of the art, in line with the EU Innovation Fund[41] for low-carbon technologies. The scope of this indicator is not limited to innovation in the RE technology directly applied by the project. Rather, the indicator should employ a broad perspective on innovation throughout the whole value chain fostered by the c-b RES project, incorporating e.g. process innovation in the manufacturing of the respective RE technology. However, only advanced technologies will be considered, reaching the demonstration and deployment stage.

A simplified, qualitative approach to assess the effect of innovative projects considers two aspects, the mapping the innovation to European and national research roadmaps (e.g. SET Plan), and a statement on how the project may advance the TRL of the applied technology.

A qualitative assessment of the indicator is performed by describing the alignment of the project's innovation with research roadmaps on national and EU level. For example, the Integrated Strategic Energy Technology (SET) Plan could be considered as an EU-wide strategic roadmap covering research and innovation to accelerate the energy transition. In particular, a project's contribution towards the SET key actions 1 & 2 on renewables could be outlined, thus technological leadership through highly performant RE technologies and their system integration, as well as a reduction of the cost of key technologies. In addition, a project's contribution to achieving the technology-specific strategic targets should be emphasised, e.g. cost-competitive substructures for offshore wind power used in deeper waters.[42] National research targets that should be taken into consideration are outlined in each country's NECP within the dimension research, innovation and competitiveness.

Furthermore, the innovation indicator is semi-quantitatively assessed through the project's contribution to advancing the current technology readiness level (TRL)[43] of the employed technologies. Only projects that reach a TRL of 7 to 9 will be considered, thus technologies in demonstration and deployment level. Thereby a project's contribution to the EU's global competitive position is assessed, including the strategic uptake of a technology and its potential for replicability of the project.

(g.2) Innovation – detailed approach

Applicability: **Stage I (preparatory studies) – not applicable**
Stage II (c-b RES Status) – not applicable
Stage III (grants for technical studies) – not applicable
Stages IV (grants for works) – optional for large-scale projects (only if project promoters deem innovation a significant benefit for their project)

In addition to the simplified approach, promoters may enhance their economic analysis by quantifying and monetizing their project's impact on innovation in line with the CBA guideline by DG Regio: The effects of innovation on various target groups can be quantified through estimating the size of the benefit group and the marginal social value of the innovation to the benefit group, e.g. the shadow profits obtained by businesses through the innovation. A potential benefit of the c-b RES project

[41] EC - Delegated Regulation on EU Innovation Fund
[42] EC – Integrated SET Plan Progress in 2016
[43] EC – Horizon 2020 - Technology Readiness Levels

compared to its counterfactual could be realised through different sizes of target groups, or different/added types of innovation.

Potential benefit groups to consider are businesses, employees and the general public. Innovation-related benefits to these groups are new products and processes, knowledge spill over, human capital development, reduction of environmental risk, and others.

A monetisation of these benefits is benefit-specific, accounting for their characteristics and valuation, e.g. new products and processes can be monetised through the shadow profits (expected profits) or the economic value of patents. Alternatively, monetisation can be done via the avoided cost approach. The total economic value of the expected benefits equals benefit quantity/size of the benefit group times the estimated marginal social value.

The described approach is not sector-specific and suitable for any RES technology. The c-b RES project's contribution to innovation is estimated through comparison with its counterfactual. Obviously, the innovation effect of the standard counterfactual is by definition the same as for the c-b RES project, since the standard counterfactual assumes the same technology and project set-up as the c-b RES project. If the project promoter claims innovation benefits, a case-specific counterfactual needs to be chosen.

In case the c-b RES project is a support scheme above described qualitative approach to assess the innovation impact is only applicable by mapping the support scheme goals to the national and European research roadmaps. A more specific evaluation of the expected innovation outcome and advancement of TRLs is only possible if the support scheme is technology specific or the innovations/technologies applied by individual projects are foreseeable with a certain reliability.

2.4.8 NPV assessment

Whilst project costs usually occur in the early stages of a project's lifetime, e.g. investment costs, the project's benefits will usually be apparent throughout the whole lifetime. Consequently, lifetime benefits and costs are aggregated and brought to a comparable base by using the discounted cash flow method. Cash flows, thus costs and benefits throughout the lifetime, are discounted to the current year and summed up to calculate their net present value, similar to the methodology applied for financial modelling of the project. Therefore, costs and benefits that have been monetised (e.g. by simulation) only for a few base years have to be extrapolated to the full project lifetime, reasonably by linear interpolation. The lifetime NPV of benefits and costs of the individual indicators is then calculated, as described, via discounted cash flow calculations.

Important parameters in the assessment of the NPV are the project's lifetime and the discount rate. As discussed before, the lifetime could be fixed to pre-defined, technology-specific values. This approach fosters comparability between different projects. However, the variety of different technologies – and possibly combinations of these within a single project – give reasoning to let the project promoters choose a reasonable lifetime. To calculate the NPV a social discount rate of 4% is used, uniformly throughout all projects. This discount rate is the average value of the rates used by the DG REGIO guideline for cohesion MS (5%) and other MS (3%). A common discount rate for all projects in any Member State ensures equal treatment of all c-b RES projects. Moreover, a unique discount rate is a necessity of the design of the economic analysis, since the results of the economic analysis might be distorted with different discount rates – the differences in the socio-economic NPV between a project and its counterfactual in another MS might be solely an effect of these different rates, not the project itself. However, social discount rates change throughout time and the reference values should be updated for the new programming period (2021-2027), in alignment with e.g. a revised version of the DG REGIO guideline.

Furthermore, for each indicator the NPV of potential socioeconomic benefits/costs is calculated as the delta between the NPVs of the reference case and the counterfactual case, as illustrated in Figure 8. Evidently, the same counterfactual has to be used for all indicator's Delta NPV. Then, the sum of all Delta NPV values represents the overall societal benefit or cost of the c-b RES project in comparison to its counterfactual. The methodology used to calculate the NPV is further illustrated in Table 4.

Notably, indicator (c) cost of support does not feed into the project's NPV, as described in the previous chapter, subsidies represent only a transfer payment and should not be considered as a societal benefit or cost. In addition to this total socioeconomic welfare, the ratio between benefit and cost NPV may be calculated. The benefit-cost ratio as a relative measure allows for comparability between different project scales and project types.[44]

The NPV can only be calculated taking into account monetised benefit and cost indicators. Therefore, if the simplified approach to the economic analysis is chosen, only a few of the above described indicators can be considered, limiting the scope of the NPV. Consequently, it is possible that the resulting NPV is negative, although it might be positive if all the other indicators which have not been monetised would be taken into account. The selection process is thus not solely focusing on the NPV as an assessment criterion alone, but rather considers all of the benefits provided by the project, even the ones only assessed qualitatively and semi-quantitively.

To be considered as eligible, the c-b RES project must have a net present value higher than zero/a benefit-cost ratio higher than one in comparison to its counterfactual. However, as just presented, this criterion is only applicable for a fully monetised economic analysis. Therefore, eligibility can also be proven by qualitatively describing significant benefits in the simplified approach, if not enough benefits have been monetised to show a positive NPV.

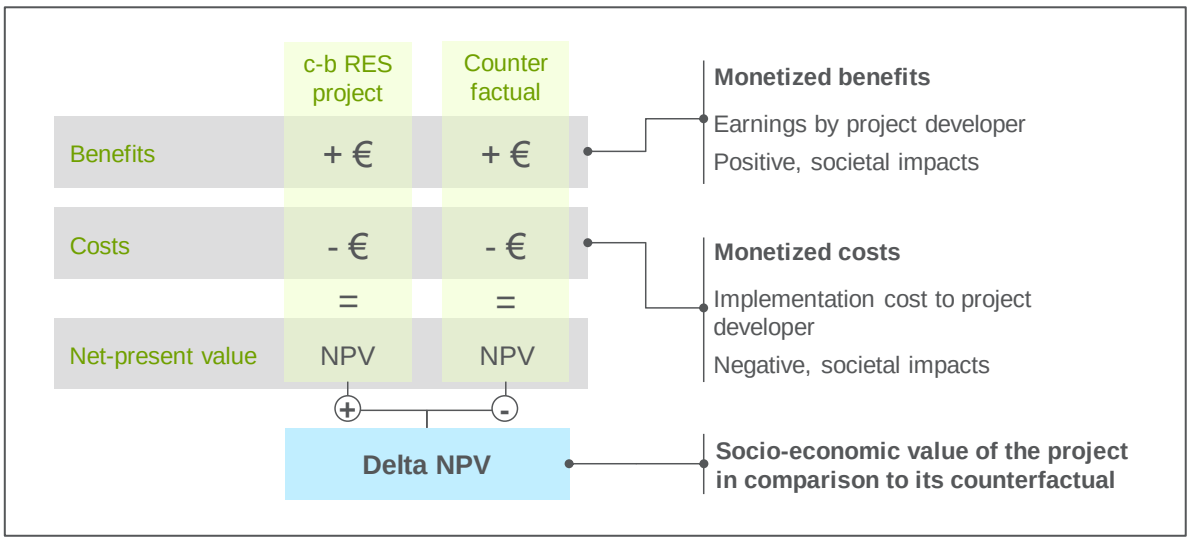

Figure 8: NPV assessment through comparison of the c-b RES project and its counterfactual (source: Navigant)

[44] Choosing the benefit-cost ratio as the central metric for the economic analysis instead of the NPV would therefore foster comparability between different projects and should be further discussed.

Table 4: Calculation of the societal NPV of a project in comparison to its counterfactual

CBA indicator	Monetisation of Benefits	Monetisation of Costs
(a) costs of energy generation	Delta Benefit NPV = benefit NPV reference case – benefit NPV counterfactual case	Delta Cost NPV = cost NPV reference case – cost NPV counterfactual case
	Note on sign convention: CAPEX and OPEX are costs, thus negative	
(b) system integration costs	Delta Benefit NPV = benefit NPV reference case – benefit NPV counterfactual case	Delta Cost NPV = cost NPV reference case – cost NPV counterfactual case
	Note on sign convention: market value of RES is a benefit thus positive; grid development and increased redispatch are cost thus negative	
(d) greenhouse gas emissions	Delta Benefit NPV = benefit NPV reference case – benefit NPV counterfactual case	Delta Cost NPV = cost NPV reference case – cost NPV counterfactual case
	Note on sign convention: increased emissions are environmental cost thus negative	
(e) security of supply (if monetised)	Delta Benefit NPV = benefit NPV reference case – benefit NPV counterfactual case	Delta Cost NPV = cost NPV reference case – cost NPV counterfactual case
	Note on sign convention: an increase in security of supply in terms of a reduction of energy not served is a societal benefit thus positive	
(f) air and other local pollution	Delta Benefit NPV = benefit NPV reference case – benefit NPV counterfactual case	Delta Cost NPV = cost NPV reference case – cost NPV counterfactual case
	Note on sign convention: an increase in air and other local pollution are environmental and societal cost thus negative	
(g) innovation (if monetised)	Delta Benefit NPV = benefit NPV reference case – benefit NPV counterfactual case	Delta Cost NPV = cost NPV reference case – cost NPV counterfactual case
	Note on sign convention: increased impact of innovation is a societal benefit thus positive	
Socioeconomic cost or benefit of the c-b RES project in comparison to its counterfactual	Total Delta Benefit NPV = Sum of all single indicator Delta Benefit NPV figures	Total Delta Cost NPV = Sum of all single indicator Delta Benefit NPV figures
Total SEW of the c-b RES project in comparison to its counterfactual	Sum of Total Delta NPV figures for benefits and costs *Note on sign convention: positive indicates an overall benefit, negative an overall cost*	
Benefit-Cost Ratio of the c-b RES project in comparison to its counterfactual	Ratio between Total Delta Benefit NPV and Total Delta Cost NPV *Note on sign convention: different from before the absolute numbers need to be used to build the ratio*	

Sensitivity analysis and comparison throughout different scenarios

Uncertainties in the future development of the energy sector are ideally addressed by using a pre-defined set of scenarios, consistent throughout the economic assessment of all different projects. This means that the quantifications and NPV assessment are performed several times for each project using different scenarios. Consequently, a set of NPV values, one for each scenario, will be derived from each project's economic analysis. Since the scenario set represents the framework in which the future is likely to occur, each single NPV value needs to be positive to ensure that the project has a positive societal impact for any possible outcome of the future development of the energy sector. For example, although the achievement of the goals set out in the NECPs is used as a base for a central scenario, it might happen that a Member State is not on target to achieve its goals. Then an additional not-on-target scenario should be introduced, reflecting recent developments in the respective Member State.

The eligibility criterion for a c-b RES project to have a positive NPV (as outlined in section 2.7.2), therefore, is valid throughout all scenarios. It is not sufficient, if a project e.g. has a positive societal impact in one of the scenarios but performs poorly in all of the other scenarios. One common scenario, the collation of NECPs (see 2.4.5), allows for comparability amongst the different applicants. In addition, it may be advisable to recommend further, common scenarios to be used for sensitivity checks by the applicants.

Moreover, the economic analysis can be enhanced by means of a sensitivity analysis on additional input parameters within each scenario, e.g. by variation of the project's CAPEX and OPEX estimates. In particular, critical parameters should be identified and assessed, which have the largest influence on the projects socio-economic impact. Preferably, an optimistic, base and pessimistic case are evaluated, showing the variability of the project's NPV within the framework of a certain scenario. Thereby, a statement on the reliability of the economic analysis can be given. If strong differences in a project's NPV are found between optimistic, base and pessimistic case, e.g. positive in the one case, negative in the other, the analysis has only limited reliability.

c-b RES projects which have been subject to a rigorous economic analysis, using a set of scenarios and sensitivity analysis, to proof a reliable, positive NPV can be rewarded with a higher scoring in the award criteria on "soundness and comprehensiveness of the analysis", as described in section 2.7.3.

The use of scenarios is most meaningful for an economic analysis employing a quantitative approach[45] to describe the costs and benefits provided by a project. However, since each scenario describes a self-contained, consistent picture of the future they can also be used within a qualitative economic analysis.[46] That is, the analysis can provide an initial idea of how project benefits might change under certain framework conditions, i.e. whether benefits are or lower within a certain scenario compared to another.

2.4.9 Significance of societal benefits

The CEF regulation asks that the project specific CBA "shall provide evidence concerning the existence of significant cost savings and/or benefits in terms of system integration, environmental sustainability, security of supply or innovation." The resulting question is how to determine "significant". Before answering this question, we take a look at the determination of a "significant impact" in the TEN-E process.

The notion of "significance" in Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure includes the following elements:

- Art 4.1.c has a 'significant impact' criterium in case of projects located within just one Member State. The Annex clarifies that such project still needs to create 500 MW cross-border

[45] As employed in stages II to IV.

[46] As used in stage I.

capacity increase. A project connecting two Member States, or a Member State with a non-EU country is automatically considered to be eligible.

- Art 4.2 states that PCIs in electricity transmission/storage need to contribute significantly to at least one of the main policy objectives: market integration, sustainability, security of supply. Similar references to general objectives are given for other PCI type of projects. Annex IV gives further guidance on these criteria but basically just refers to the latest TYNDP. The electricity TYNDP does not give any criterium for significance in its analysis. The gas TYNDP does (see below). Annex V gives guidance on the CBA methodology itself; the European Commission approved methodology does not give a criterium for significance. We are not aware that ACER in its opinions on the TYNDP, PCI list or CBA methodology questioned the absence of a significance test.
- The TEN-E regulation allows for a cross-border cost allocation (CBCA) scheme to non-hosting countries. All countries with a 'significant' net positive impact need to agree on this. Such CBCA is a prerequisite before asking INEA for funding. Evidently this is a contentious issue, and it is difficult to prove a non-hosting country has a 'significant' net benefit. Such case does not exist in the c-b RE project process as only the directly involved cooperation countries are addressed.
- Art 14.2 prescribes that if a promoter applies for funding, the project specific CBA has to "provide evidence concerning the existence of significant positive externalities, such as security of supply, solidarity or innovation"
- Annex 2 states that when establishing the PCI list, any Member State who believes a project has a significant impact on their territory can raise their concern

How in our understanding 'significance' is handled in practice in the TEN-E process (for electricity)

- 'Significant' is often used as a synonym for "PCI-eligible", so referring to a transmission line connecting two countries, to an internal line providing 500MW c-b capacity, or a storage site being larger than 225MW / 2500GWh.
- The 2017 PCI selection process had a non-transparent process in their Regional Groups. In essence the RGs agreed on a methodology of how to handle NPVs (e.g. agreeing on harmonised economic lifetime and discount factor), how to handle multiple TYNDP scenarios, discarded non-monetised benefits from the TYNDP, and included two new non-monetised benefits (based on interconnection target and loop flow issues). A multi-criterion scoring system was agreed to handle all these elements and come to a normalised 1 to 10 scoring. A threshold of 3.5 was agreed to become PCI. One could argue this was the 'significance test'. Note this method was agreed in the RGs and not part of any formal process.
- ACER in its opinion on the PCI list uses Annex 2 and the fact that no Member States raised new concerns on significant (negative) impact to claim that no potential significant impacts were overlooked.
- INEA's guidance mentions that significant positive externalities need to be demonstrated (especially for grants for works) but does not describe what significant means. For quantification of significant benefits, it just refers to the gas and electricity CBA methodology.

On the one hand, it seems reasonable to ask for analyses to show "significant" impacts and show significant benefits on key political ambitions. However, the TEN-E process has clearly shown that it is difficult to give a clear metric for "significance". The main options to interpret "significance" are

- "Likeliness" of a benefit, i.e. the probability of a positive benefit in an optimistic case, base case or pessimistic case, as determined through a sensitivity analysis. The challenge is that in this approach we still need to define what is an appropriate distribution of a parameter, which do we include in the sensitivity analysis, how are they correlated, etc.
- Define thresholds for volumes/sizes of projects: this approach is not practical as there is no sensible hard coded threshold to define "significant". In addition, smaller projects would automatically be excluded from the process.

- Fixed benefit over cost ratio which defines “significant”. This ratio is comparable throughout different applicants and allows for the definition of a single-value threshold for significance. Similarly, the definition of a certain social discount rate for the calculation of a project’s socioeconomic NPV, implicitly defines a threshold for the significance of benefits in itself. If benefits are not significant, the NPV will be negative with the considered social discount rate. Lowering the discount rate would turn the NPV positive and deem project benefits significant in comparison to other societal opportunities to invest. The problem is it becomes a non-rational discussion on which % or threshold makes sense. Additionally, not necessarily all benefits are monetised throughout the different application stages and can be accounted for in the benefit-cost ratio. These qualitatively described benefits, may be significant anyway but would be neglected by a threshold on a monetary benefit-cost ratio.
- A more qualitative approach, which as always, circumvents the problem of defining ex-ante fixed thresholds, but which at the same time is not measurable and does not help to make projects comparable. However, a detailed, monetised description of benefits is only foreseen for the advanced application stages and high-volume projects. Therefore, a qualitative approach to defining significance can be used for earlier application stages and smaller scale projects.

Following the reasoning outlined above, it is justifiable to use a two-folded approach to show the significance of benefits, differentiating throughout application stages and project sizes. I.e., the proof of significance is aligned with the simplified and detailed approaches used to describe the individual indicators of the economic analysis in the different stages of the process.

Table 5 Proof of significance: simple vs. detailed approach

Simple	Detailed
Based on the simplified quantification approaches for the individual indicators of the economic analysis, a rough estimation of the benefits provided by a project is calculated. A benefit-cost ratio based on these figures can thus be used as an eligibility criterion (benefit-cost ratio >1, see chapter 2.6), but is insufficient to show significance of the benefits. Therefore, against the background of how “significance” is termed in the Regulation (EU) 347/2013 and how it is put into practice in the TEN-E process, we suggest a qualitative approach, whereby the project promoter needs to describe why the project’s societal benefits are significant. In the process of project selection for the CB-RES status and for grants it would be up to the Group for c-b RES projects and the CEF coordination committee to determine whether they agree with the provided reasoning of “significance”.[47]	Based on the detailed quantification approaches for the indicators of the economic analysis, a benefit-cost ratio is established. To do so a certain social discount rate is used. A threshold for significance can either be set equal to the threshold for eligibility (positive NPV; i.e. benefit-cost ratio > 1), in consideration of an increased social discount rate, which implies a measure for significance in itself. Or, the threshold on the benefit-cost ratio could be set even higher than >1, using the standard social discount rate. In any case, defining a suitable threshold is not an easy task. Therefore, we suggest using the standard discount rates (taken from DG REGIO) and a positive NPV as thresholds. Beyond these thresholds, a ranking approach can be used for scoring. Projects showing an above average benefit-cost ratio receive an above average scoring and vice versa.[48] Additionally, the significance of benefits, which have not been monetised via a detailed approach and are not taken into account in the benefit-cost ratio can be described qualitatively. The project’s scoring can be increased to account for these additional benefits.

[47] The significance of the societal benefits can be scored according to the scale outlined in Table 12 (0 – very poor to 5 – excellent). All projects that meet the eligibility criteria of a benefit-cost ratio > 1 receive a score equal or higher to 2 – fair.
[48] Similar to the simple approach, scoring is done according to the scale outlined in Table 12. All projects that meet the eligibility criteria of a benefit-cost ratio > 1 receive a score equal or higher to score 2 – fair.

Application Stage: II, III, IV[49] Threshold: -	Application Stage: IV Threshold: large-scale project

2.5 Subtask 1.3 Methodology for grants for works (based on financial analysis)

The aim of this subtask is to develop a methodology that delivers financial details required for each project undergoing the CBA applying for grants for works. The steps include:

- Assess whether the project under consideration fulfils financial eligibility criteria – commercial non-viability without support by EU funds, compliance with co-financing rates and financial sustainability;
- Quantify the amount of grants for works required from CEF to implement the project;
- Provide a robust financial dataset to be used in the following process of grant processing.

2.5.1 Methodological approach

The financial analysis described in this chapter contains four analytical modules: Assessing commercial viability, quantifying the amount of grants, calculating the co-financing rate and examining financial sustainability (see Figure 9).

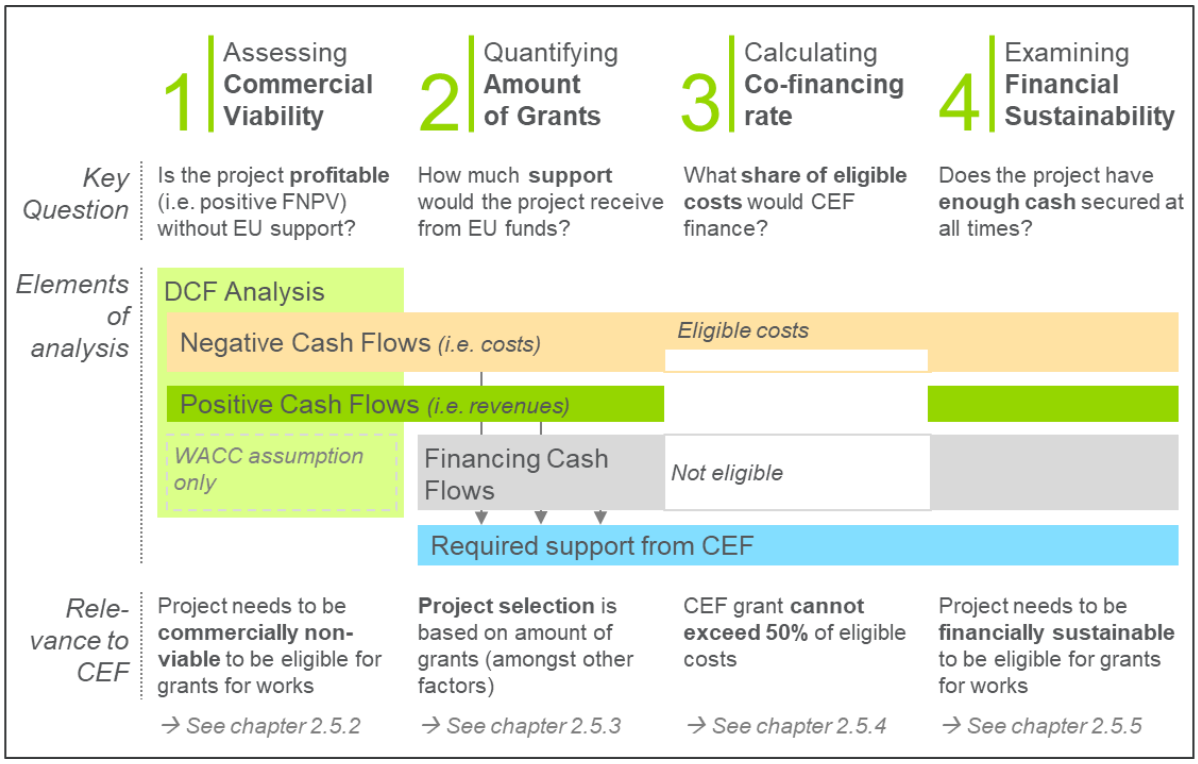

Figure 9: High-level schematic to methodological approach to the financial analysis of project projects

The first module employs a common Discounted Cash Flow (DCF) analysis which yields the Financial Net Present Value (FNPV) of the project under market conditions. If the FNPV of a project turns out to be negative, the project would not be commercially viable and is hence eligible for grants for works in this aspect.

[49] The PCI status is only granted at the end of stage II, therefore, no proof of significance is needed for stage I.

In the next module, all expenditure and revenues including financing costs are then considered to calculate the funding gap that needs to be covered by a CEF grant in order to ensure project realisation.

In the third step, costs that are not eligible for EU funding are subtracted from the previously modelled costs. The co-financing rate of the project – the ratio of the amount of grants to eligible costs – must not exceed 50%.

Lastly, all project cash flows including those from potential CEF funding are examined at a yearly basis to assess whether the project can cover its cash outflows at all times. If this is not the case, the project is not financially sustainable and hence not eligible for grants for works.

Financing costs are taken into account in different ways through the financial analysis:

- When assessing commercial viability, financing costs are implicitly contained through discounting with a WACC assumption;
- When quantifying the amount of grants, financing costs are explicitly calculated through full financial modelling (profit & loss statement, balance sheet);
- When calculating the co-financing rate, financing costs are excluded assuming that they are not eligible and
- When examining financial sustainability, financing costs are included as long as they are cash effective (e.g. through interest payments).

Each of the four modules are explained in more detail in the following chapters.

2.5.2 Assessment of commercial viability

Decisions on the commercial viability of investment projects are usually based on the projection of cash flows using a **DCF method**. The cash flows of the project are forecasted over the reference period appropriate for the type of the project, which usually covers the entire life cycle of the project. The financial outflows comprise investment, operational and replacement costs of the project in the reference period. The financial inflows are market revenues, payments from national support schemes and other sources of financing which depend on the type of project and type of support used for financing of the project.

The cash flows of each year are then discounted with a discount rate that is equal to the weighted average cost of capital (WACC). The method therefore implies all financing costs such as debt service or return on equity to be included in the WACC. In terms of the DG REGIO methodology, this would be equivalent to the financial discount rate.

Finally, the discounted cash flows are added resulting in the FNPV. A positive FNPV indicates that an investment is commercially viable while a negative FNPV shows that the investment is not able to cover its cost of capital. Only projects with negative FNPV are eligible for CEF grants for works.

The most important assumptions and inputs to the DCF calculation are discussed in more detail in the following sections.

2.5.2.1 General considerations

The WACC used as discount rate potentially has a large influence on the FNPV calculation, hence its value must be carefully chosen. The DG REGIO CBA refers to the Article 19 (Discounting of cash flows) of Commission Delegated Regulation (EU) No 480/2014, for the programming period 2014-2020, which recommends that a 4 % discount rate in real terms is considered as the reference parameter for the opportunity cost of capital in the long term. For the sake of simplicity, this rate could be used as a fixed value for CEF applications. Many renewable projects, especially in highly investable Member States and with mature technologies, achieve financing costs not exceeding this value. On the other hand, some Member States generally experience higher costs of capital. The lower credit rating of some EU Member States and the related increased cost of capital is an

important aspect in the evaluation of c-b RES project as these countries might be considered as convenient projects for c-b projects in terms of the geographical distribution and available RES potential. Additionally, the project's technology or company specifics may lead to WACCs significantly above 4%. In that case, projects would appear more profitable than they actually are, up to the possibility of relevant projects being ineligible due to an artificially positive FNPV.

Hence, following DG REGIO's CBA guide, applicants should have the flexibility to use a WACC tailored to the project specifics. This potentially adds a step to the process of examining the applications but is required not to exclude attractive projects due to a rigid WACC. Furthermore, an abuse of this flexibility is not a major concern: firstly, the WACC does not influence the amount of grants which is calculated using the actual financing plan (see chapter 2.5.3). Secondly, deviations from the standard rate of 4% would need to be justified by quoting industry benchmarks, national data or annual reports.

Figure 10 illustrates how different risk profiles of countries lead to different WACCs in the example of onshore wind. Another aspect influencing the WACC is the technology of the energy generation as shown in Table 6. It should be noted that both studies report nominal WACCs, while DG REGIO's suggested WACC of 4% is in real terms. This means that the values shown below need to be reduced by 1 – 2 %-points to reflect real WACCs. Thereby it can be seen that some technologies in some regions can be financed with a 4% real WACC. On the other hand, the presented figures are partly well over 4% and therefore necessitate an adjustment of the discount rate based on Member State-specific macroeconomic conditions and the RES sub-sector as prescribed in the DG REGIO methodology.

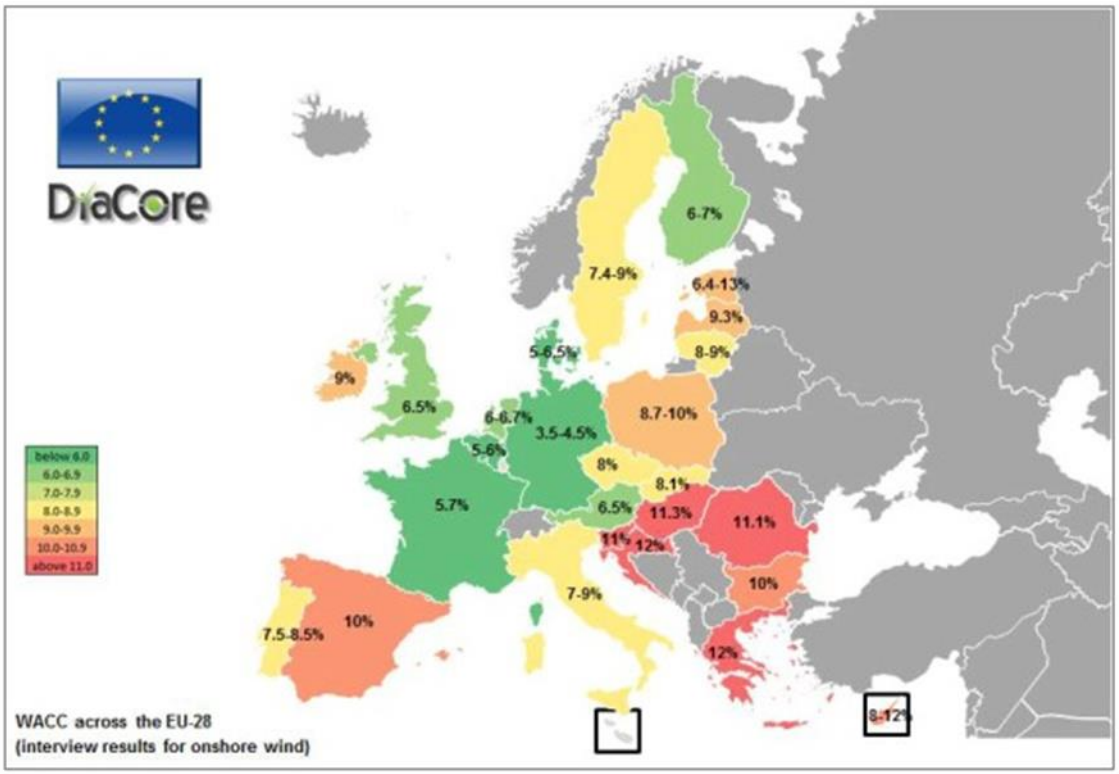

Figure 10: WACC for onshore wind projects across EU-28. Source: DiaCore (2016), The impact of risks in renewable energy investments and the role of smart policies.

Table 6: Levered discount rates expected by investors per country and RES technology. Source: Renewable energy discount rate survey results – 2017 (Grant Thornton, 2018)

	Hydroelectric	Photovoltaic	Onshore wind	Offshore wind
France	6.25%	6.50%	7.25%	9.75%
Germany	x	5.50%	6.50%	8.00%
Nordics	5.75%	7.25%	7.25%	8.25%
Spain	x	7.75%	8.50%	x
United Kingdom	7.75%	7.25%	8.25%	9.00%
Italy	6.25%	8.00%	9.00%	x

The prices used for the forecasting should be usually set in constant prices fixed at a base-year or with current prices adjusted by the consumer price index. If the current prices are used, then the nominal financial discount rate must be adopted.

In case that VAT is recoverable, the financial inflows and outflows should be always netted of VAT. If the costs or revenues are not recoverable, VAT must be included. Direct taxes should be considered only in evaluation of financial sustainability.

The main aggregated components of the financial analysis are shown in Table 7. Each cash flow line item is the aggregated outcome of detailed evaluation of individual sources of cash flows. Further detail to the particular elements of aggregated cash flows is presented in the following sections.

Table 7 Overview of aggregated elements included in financial analysis

Component	
Investment period	years
Operative revenues	
Revenues from energy sales	EUR
Revenues from national support scheme	EUR
Residual value	EUR
Total cash inflows	**EUR**
OPEX	
Maintenance costs	EUR
Land lease	EUR
Insurance	EUR
Transaction costs of energy sales	EUR
Operating expenses	EUR
Other costs	EUR
Capital expenditures	
Main technology investment costs	EUR
Foundation	EUR
Network connection cost (if applicable)	EUR
Planning costs	EUR
Other side investment costs	EUR
Total cash outflows	**EUR**
Total cash flows	**EUR**
Discount rate (WACC)	**%**
Discount factor	#
Discounted total cash flows	EUR
FNPV	**EUR**

2.5.2.2 Investment cost, replacement costs and residual value

Investment costs represent a major share of most RES project's financial outflows. The investment phase of the project includes all capital costs of all fixed and non-fixed assets and other expenditures in the initial stage of the project. Typical cost elements in the phases of planning and construction of RES projects are:

- Technological plant installations and equipment (turbine, etc.)
- Land acquisition (unless land is leased) and purchase of rights of way (at this point eligibility of costs for funding is not considered since the commercial viability is assessed)
- Road access
- Foundation of the RES plant
- Equipment required for the construction
- Connection to the electricity, heat or gas network
- Labour costs
- Costs related to planning and permitting (environmental impact assessment, permits, etc.)
- Mitigation measures for environmental protection
- Decommissioning/dismantling/demolition costs borne when rehabilitating old energy-generation facilities

Replacement costs represent the cost of assets with shorter life cycle than the life cycle of the project. These assets must be replaced during the project life cycle.

In case that the life cycle of the fixed assets goes beyond the reference period, the **residual value** of not-yet exhausted economic life of the asset must be calculated as a net present value of cash flows in the remaining life years of the operation. The DG REGIO CBA includes further possibilities of calculation the residual value of assets: 1) by computing the value of all assets and liabilities based on standard accounting depreciation formula (non-revenue generating projects and project with very long project life cycles), 2) by considering the residual market value.

2.5.2.3 Operating costs

The costs during the operating phase of the project include all costs related to the operation and maintenance of the RES installation, as well as other services. Furthermore, expenditures for dismantling after decommissioning of large assets at the end of their life cycle are included. Examples of operating costs are:

- Periodic maintenance and repairing costs
- Land lease costs (if land is not purchased)
- Costs related to electricity, heat or gas use
- Transaction costs of energy sales
- Insurance costs
- Labour costs
- General and variable overheads

2.5.2.4 Operating revenues

Operating revenues are the cash flows received during the operating phase of the project. These include mainly:

- Revenues from energy sales
- Revenues from national support schemes
- Other forms of revenues resulting from regulated environment

Subsidies and state aid from Member States such as feed-in tariffs or investment aid must be included as revenue. One reason for this is that if subsidies were excluded, projects that would be

commercially viable under existing national support schemes would appear commercially non-viable and hence be eligible for CEF grants. This would potentially lead to a mere substitution of Member State grants by Union grants which is not the purpose of CEF. Another reason is that the exclusion of subsidies from revenues would create the risk of overfunding due to parallel national and EU support.

2.5.3 Quantification of amount of grants for works

Once the eligibility for grants for works of a project project is confirmed through the assessment of commercial viability (chapter 2.5.2), the amount of grants for works that the project would receive needs to be calculated. Pursuant to Article 7 (5) of the CEF regulation, the aim of this analysis is hence to determine the amount of the grant which ensures that the project materialises or becomes commercially viable. Simultaneously it is necessary to ensure that the project will not be over-financed. Article 7 (5) also states that the grant size "shall be proportionate to the cost savings and/or benefits" from the economic analysis in chapter 2.4.

To warrant this, all costs and all revenues must be summed up with the remaining costs being equal to the amount of grants. All payments from national support schemes must be for instance be included to avoid overfunding.

2.5.3.1 Financing costs

Costs of financing are often not eligible; they must however be included in the calculation of the grant size to make sure the funding gap is fully closed by the amount of grants.

A precise way to calculate a grant that does neither under- nor overfund would be to base the calculation on a full financial model with profit & loss statement and balance sheet. There would be no discounting to account for financing costs since these would be included in the model based on the actual project financing plan including equity investments, debt financing, interest rates etc. Cost of equity would also not be included as a discounting factor, but as a result of the equity investments and profits in the financial model. The implied return on equity would need to be within typical market values. The size of the grant would then be calculated as a target value of a payment in the initial project phase that makes the project just profitable enough to be viable in the market.

Current methodologies in contrast usually account for financing costs not through a detailed financing plan as suggested here. Instead, revenues and expenditure are discounted using the WACC which implicitly contains the financing costs as in the DCF analysis in chapter 2.5.2. This methodology has the advantage that it does not require judgements e.g. on what "fair" returns on equity are which may in some cases be complex. Also, it has been used for years and is known to many stakeholders. On the other hand, the not always transparent WACC determination (see chapter 2.5.2.1) might leave room for projects receiving more funds than needed. If applicants were therefore required to deliver thorough justifications for their WACC though, one is confronted with the same complexities as for the proper financial model.

2.5.3.2 Amount of grants for joint support schemes

Assessing economic and financial impacts is **more challenging for joint support schemes than for single projects**. For instance, the fact that the outcome of tenders is not known ex ante leads to uncertainties regarding the input parameters. The system integration costs or effects on security of supply are already difficult to model in the case of a single project, but the uncertain location of projects being built through a joint support scheme further increase the related uncertainties.

In the financial analysis discussed in this chapter, the four steps require different attention in the case of examining a joint support scheme:

- Commercial non-viability (chapter 2.5.2) does not need to be demonstrated since support schemes are by definition non-profitable one-way cash flows;

- Amount of grants (chapter 2.5.3) requires a shift from the cost-based approach presented above towards a “willingness-to-pay” approach, which results from the cost of alternative options to support renewables. This is discussed in more detail below;
- Co-financing rates (chapter 2.5.4) need to comply with CEF rules. However, since the cost structure of awarded projects is not disclosed, outside-in assumptions need to be made. This is discussed in more detail below;
- Financial sustainability (chapter 2.5.5) does not need to be demonstrated since project failure due to insolvency is massively less likely for governments than for private entities.

Due to these changes compared to project-specific support, it is possible that applicants which are Member States may only go through the c-b RES process **up to Stage III to receive grants for studies**. This would require the applicants (i.e. the Member State intending to cooperate on the joint support scheme) to complete all elements of the CBA as shown in Figure 3. Specifically, this would need to contain:

- CBA elements 1-4 (project description, chapters 2.3.2, 2.3.3, 2.3.4, 2.3.5), which applies to joint support schemes as for single projects;
- CBA elements 5-6 (cooperation mechanism and added value of cooperation, chapters 2.3.6 and o), which lie in the nature of the joint support scheme and should be thoroughly outlined;
- CBA element 7 (economic analysis, chapter 2.4), which is, as discussed above, not trivial for joint support schemes. Applicants should calculate the benefits of the joint support scheme compared to a purely national support scheme on an aggregated basis assuming, among others, likely changes in costs of and revenues for projects and resulting changes in support costs.
- CBA element 8 (financial analysis, this chapter) would not have to be applied in a detailed manner, since at this stage (i.e. all stages up to and including request for grants for technical in-depth studies) a detailed approach would not be required. Still, two brief analyses would be needed in compliance with the CBA elements (see Figure 3):
    - Reasonable forecasts on the costs of the joint support scheme and an outline what the willingness to pay for each Member State is. The difference between the two figures would yield the indicative potential grant size. Most joint support schemes are initiated to save costs, meaning that there is no positive grant size. At this stage this is no issue, however, since a funding gap is an eligibility criterion only in the next stage (grants for works). Member States can hence apply for grants for in-depth technical studies even if they do not intend to apply for grants for works later;
    - An indicative co-financing rate (in case there is an indicative positive grant size). This could be obtained by subtracting a high-level estimate of project financing costs (as proxy for non-eligible costs) from joint support scheme costs and putting the indicative grant in relation to this (which is only applicable if a grant for works is envisaged);
- CBA element 9 (risk analysis, chapter 2.5.6) should focus on different potential costs of the joint support scheme to quantify uncertainties associated with the cost of support (e.g. the outcome of competitive tenders to be conducted or the market prices to be subtracted in case of a contract-for-difference support scheme).

When taking the application further to **Stage IV to receive grants for the conduction of the joint support scheme**, the amount of grants needs to be explained further. As mentioned above, the grant would cover the gap between the expected cost of the joint support scheme and the willingness-to-pay from the Member State. Usually the purpose of joint schemes is to lower support costs, meaning that there would be no gap to be covered and hence no CEF grant needed. Consequently, joint support schemes seeking a CEF grant for works would need to demonstrate that they are related to additional costs and that these costs are justified. In terms of the CBA elements, this would mean:

- CBA element 6 (added value of cooperation) would need to present compelling reasoning which added value justifies the premium on support costs that CEF would bear and what the premium is exactly resulting from. This could include the promotion of technological innovation through the support scheme, regulatory convergence, or quantifiable benefits like reduced pollution or GHG emissions as shown in the economic analysis;
- CBA element 8 (financial analysis, this chapter) would need to

- determine the grant size. For a joint support scheme, the project-specific cost-based approach has to be replaced by a willingness-to-pay approach. The willingness to pay by Member States needs to be demonstrated by evidence-backed figures on alternative costs of RES expansion, e.g. through payments for statistical transfer or purely national support. Then the expected support costs under the joint support scheme must be estimated, e.g. based on the technical studies in the previous stage. The remaining gap between the willingness to pay and the expected cost of the joint support scheme may then be eligible for CEF support and define the funding gap. Since the grant size is static but the cost of support may not be known upfront (e.g. because it results from a competitive auction), this step is related to some uncertainty;
- show compliance with CEF co-financing limits must be demonstrated. This could be done by making an outside-in estimate of the cost structure of projects receiving support and subtracting non-eligible costs e.g. for financing. The CEF grant must then be below 50% of eligible costs as discussed in more detail in chapter 2.5.4.

As the determination of the grant size is necessarily subject to uncertain assumptions (even more than in the single project case), the added value of the joint support scheme must be verified well to ensure meaningful use of CEF resources.

2.5.3.3 Interaction of CEF grants with national grant support schemes

As a supranational support scheme, CEF grants will coexist with national support schemes meaning that project developers might consider both of these funding opportunities. This leads to two conceivable risks:

- CEF grants might replace national grants, meaning that no additional funding is provided for RES projects;
- Projects might receive more funding than required.

Replacing national grants can never be fully avoided. However, the award process proposed in this report is assumed to be complementary to most national support schemes: Firstly, most national support schemes follow a market-based allocation of funding, while CEF follows a cost-based logic. This means that projects with higher funding needs being financed by CEF would likely not have been able to obtain a national grant in a competitive tender. Secondly, the CEF award process appreciates EU added value and implicitly finances costs associated with providing this added value – since national support schemes are usually not concerned with that, it is assumed that CEF projects will be fairly complementary to those competing in national auctions.

Due to the grant calculation process discussed above, overfunding due to national grants can largely be excluded. The CEF grant is designed to close the funding gap that remains after all revenues, including those from national support schemes. Hence, project promoters should apply for national grants first and submit their CEF application once they have confirmation of the national grant (if any). The CEF grant is then calculated taking this into account to avoid overfunding. Following this order is also in the interest of the project developer due to severe risks otherwise:

- If the developer simultaneously applies for a CEF grant and participates in a national tender, there are major uncertainties:
  - If the financials behind the application assume both a CEF grant and a national grant, the developer risks receiving a poor CEF CBA rating due to the inherent uncertainty of the bid;
  - If the national tender is only regarded as a back-up if no CEF grant is awarded, the developer risks non-realisation penalties in case both CEF and national support is awarded;
- If the developer participates in a national tender first and then still requires a CEF grant, the initial bid was set too low, risking a loss.

2.5.4 Calculating co-financing rates

The aim of this part is to ensure that CEF funding does not account for an overproportionate amount of project revenues. In the previous step the amount of grants for works was identified which is now expressed as a percentage of total eligible costs. This ratio is highly relevant in the award process in the context of maximal co-financing rates for Union operational programmes. CEF for instance prescribes a co-financing rate of up to 50%.

Based on cost modelling from the previous assessments, non-eligible cost items will be deducted to comply with the respective funding regulation. There is however no universally applicable list of non-eligible items since eligible costs are regulated in the rules for every operational programme and even in individual calls differently. In the CEF Energy general model agreement for example, ineligible costs include:

- Reckless expenditure
- Deductible VAT
- Indirect costs
- Debt service
- Return on capital
- Costs declared under other EU grants

Also, land acquisition costs are not eligible under CEF since land can be resold after the project lifetime and should hence not be subsidised (note that land lease costs may indeed be an eligible cost as it has no residual value but is expenditure and not an investment).

Listing costs covered by other EU funds as non-eligible excludes the risk of double funding by the Union. For instance, a project promoter might receive a grant from ETS Innovation Fund for additional costs occurred due to an innovative feature to the project. These additional costs would then be non-eligible and would in no case be funded by CEF after already being funded by the Innovation fund.

2.5.4.1 State aid

CEF as a centrally managed Union fund does not constitute State aid pursuant to the current State aid guidelines (EC Communication 2014/C 200/01 (81)). However, the co-financing rate of up to 50% must also take into account potential national support payments. Project promoters must therefore add all support payments they intend to receive from CEF, other Union funds or Member States and divide that sum by the total eligible cost. This ratio must then not exceed 50% or the respective applicable co-financing rate.

Beyond this, it should not be the role of CEF to evaluate Members States' support schemes for compliance with State aid guidelines. It is also expected that most projects applying for CEF will not participate in national support tenders as laid out above in chapter 2.5.3.3.

2.5.4.2 Co-financing rates and blending

For EU funds in general, the co-financing rate might be up to 100% of eligible costs. Cohesion Funds have an EU-wide set co-financing rate which is generally 85%. The co-financing rates in European Structural and Investment Funds (ESIF) are set separately for different programmes based on cooperation with Member States to address specific needs in every country and it should generally be around 70% of eligible costs. The co-financing rate can also be based on company category (e. g. SME) and in case of RES also on technology used.

For c-b RES projects, up to 50% of eligible costs can be covered by CEF funding. If CEF grants and market revenues together are not sufficient to cover all costs, the project developer needs to include also other support schemes from Member States. This means that the funding must be covered by blending/combination of financial instruments, for example:

- Combining a CEF grant with a financial instrument from Union funds. A prime example for this would be InvestEU. The current proposal[50] foresees the combination of InvestEU guarantees with support from other EU funds in Article 6;
- Blending a CEF grant with a financial instrument from a public finance institution, e.g. EIB. This could again be organised in blending calls;
- Blending a CEF grant with a financial instrument from a national support scheme, where available;
- Blending a CEF grant with a financial instrument from a private financial institution.

The politically agreed CEF regulation defines "blending operations" as "actions supported by the EU budget, […] combining non-repayable forms of support and/or financial instruments and/or budgetary guarantees from the EU budget with repayable forms of support from development or other public finance institutions, as well as from commercial finance institutions and investors", i.e. support payments financed through the MFF combined with financial instruments from outside the MFF. The financial regulation (EU, Euratom 2018/1046) establishes a similar notion of "blending" in its definition of a "blending facility or platform" when referring to "combining non-repayable forms of support and/or financial instruments and/or budgetary guarantees from the budget and repayable forms of support from development or other public finance institutions, as well as from private-sector finance institutions and private-sector investors".

Blending is a form to increase the leverage effect of individual funds and mobilise available funding. It combines different sources of support which can in many cases ensure the materialisation of projects which would not materialise without the support. As every fund/call has specifically defined eligibilities and eligible costs which do not always match the specific financing needs or phases of life cycle of a complex project, blending enables to address them by a combination of different sources of financing. Recitals 226 et seq. of the financial regulation explicitly state that it "should be possible to establish blending facilities […] for one or more of the Connecting Europe Facility (CEF) sectors. Such blending facilities could finance blending operations which are actions combining non-reimbursable forms of support, such as support from Member States' budgets, CEF grants, the ESI Funds and financial instruments from the Union budget, including combinations of CEF equity and CEF debt financial instruments and financing from the EIB Group, from national promotional banks, from development or other finance institutions, from investors and private financial support".

In the next Multiannual Financial Framework 2021 - 2027, the existing heterogeneous and fragmented portfolio with different eligibility rules will be replaced by a single structure for rules of funds under Invest EU. The simplified process of funding rules has a direct impact on possible interactions as the Invest EU regulation foresees a complementarity with Horizon Europe, CEF, LIFE, ESIF and the ETS Innovation fund. In contrast to the MFF 2014 – 2020, blending with financing instruments from other programmes will be implemented using one single set of applicable Invest EU rules for the entire project. This aims to ensure that distortions between the programmes are avoided.

2.5.5 Assessment of financial sustainability

The aim of the final step of the financial analysis is to make sure that the project secured all cash flows during the whole life of the project and will not be interrupted or terminated due to cash constraints. The financial sustainability analysis is based on cash flow analysis as DCF but focuses on the cash balance in each year rather than the sum of cash flows over the project's life cycle. In case that the cash balance in any given year is negative, the project would not be sustainable and hence not eligible for CEF funding.

2.5.5.1 General considerations

To examine the cash flows of each year, all cash flows contained in the previous analyses are used (see chapters 2.5.2.3, 2.5.2.4 and 2.5.3). Only the residual value is not included in the financial

[50] Proposal for a Regulation of the European Parliament and of the Council establishing the InvestEU Programme from 27 March 2019

sustainability assessment since it does by definition not provide cash flows during the life cycle of a project. The difference between the assessment of commercial viability and financial sustainability is that the former includes financing costs only implicitly through an assumed WACC, while the latter reflects actual inflows of funds and costs of capital based on the individual project's financing plan. The nature and derivation of financing cash flows is outlined in more detail in the next section.

2.5.5.2 Financing cash flows

Over the life cycle of a project, there are both positive and negative financing cash flows. In the initial investment phase of the project, operating and investing cash flows are usually strongly negative due to capital expenditures. Consequently, positive financing cash flows must compensate for this to yield an overall positive cash balance. This must also be the case in any other period where the financial outflows outweigh the inflows of the project. Sources of positive financing cash flows include:

- Equity investments
- Long-term loans
- Short-term credit facilities

Negative financial cash flows include interest payments and dividends to equity owners. The calculation of these cashflows will be based on the project specific financing plan.

Figure 11 shows schematic examples of the calculations performed in the entire financial analysis. For the assessment of financial sustainability, the example reflects an early year of the project with high investment cash outflows that require large cash inflows from borrowing.

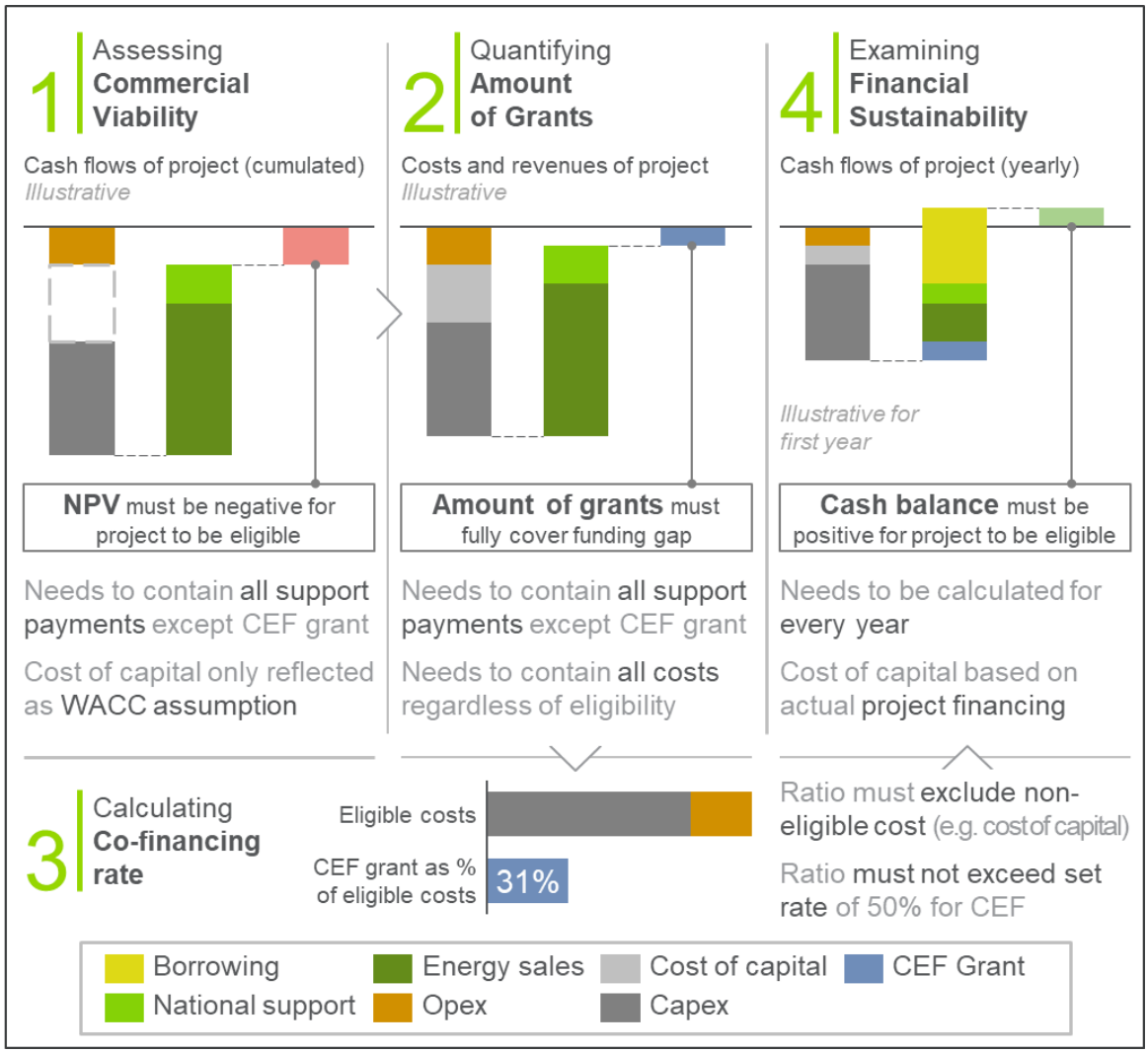

Figure 11: Illustration of calculations to be performed in each step of the financial analysis.

2.5.6 Sensitivities and risk assessment

The financial analyses conducted in the application process are subject to both variable quantitative assumptions and insecure qualitative developments. To avoid overfunding or non-realisation of projects, all projects that enter the application stage for grants for works shall undergo a sensitivity and risk analysis.

2.5.6.1 Quantitative sensitivity analysis

The aim of the sensitivity analysis is to assess how changes of input parameter assumptions (variables) affect the overall financial performance (e.g. the FNPV) of the project.

In a first step “critical” variables are identified by varying each input variable by 1%. If the variation of a given variable by 1% changes the value of FNPV by more than 1%, the variable is considered “critical”. Since this analysis does not entail significant transaction costs, it should always be conducted for key variables such as technology costs. Input variables that should be considered in this context include the following:

- WACC
- number of years necessary for the realisation of the infrastructure;
- investment costs (incl. technology cost assumptions; as disaggregated as possible);
- operation costs (as disaggregated as possible);
- maintenance costs;
- market price or opportunity cost of energy sources and products;
- estimated willingness-to-pay for increased energy reliability of security of supply.

In a second step, “tipping points” should be identified for the set of previously identified critical variables. Tipping points represent the value of a variable which, if exceeded, changes the decision about the financial performance of the project. For example, a project might result in a negative FNPV at the assumed market power price. If the power price used in the FNPV calculation however exceeds the tipping point, the FNPV of the project will be positive.

Finally, a scenario analysis including pessimistic and optimistic scenarios should be conducted. The design of scenarios must be aligned with the scenarios used in the economic analysis (see chapter 2.4.5). For projects with a significant risk exposure, a probabilistic risk analysis is required. This means that for each of critical variable, probabilities are assigned to the potential scenario values. In line with the DG REGIO CBA methodology, the multiplication of each variable value with the respective probability leads to the expected base case. The results of this simulation are further assessed in terms of commercial viability, financial sustainability and funding requirements.

2.5.6.2 Qualitative risk analysis

The sensitivity analysis evaluating risks with possible quantification should be further complemented by qualitative risks analysis which includes a list of adverse events with potentially negative impact on project performance or realisation. The qualitative risks should be linked to sensitivity analysis and should create the basis for explanation of possible changes in variables. Every significant risk should be also evaluated in terms of probability and the actions leading to its mitigation should be presented. The existing CBA methodologies describe following risks in the energy sector:

Table 5 Potential risks in c-b RES projects:

Stage	Risk
Regulatory / policy / political	Delay in or cancellation of cooperation negotiations
	Change in scope of cooperation between involved Member States
	Changes of policy and economic instruments impacting the financial basis of the project (e.g. renewable energy source support schemes, EU ETS design resulting in unexpected changes in CO_2 and thus energy prices)
	Additional changes in energy policy (e.g. concerning the discontinuation of certain types of energy sources and fuels)
	Changes of environmental requirements
Demand	Less demand than projected e.g. in RES-H&C
	Lower energy market prices than estimated
Innovation in energy	New production/transmission or energy storage technology making the one in the project obsolete
Administrative	Delay or denial of permits
	Grid connection application delays or rejection
Land acquisition	Land costs higher than predicted
	Higher costs for the acquisition of rights of way
	Procedural delays
Procurement	Procedural delays
	Delays in parts of the supply chain
Construction	Project cost overruns
	Delays due to unexpected technical difficulties (such as the installation of undersea pipelines or underground power cables)
	Delays in complementary works outside the project promoter's control (e.g. additional roads / paths to be build)
	Flooding, landslides, etc.
	Accidents
Operation	Maintenance and repair costs that are higher than predicted
	Accumulation of technical breakdowns
	Long out-of-service time for accident or external causes (earthquake, flood, sabotage, etc.)
	Frequent curtailment of generation asset
Financial	Changes in the tariff system
	Changes in the system of incentives
	Discontinuation of financing sources, e.g. termination of loan
	Inadequate estimate of additional revenues (e.g. balancing power)
	Delay or other challenges in the implementation of the cooperation mechanism between Member States (e.g. regarding flows of information and payments)
Climate	Adverse effects due to climate change, e.g. disrupted feed-in due to grid instability, changes in resource patterns (e.g. sun and wind), drastic changes in demand for project output.

2.6 Application procedure for small-/medium-scale c-b RES projects and/or small/medium grants (summary)

Previous chapters outlined a rigorous application procedure that is applicable to a wide range of projects and requires an increasing level of detail for advanced application stages (and higher grant sizes) – from a simple, qualitative description in stage I (preparatory studies) to a full-fledged, quantitative assessment of the project in stage IV (grants for works).

However, the chosen flexible approach allows for a simplified application procedure for small-scale RES projects or large-scale projects in early application stages, as illustrated in Figure 12. The simplified application procedure is applicable for projects below a certain threshold on investment cost or grant size (see section 2.4.1).

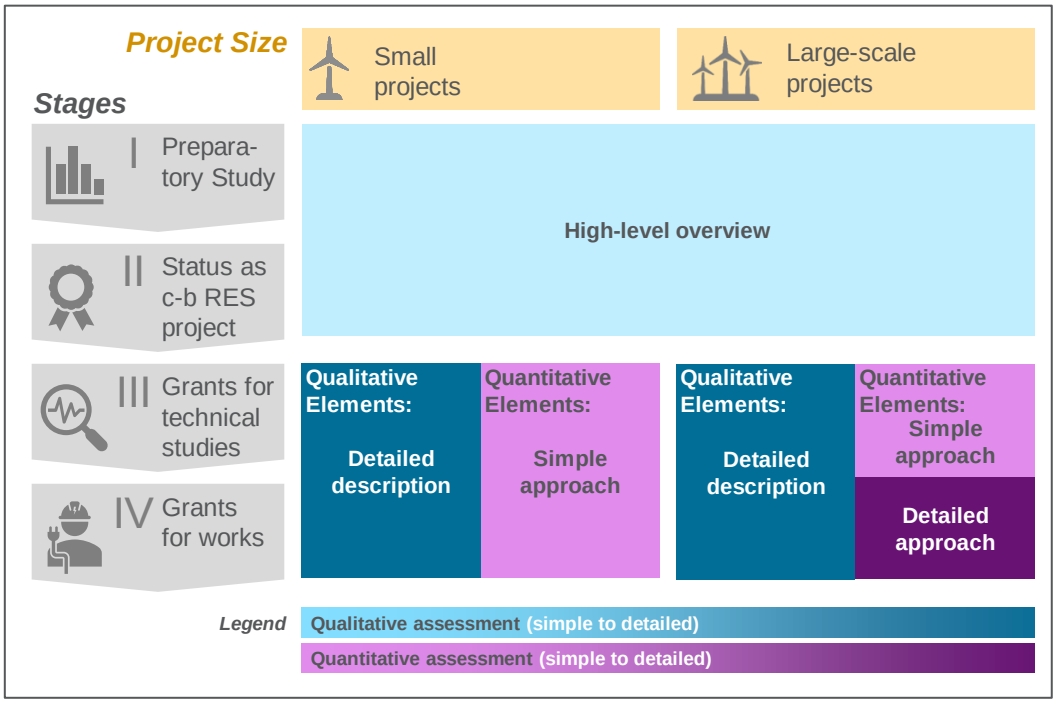

Figure 12: Applicability of different assessment approaches (qualitative, simple/detailed quantification) for different project sizes and application stages (source: Navigant)

In the following, therefore, a summary of the simplified application procedure and its nine elements is given, to underpin that project promoters of small-scale projects will not be overburdened by the suggested approach.

Application Element 1: Presentation of the socio-economic and energy market context

The implementation context of a project is presented to understand which direct and indirect impact the project can potentially develop. Therefore, for all involved Member States a description is given, of the socio-economic trend, status quo and target setting (NECP) for the energy system, as well as the energy market conditions. The context helps to situate the c-b RES project and allows to identify whether the subsequent objective and proposed project is suitable for this context.

Application Element 2: Definition of objectives

A description of the project's contributions to the energy system of the host country, the cooperating Member States and the European energy system is given. The outlined objectives should refer to the objectives mentioned in the CEF regulation. Moreover, promoters may refer to the specific objectives

of the c-b RES funding line, such as the promotion of cross-border cooperation. The objectives outlined here will be further assessed in the economic analysis.

Application Element 3: Project identification

The project is described on a high-level including information and data about technology, size and features. In addition, the responsible bodies project implementation (e.g. the project developer, the Member State, TSO, DSO) are described.

Application Element 4: Technical feasibility and environmental sustainability

Furthermore, the technical design of the project is described alongside an implementation schedule and an analysis of the demand for the projects output. Likewise, a high-level statement on environmental considerations, including climate change other environmental impacts is developed.

Application Element 5: Cooperation mechanism involved

Within this element the scope, legal embedding and maturity of the involved cooperation mechanism needs to be described. In particular, project promoters need to identify the applicable cooperation mechanism between Member States as defined in the RED II (statistical transfer, joint project, joint support scheme). Moreover, the status of the cooperation agreement needs to be clearly described, ranging from mere information of the Member States to a signed cooperation agreement.

Application Element 6: Added value of cooperation

Here, project promoters need to describe the added value of the envisaged cooperation project. To do so, promoters should highlight the project's added value of cooperation for policy coordination, policy convergence, regulatory innovation, technology innovation and local job creation. Thus, project promoters should elaborate on the more qualitative benefits of cooperation that cannot be captured by the economic analysis, which focuses on the quantifiable benefit categories mentioned by the CEF regulation.

Application element 7: Economic analysis

Goal of the economic analysis is to assess whether benefits of the cooperation project outweigh its cost from a wholistic, societal perspective. To do so, the economic analysis captures the quantifiable added value of cooperation to the extent possible, in addition to the qualitative description of cooperation benefits in element 6. For small-scale projects a simple approach to the economic assessment is applicable, that does not require any modelling for benefit quantification. Moreover, most of the quantifications can be done as back-of-the-envelope calculations, to give a rough estimation of a project's societal costs and benefits.

Within the economic analysis seven indicators are assessed, in line with the CEF regulation. The following short description will focus on the assessment of physical projects within the electricity sector:

(a) costs of energy generation

The costs of energy generation are assessed through the project's levelized cost of energy (LCOE), which cover all types of costs over the plant lifetime. Since this measure is commonly used by project developers in project appraisal, it does not require any additional efforts from the promoter's side. To calculate the LCOE, the net present value of total costs (CAPEX, OPEX) is compared to the net present value of the energy production of the plant throughout its lifetime. Simple assumptions can be taken for the total energy yield in case of variable renewable infeed based on known resource measurements and an assumption of no curtailment. For dispatchable sources a reasonable number of full-loud-hours is assumed.

(b) system integration costs

A rough estimation of the c-b RES project's system integration cost or benefit can be achieved by solely quantifying the market impact without taking into account grid related system integration cost. Instead of a thorough market modelling, the project's impact on energy markets, i.e. the social welfare gains through additional producer rent, is quantified by valuation of the project's expected annual energy output at average market prices (minus the project's marginal cost). In case of power markets, the assumed market price could be the expected day ahead price adapted to the relative market value of the respective RES in the market region.

(c) cost of support

The cost of support is estimated as the total amount of support that is needed, to make the project economical viable. Therefore, national support schemes can be used as a benchmark to estimate these support cost, although the project may not be able to profit from these support schemes if it is applying for c-b RES status. These support schemes may differ from country to country, e.g. feed in-tariffs or technology-specific auction schemes. Annual costs of support are estimated through the expected annual energy output of the project, valued at the average per-MWh-support, granted to comparable projects in the respective country.

(d) greenhouse gas emissions

The project's impact on systemwide GHG emissions is estimated through the project's RES production. The quantification is based on the assumption that the project shifts up other generation units in the merit order. Therefore, avoided GHG emissions are estimated as the project's annual RES production times the difference between the system's average emission factor and the project's emission factor. Furthermore, the avoided GHG emissions can be monetised using carbon prices in line with the employed scenarios.

(e) security of supply

A project's contribution to supply security can be semi-quantitatively assessed through indicators accounting for the physical dimension of supply security (availability, reliability) as well as supply security in terms of diversity of energy sources and import dependency.

To assess the physical dimension of supply security, the system average interruption duration index (SAIDI) – an indicator of a system's need for reliable capacity – can be compared for the project site and the counterfactual project site. A higher SAIDI indicates a greater need for an improvement of the supply security. In addition, the project's contribution to the net generating capacity can be quantified e.g. through literature values of a technology-specific percentage share of the project's total capacity.

Moreover, the project's contribution to supply security in terms of import dependence can be assessed by estimating the share of the project's energy output in a country's primary energy consumption of the respective sector. By comparison with the share of imported primary energy supply for the respective sector, a statement about the projects contribution to a reduced import dependence is derived.

(f) air and other local pollution

Similar to indicator (d), the project's impact on air and other local pollution is estimated based on the project's RES production. The quantification is based on the assumption that the project shifts up other generation units in the merit order. Therefore, avoided pollutant emissions are estimated as the project's RES production times the difference between the system's average emission factor and the project's emission factor. Pollutant-specific emission factors can be derived from the system generation mix and technology-specific emission factors. The avoided emissions can be monetised using pollutant-specific unit economic cost factors.

(g) innovation

The impact of innovative projects is assessed qualitatively through mapping the innovation to European and national research roadmaps (e.g. the SET Plan, innovation dimension of the NECPs). Moreover, a statement on how the project may advance the TRL of the applied technology can be given.

After assessment of the individual benefits, monetised indicators can be aggregated to a single figure using the discounted cashflow methodology, considering the plant's lifetime and a social discount rate of 4%. Aggregated monetised and individual non-monetised indicators are then used for comparison of the c-b RES project with its counterfactual. A c-b RES project that outperforms its counterfactual in the assessment of one of the indicators (and has at least a similar rating in the other indicators) provides an added value through c-b cooperation.

Application Element 8: Financial analysis

Within the financial analysis, the commercial viability of the project is assessed by means of discounted cash flow analysis. To do so, promoters evaluate the commercial viability of a project by taking into account inflows (operating revenues, national support schemes, residual value) and outflows (CAPEX, OPEX) throughout the reference period. Only projects with a negative financial net present value are eligible for a CEF grant. Then, the potential grant size can be determined as a funding gap based on the financial analysis. In addition, promoters need to verify a positive cash balance throughout the whole project lifetime with the financial analysis to prove financial sustainability.

Application Element 9: Risk assessment

Lastly, promoters are required to perform a qualitative assessment of regulatory, administrative, operational and financial risks, as well as risks related to procurement and construction. Project promoters are required to develop a risk mitigation plan for every significant risk identified. Moreover, a sensitivity analysis has to be performed on the quantitative results of the CBA, to assess the influence of risky input parameters on the project performance, e.g. by varying the costs of financing.

2.7 Subtask 1.4 Detailed eligibility, selection and award criteria

Based on and consistent with the methodology outlined above, this subtask's aim is to develop detailed criteria

- to assess the eligibility of projects (**eligibility criteria**);
- to select applicants (**selection criteria**); and
- to award projects the status of c-b RES projects and/or award grants for technical studies and / or for works (**award criteria**).
- and propose to what extent these criteria need to be further specified in the delegated act and/or can be detailed in the work programme and calls for proposals.[51]

Moreover, this chapter provides an overview of relevant objectives which need to be addressed by the applicant and assessed accordingly by the evaluator. To ensure that these objectives are sufficiently considered by project proposals and adequately assessed in their evaluation, we suggest incorporating them as part of the assessment of award criteria in line with the elements to be considered according to Article 13 of the CEF Regulation (see section 2.7.4).

The agreed CEF Regulation (incl. its Annex) already provides various objectives, eligibility and award criteria and the Financial Regulation sets out applicable selection criteria assessing the applicant's

[51] According to Art. 7 the delegated act specifies the selection criteria and lays down the details for the selection process of the projects. It shall also publish the methodologies for assessing the contribution of the projects to the general criteria and for producing the cost-benefit analysis specified in Part IV of the Annex. According to Art. 13, award criteria shall be defined in the work programmes and in the calls for proposals.

ability to complete a proposed action. Specific criteria (e.g. award criteria) may, however, be further refined in the work programme and calls for proposals.

To align our recommendations with the relevant legislative provisions, we use them as our starting point and incorporate them where necessary and relevant. A challenge, however, pertains to the fact that the criteria to assess the eligibility and to award grants or the status as c-b RES project follow a somewhat different structure than the CBA guideline, which is based on existing guidelines by DG Regio and ENTSO-E. However, we ensure that each CBA element proposed in the Regulation will directly or indirectly be represented in the award criteria. We also indicate on which basis to assess the relevant criteria (e.g. from the economic or financial analysis or additional (qualitative) information provided as part of the broader CBA).

Moreover, clarification is required as to which elements need to be assessed by whom and at which stage of the process (see also section 3.1). This includes evaluating whether some award criteria may or should not be assessed at all in the context of c-b RES projects, given that the CEF Regulation proposal only requires the consideration of listed elements in Article 13 “to the extent possible”. We also provide guidance for the applicability of criteria for each application stage, e.g. differentiated by applications for the status as c-b RES projects and applications for grants for works.

To this end, the remainder of this chapter is structured as follows: Section 2.7.1 describes objectives that need to be addressed by the applicant. Section 2.7.2 provides guidance as to the relevant eligibility criteria. Section 2.7.3 selects and specifies relevant award and selection criteria and section 2.7.4 proposes an evaluation framework, including a robust ranking and scoring methodology according to the applicable award criteria.

2.7.1 Objectives which need to be addressed by the applicant

Article 3 of the CEF Regulation stipulates the goal to facilitate cross-border cooperation in the area of energy, including renewable energy as one of two specific CEF objectives in the energy sector. Part IV of the proposed Annex further specifies this objective by adding that the cross-border cooperation between Member States shall be promoted in the field of planning, development and cost-effective exploitation of renewable energy sources. C-b RES projects shall also facilitate their integration through energy storage facilities and with the aim of contributing to the Union’s long-term decarbonisation strategy.

Table 8 gives an overview of relevant objectives for c-b RES projects as provided for in the revised CEF Regulation. One option is to assess whether projects actually create impact in terms of the objectives mentioned by project promoters. We provide high-level guidance on the required information in each objective and where this information may be derived from, e.g. results from the economic analysis or additional information provided as part of the CBA. While not being award criteria in themselves, they can be incorporated as part of the elements to be assessed as set out in Article 13 of the CEF Regulation and in line with the methodology described in section 2.7.4, i.e. via award criteria.

Table 8 Overview of objectives to be addressed by applicant as set out in CEF Regulation

Objective	Assessment based on
Main Objectives to be addressed (Art. 3 & Annex IV)	
C-b RES projects shall contribute to decarbonisation, completing the internal energy market and enhancing the security of supply	Economic analysis of CBA (GHG emissions, system integration, security of supply) and additional information as stated in the relevant "objectives" section of the application
Promote the cross-border cooperation between Member States in the field of planning, development and cost-effective exploitation of renewable energy sources as well as facilitate their integration through energy storage facilities and with the aim of contributing to the Union's long term decarbonisation strategy	Economic analysis CBA (support costs, GHG emissions) and additional information required from applicant (e.g. cooperation intensity, use of storage)
Specific Objectives to be addressed (Recital 20a)	
Achieve cost-effective deployment for renewables in the Union	Economic analysis of CBA (support costs)
Achieve cost-effective EU target achievement of at least 32% renewable energy in 2030	Economic analysis of CBA (support costs)
Contribution to the strategic uptake of innovative technologies (e.g. offshore wind, geothermal and combinations as well their grid connection and additional elements such as storage and conversion facilities)	Economic analysis of CBA (innovation) and qualitative description required from applicant regarding the deployed technologies.

2.7.2 Eligibility criteria

Eligibility criteria are Yes/No-criteria that are mandatory preconditions for applicant projects to be further assessed in the selection process. Not complying with these criteria will therefore result in the exclusion from further assessment procedures. Given the technical nature of assessing eligibility criteria, we recommend the Innovation and Networks Executive Agency (INEA) as the responsible party to execute this task based on its extensive experience in implementing the current CEF program.

The CEF Regulation already provides for the eligibility criteria applicable to c-b RES projects in the area of renewable energy. More specifically, Article 7, 9, 11 and part IV of the Annex specify these eligibility criteria for c-b RES project. In line with Article 7 of the CEF regulation, eligibility criteria, including provisions on which basis they will be assessed, should generally be specified in the delegated act setting out the selection procedures for c-b RES projects. Nonetheless, these criteria should, where necessary, be additionally laid down in the work programs and calls for proposals, to provide complete and transparent information for applicants.

Table 9 gives an overview of applicable eligibility criteria for c-b RES projects and provides further details on each one with a focus on the basis of their assessment as well as their respective applicability for each application step.

A number of (general) eligibility criteria are relevant for all application stages (except for pre-feasibility studies), namely the existence of a (or reference to an envisaged) cooperation agreement, the existence of a project-specific CBA as well as requirements regarding eligible entities.

For pre-feasibility studies, initial eligibility checks need to provide very low thresholds, given the prematurity of planned actions involved. Initially, we therefore suggest a mere check whether the applicant(s) belongs to the group of eligible entities. However, the specific calls for proposals to allocate grants for pre-feasibility studies may provide for additional eligibility criteria at the Commission's discretion, such as minimum content requirements or the study's alignment with the elements to be covered by the CBA required for later application stages. While applicants may not be asked to provide a dedicated cooperation agreement, different maximum grant amounts may apply depending on the level of commitment by one or two Member States (e.g. in the form of a Member State expression of interest) the applicant has secured at the time of application (see section 3.1.1 for more detail).

For the remaining application stages, the detail of assessment of (general) eligibility criteria should vary by step, particularly in terms of the number of sub-criteria and the required detail of information to be provided by applicants. This means that eligibility criteria for each application step should be in line with an increasing degree of detail required from applicants with each assessments step (i.e. from awarding the status as c-b RES project to grants for technical studies and works). For instance, regarding the existence of a cooperation agreement, a Memorandum of Understanding or a Letter of Intent signed by all involved Member States, including their common understanding of the concept and principles on the distribution of payments and benefits, might suffice when applying for the status of a c-b RES project. For grants for studies, a minimum level of cooperation intensity may be required and for grants for works this criterion may be further specified by asking for a pre-agreement that includes an indicative distribution of payments and benefits as well as clarification on practical issues, such as roles and responsibilities and processes for data exchange. Funding provided for pre-feasibility studies, on the other hand, should be subject to substantially lower thresholds than the above-mentioned, i.e. the existence of a cooperation agreement should not be obligatory, but maximum grant amounts may be tied to the degree of Member State commitment an applicant project can demonstrate at this stage. For example, in case a project promoter can already provide for a LoI signed by at least one Member State at this application stage, maximum grant amounts could be higher than if no such commitment is yet in place (see also section 3.1.1 for more details).

For grants for works, additional eligibility criteria are foreseen as set out in Article 7 para. 4 (see Table 9). In particular, grants for works should only be allocated only if there is "evidence for significant cost savings or benefits in terms of system integration, environmental sustainability, security of supply or innovation". As outlined in section 2.4.9, the methodological challenge is how to determine cost savings or benefits that are significant. While it seems reasonable to ask proposals to demonstrate "significant" impacts and benefits on key political ambitions, the TEN-E process has shown that it is difficult to provide a clear metric for significance. In general, there is apparently no straightforward technical solution to this challenge, e.g. by defining a definite threshold of what constitutes a significant cost saving or benefit, not least because there are benefits that cannot be monetised or even quantified. Therefore, we suggest a qualitative approach, whereby the promoter needs to describe why the project's benefits are significant which is then subject to approval by the CEF committee (in case of grants) or the Group (in case of the status as c-b RES project).

Moreover, the application for grants for works and studies is conditional on the prior attainment of the status of c-b RES project. Finally, the two specific eligibility criteria for the status as c-b RES project are laid down in part IV of the Annex to the CEF Regulation. For the requirements regarding the provision of a project-specific CBA, the general idea elaborated in subtask 1.2 pertains, i.e. the further the application process towards grants for works progresses, the more detail should be required by

In addition to the eligibility criteria mentioned, technology- or sector specific eligibility requirements or quotas may be set as part of the delegated act and to be further defined in the work programs, e.g. via centrally defined lists of eligible technologies/sectors, size thresholds or a further detailing of certain eligible technologies such as innovative storage. However, such administratively-set technology thresholds should only be applied with care and in line with market conditions, so as to avoid excessive restrictions for certain technologies or a lack of consideration of technological

developments. If such technology restrictions should be deemed necessary, they should therefore be set using rather broad technology categories rather than very specific technologies. Moreover, the implementation of technology-specific eligibility criteria should be given as an option to be applied for individual calls for proposals if deemed necessary, rather than a generally applicable list of eligible technologies defined in the delegated act defining the selection procedure for c-b RES projects. This would allow to react flexibly to technology developments or lack of funding uptake in case of a previously flawed configuration of thresholds.

Finally, the Commission may allow in the delegated act for the possibility to set regional or country quotas as part of the work programme and calls for proposals in order to allow for geographical diversity. A specific configuration of quotas may be set up front and to applied in the ranking of eligible projects in the evaluation process for grants for studies and works. For the selection of projects receiving the status as c-b RES project, quotas may be set by the Group to create a ranked list of projects receiving this status. However, this might only be necessary in case a maximum number of projects receiving the status has been set and high competition exists, e.g. to ensure a manageable number of projects.

Table 9 Overview of eligibility criteria as set out in CEF Regulation and to be included in delegated act

Criterion / element	Assessment based on	Application stage			
		Pre-feasibility study	Status as CB-RES project	Grants for technical studies	Grants for works
(General) Eligibility criteria for all application stages (Art 7, 9, 11 & Annex Part IV)					
Existence of a **cooperation agreement** or any other kind of arrangement between at least two Member States[52] and/or arrangements between at least one Member States and at least a third country or countries as set out in Articles 8, 9, 11 and 13 of Directive (EU) 2018/2001	Information provided on e.g. LoI/MoU/MoA, description of common understanding of project concept, type of cooperation, cross-border nature of project, principles on distribution payments and benefits; data exchange (CBA Element 5: Cooperation mechanism).	(X)[53]	X	X	X
Eligible entities: legal entities established in a Member State including joint ventures; legal entities established in a third country associated to the Programme or overseas countries and territories; legal entities created under Union law and international organisations where provided for in the work programmes. Natural persons are not eligible.	Information on legal status of applicants provided in application form (CBA Element 1-4: Project Description)	X	X	X	X

[52] For instance, a bi- or multilateral agreement settling financial flows between Member States around a cooperation on renewables that would not have the form of a statistical transfer, joint tender or joint project. It could be for example integrated into a broader bilateral agreement that covers more than RES.

[53] We propose maximum grant amounts to be tied to the degree of Member State commitment an applicant project can demonstrate at this stage. Nonetheless, Member States may receive funds for pre-feasibility studies even in case no form of Member State agreement is yet in place, but the maximum grant amount would be lower than if a commitment by at least one Member State existed (see section 3.1.1).

Criterion / element	Assessment based on	Application stage			
		Pre-feasibility study	Status as CB-RES project	Grants for technical studies	Grants for works
A **project-specific cost-benefit analysis** is compulsory for all supported projects (and for the status as c-b RES project) and shall be performed in a transparent, comprehensive and complete manner	Existence of a cost-benefit analysis in line with requirements for each application stage as outlined in section 2.3.1		X	X	X
Eligibility criteria for the status as c-b RES project (Annex Part IV) [54]					
Potential overall benefits of cooperation outweigh its costs, including in the longer term, as assessed on the basis of the cost-benefit analysis.	CBA Element 7: Economic analysis; potential benefits outweigh costs can be shown quantitatively (NPV>0) or qualitatively, if no or not all benefits have been monetised (as is the case for the status as cb-RES project and in the simplified approach to economic analysis)		X	X	
Provide cost savings in the deployment of renewables and/or benefits for system integration, security of supply or innovation in comparison to a similar project or renewable energy project implemented by one of the participating Member States alone	CBA Element 7: (Economic analysis): >0 (yes/no); potential cost savings can be shown quantitatively (NPV>0) or qualitatively, if no or not all benefits have been monetised (as is the case for the status as cb-RES project and in the simplified approach to economic analysis)		X	X	

[54] Note that the CEF regulation only defines these eligibility criteria in the context of receiving the status as c-b RES project (i.e. in Annex Part IV CEF Regulation). In our view, it makes sense to apply these criteria for grants for studies as well. For grants for works, the additional eligibility criterion "significant cost savings and/or benefits", i.e. a higher threshold, applies.

Criterion / element	Assessment based on	Application stage			
		Pre-feasibility study	Status as CB-RES project	Grants for technical studies	Grants for works
Eligibility criteria for grants for technical studies and grants for works (Art. 9)					
Status as c-b RES project	Project has acquired status (yes/no)			X	X
Additional eligibility criteria for grants for works (Art. 7)					
The project specific cost-benefit analysis provides evidence concerning the existence of **significant cost savings and/or benefits** in terms of system integration, environmental sustainability, security of supply **or** innovation	CBA Element 7 (Economic analysis): Determination of "significant" cost savings and/or benefits (yes/no), qualitative approach for the determination of "significance" (see section 2.4.9)				X
Applicant demonstrates, that the **project would not materialise in the absence of the grant**, or that the project cannot be commercially viable in the absence of the grant	CBA Element 8 (Financial analysis): Results of cash-flow analysis (yes/no)				X

2.7.3 Award and selection criteria

Selection and award criteria form the basis for the scoring, ranking and thus comparison of eligible applications. Most of the award criteria will be directly based on the outputs and assessments described under task 1.1 to 1.3, such as the CBA's economic analysis. Other information (e.g. cross-border dimension) will require additional information provided by the applicant in the submitted application forms as part of the broader CBA.

As of 2021, all selection and grant application procedures are planned to be streamlined across the various CEF funding lines at the initiative of DG MOVE. As part of this harmonised e-grant application procedure, a common list of five award criteria are foreseen, of which three are evaluated by external experts and two are evaluated internally by the Commission. The scoring of proposals follows a two-stage process. In a first step, external evaluators not part of the Commission/INEA and selected on the basis of their technical knowledge would be responsible to evaluate independently proposals against the following award criteria, thereby taking into account the thematic focus of the call:

- **Maturity**: assessing the maturity of the action in the project development;
- **Quality:** evaluating the soundness of the implementation plan proposed;
- **Impact:** assessing the financial, economic, social and environmental impact (CBA), including climate impact, soundness and comprehensiveness of the proposal, innovation and digitalisation and cross-border dimension.

Experts would be required to provide comments to justify their scores. After experts have finalised their independent assessment, a consensus meeting would be held between the experts responsible for the respective proposal which is moderated by INEA. As part of this meeting, a consensus report is developed and signed by external experts for each proposal that lays out the score for each award criterion including a justification for the respective score.

Evaluation tasks conducted by external experts could additionally be distributed between CBA experts (mainly responsible for Impact criterion) and technical and financial experts (responsible for all other criteria to be evaluated by external evaluators). This is in line with best practices from other CEF funding lines, e.g. CEF Transport.

The two remaining award criteria would, upon the successful evaluation by external experts, be evaluated internally by the Commission, i.e. only projects with a minimum score (e.g. minimum of 3 points) will proceed to the internal evaluation:

- **Stimulating Effect of Financial Assistance:** assessing the catalytic effect of the Union financial assistance on the investment;
- **Priority and urgency of the action:** evaluating correspondence of the proposal with the sectoral policy objectives, measuring its EU added value.

In line with Article 13 of the CEF Regulation, detailed award criteria, e.g. by developing specific sub-criteria under each of the general award criteria, may be defined in the work programmes and in the calls for proposals. Article 13 also provides for a list of elements that require consideration "to the extent possible" when specifying award criteria. Other elements than the one listed may not be taken into account according to the most recent political agreement on the CEF Regulation.

In line with the Financial Regulation, selection criteria aim at assessing the applicant's ability to complete the proposed action. The two relevant criteria in this respect are:

- **Financial capacity**
- **Operational capacity**

Given the rather technical nature of their assessment, selection criteria would be evaluated by INEA as the responsible implementing agency for the CEF program. Like the award criteria, these selection criteria would be set out in the work programmes and the respective calls for proposals. Check of compliance with the selection criteria follows a similar yes/no logic as in the case of eligibility criteria.

Table 10 lists applicable selection criteria as well as the relevant elements to be considered when specifying the award criteria in the work programmes. It also provides short descriptions on each criterion/element in the context of its application for cross-border RES selection procedures, gives guidance on the respective basis of assessment and outlines which elements/criteria to be used in which application stage.

Note in this context that we deem the following four elements to be considered for the definition of award criteria in line with Art. 13 CEF Regulation less relevant in the context of the selection of c-b RES projects and/or not suitable as an award criterion:

- (d) Synergies between the transport, energy and digital sectors;
- (ea) Soundness of the maintenance strategy proposed for the completed project
- (h) Need to overcome financial obstacles, such as those generated by insufficient commercial viability, high upfront costs or the lack of market finance
- (ha) Potential of dual-use in the context of military mobility.

As such, the above-mentioned elements are not further considered in the following elaborations.

Regarding the criterion “Need to overcome financial obstacles”, more specifically, we believe that this is already adequately reflected in the applicable eligibility criteria, namely that applicants need to demonstrate that a project is not commercially viable to be considered for a grant for works (see section 2.7.2). Moreover, it would be questionable more generally, how this award criterion could be assessed and scored, i.e. whether it would be better or worse to have a bigger/smaller financial gap. In our view, no sensible recommendation for one or another project would thus be possible on the basis of this criterion.

Table 10 Selection criteria and award criteria mentioned in CEF regulation and how to apply them to c-b RES projects

Criterion / element	Description	Assessment based on	Application stage			
			Pre-feasibility study	Status as CB-RES project	Grants for technical studies	Grants for works
Selection criteria assessing the applicant's ability to complete the proposed action (Art. 198 of the Financing Regulation)						
Financial capacity	The applicant shall have stable and sufficient sources of funding to maintain his or her activity throughout the period for which the grant is awarded and to participate in its funding. Exemptions apply e.g. for public bodies, including Member State organisations and international organisations.	Financial capacity check form and financial statements: It must be demonstrated that organisation is liquid, solvent, profitable and autonomous. *See also "Readiness to reach financial close for the specific project" in the award criteria for the project.*			X	X
Operational capacity	The applicant shall have the professional competencies and qualifications required to complete the proposed action or work programme unless specifically provided otherwise in the basic act. Exemptions apply e.g. for public bodies, including Member State organisations and international organisations.	List of previous activities carried out in related fields, description of people primarily responsible for managing and implementing proposed action, company activity report and potentially supporting documents (e.g. reports of similar projects realised and CVs of key team).			X	X

Criterion / element	Description	Assessment based on	Application stage			
			Pre-feasibility study	Status as CB-RES project	Grants for technical studies	Grants for works
Elements to be considered for award criteria as defined in Art. 13 of CEF Regulation proposal ("to the extent applicable") and how to use them						
(a) economic, social and environmental impact, including climate impact (project life cycle benefits and costs), soundness, comprehensiveness of the analysis.	Extent of positive externalities provided by funded action (i.e. total net benefit) as well as quality of the analysis	CBA (Economic analysis, Elements 1-4 and 6): Overall result of economic analysis and its soundness and comprehensiveness		X	X	X
(b) innovation and digitalisation, safety, interoperability and accessibility aspects, including persons with reduced mobility	Focus on innovation: Contribution to the strategic uptake of innovative technologies (e.g. offshore wind, geothermal and combinations as well their grid connection and additional elements such as storage and conversion facilities)	CBA (Economic analysis & Elements 1-4 and 6): Innovation indicator of economic analysis and additional qualitative information required from applicant regarding the deployed technologies		X	X	X
(c) cross-border dimension, network integration and territorial accessibility, including for outermost regions and islands	Focus on cross-border dimension: Assessment of the intensity of cooperation,	CBA (Element 5-6): Qualitative information required from applicant e.g. in terms of number of Member States involved, regulatory convergence, magnitude of c-b benefits, area affected.		X	X	X

Criterion / element	Description	Assessment based on	Application stage			
			Pre-feasibility study	Status as CB-RES project	Grants for technical studies	Grants for works
(cb) European added value	The Union added value in terms of cost-effective deployment of RES, cost-effective achievement of Union binding RES target, enhancing European technical leadership, decarbonisation, completing the internal energy market and enhancing the security of supply (see objectives of section 2.7.1). In addition, added value of the cooperation (see section o)	CBA (Elements 1-4, 6 and Economic analysis): Indicators of economic analysis (support costs, GHG emissions, innovation, security of supply) and qualitative information required from applicants (e.g. use of storage and innovative generation and conversion technologies, participation of new market players), information from applicant on added value of cooperation		X	X	X
(e) maturity of the action in the project development	Status of preparation of action to establish capacity for its implementation in line with foreseen time plan and technical specifications.	CBA (Elements 1-5): Qualitative information provided by applicant on project status, e.g. time plan, deployed equipment, readiness to reach financial close, existence of cooperation agreement			(X)	X
(f) soundness of the implementation plan proposed	Coherence between proposed objectives and planned resources/activities leading to its timely completion, appropriateness of project management and risk control processes.	CBA (Elements 1-4, 9): Qualitative information provided by applicant, such as project description, schedule and management stated objectives, risk assessment and technical feasibility		X	X	X

Criterion / element	Description	Assessment based on	Application stage			
			Pre-feasibility study	Status as CB-RES project	Grants for technical studies	Grants for works
(g) catalytic effect of Union financial assistance on investment	Extent to which funding will ensure/accelerate the implementation of the proposed action, e.g. via ratio of "benefit per required grant".	CBA (financial and economic analysis)				X
(i) consistency with Union and national energy and climate plans	Degree to which project contributes to the respective national energy and climate plans as well as Union plans such as the Union's long-term decarbonisation strategy	CBA (Elements 1-4, 6 and Economic analysis)		X	X	X

Table 11 assigns the elements to be considered for the definition of the applicable award criteria in the context of the selection procedure for c-b RES project to the five award criteria in line with harmonised e-grant application procedure as outlined above. It also demonstrates the degree of applicability of each award criteria per application stage and sets out the responsible party assessing the award criterion in question.

As a result of this exercise, it becomes evident that the criteria *Impact* and *Quality* (external evaluators) as well as *Priority and Urgency of the action* and *Consistency with Union and national energy and climate plans* (internal evaluation, i.e. European Commission) will be assessed for all application stages (except for grants for pre-feasibility studies), though with varying degree of rigidity and degree of quantification/monetisation as a result of the increasing level of detail provided in the application/CBA for different stages in the application. By contrast, the *Stimulating Effect of Financial Assistance* (internal evaluation) can only be sensibly determined for the awarding of grants toward actual project implementation and thus only in the context of the selection procedure for grants for works. In a similar vein, the award criterion *Maturity* is only relevant in the case of the more substantial grants for technical studies as well as grants for works, where actual project implementation progress is feasible.

Note that we recommend a separate selection process for pre-feasibility studies outside of the proposed evaluation framework for the status and grants for studies and works that provides fewer thresholds for applicants in line with the pre-maturity of project development and the low funding volumes involved. This selection procedure will be outlined in more detail in section 3.1.1.

Table 11 Applicable award criteria (harmonised e-grant application procedure)

Award criteria	Elements to be considered (Art. 13)	Responsible party	Pre-feasibility study	Status as CB-RES project	Grants for technical studies	Grants for works
Maturity	(e) maturity of the action in the project development				(X)	X
Quality	(f) soundness of the implementation plan proposed			X	X	X
Impact	(a) economic, social and environmental impact, including climate impact (project life cycle benefits and costs), soundness, comprehensiveness of the analysis.	External evaluators		X	X	X
	(b) innovation and digitalisation, safety, interoperability and accessibility aspects, including persons with reduced mobility			X	X	X
	(c) cross-border dimension, network integration and territorial accessibility, including for outermost regions and islands			X	X	X
Stimulating Effect of Financial Assistance	(g) catalytic effect of Union financial assistance on investment	European Commission				X
Priority and urgency of the action	(cb) European added value			X	X	X
	(i) consistency with Union and national energy and climate plans			X	X	X

2.7.4 Evaluation matrix for award criteria (grants for works)

Besides the identification and specification of relevant criteria, a differentiated evaluation and scoring methodology will be required to transparently assess and compare eligible projects. Along these lines, this section's aim is to develop a comprehensive evaluation framework translating the individual award criteria outlined above into a final (point) score. Establishing such a points-based evaluation and scoring methodology enables the determination of a final score for each project and thus a sufficiently objective comparison and ranking of eligible projects. This task will also include developing detailed sub-indicators applicable for each step in the c-b RES project process to enable an objective assessment of proposals against the individual award criteria and to provide a starting point for a further refinement of these indicators as part of the work programmes and calls for proposals.

In line with proposed harmonised e-grant application procedure, scoring from 0 (insufficient) to 5 (excellent) for each award criteria is possible. More specifically, evaluators examine each award criterion (as well as their respective sub-indicators) on a six-point scale from 0 to 5. In this scheme, the scores indicate the following with respect to the criteria under examination:

Table 12 Description of scores

Score	Meaning
0	Very poor: The proposal fails to address the indicator/criterion under examination or cannot be judged against the criterion due to missing or incomplete information
1	Poor: The criterion is inadequately addressed or there are serious inherent weaknesses.
2	Fair: The proposal broadly addresses the criterion but there are significant weaknesses.
3	Good: The proposal addresses the criterion well, but a number of shortcomings are present.
4	Very Good: The proposal addresses the criterion very well, but a small number of shortcomings are present.
5	Excellent: The proposal successfully addresses all relevant aspects of the criterion. Any shortcomings are minor.

Where appropriate, half marks can be given (which is subject to a final decision by European Commission and alignment with DG Move). Each sub-indicator can be assessed on the above-mentioned point-scale, whose (potentially weighted) average then provides the overall score for each of the five award criteria. For grants for works, a maximum score of 25 can be achieved (in the case of grants for works) by adding the external and internal evaluation scores. Weighting may be applied to individual award criteria to give more importance to some elements (e.g. to the Impact criterion because of its importance and given its higher number of sub-indicators).Thresholds are set for the applicable award criteria in such a way that a proposal must achieve at least 3 points for each applicable award criteria under the external evaluation and a total of at least 10 points for the three criteria under the external evaluation to be recommended for the internal evaluation. For the internal evaluation, proposals obtaining less than 3 points for at least one of the internal award criteria would not be recommended for funding. Table 13 gives a high-level overview of this evaluation matrix (for grants for works), including award criteria and the sub-indicators assessed under each criterion. With this detailing of applicable award criteria, the suggested evaluation methodology aims to provide a robust and transparent guidance on how scoring, ranking and selection of eligible projects can be implemented and further refined as part of the work programme and calls for proposals.

Table 13 Evaluation matrix for grants for works (no weighting)

Award criteria	Elements to be considered (Art. 13)	Sub-indicators (scored from 0 to 5)	Score per sub-indicator	Average total score per award criteria (0 to 5)
Maturity	Maturity of the action in the project development	Status of preparation of the action, i.e. its capacity for implementation in line with the foreseen time plan and technical specifications as well as state of readiness for commencement at short term		
		Readiness to reach financial close for the specific project		
		Status of the cooperation agreement (concept to signed cooperation agreement)		
Quality	Soundness of the implementation plan proposed	Coherence between proposed objectives and planned resources of the action		
		Appropriateness of project management		
		Adequacy of risk and quality control processes		
Impact	Economic, social and environmental impact, including climate impact (project life cycle benefits and costs), soundness, comprehensiveness of the analysis.	Consistency of CBA implementation with quality requirements at the respective stage as outlined in chapter 2.3		
		Extent of positive externalities provided by funded action, i.e. the level of total net benefit as resulting from CBA economic analysis.		
	Innovation	Contribution to advancing the current technology readiness level (TRL) of the employed technologies as resulting from CBA economic analysis		
		Quantified effect of innovation on target groups via size of target group and marginal social value of the innovation, as resulting from CBA analysis (if applicable) *(optional)*		
	Cross-border dimension	Size of project (relative to national RES capacities / RES support / RES share)		
		Number of Member States and/or third states involved, or area affected		

Award criteria	Elements to be considered (Art. 13)	Sub-indicators (scored from 0 to 5)	Score per sub-indicator	Average total score per award criteria (0 to 5)
		Magnitude of cross-border benefits for the energy system		
		Extent of alignment between support schemes or other regulatory conditions		
		Coordination requirement between government entities throughout the project		
		Reduction of cross-border distortions		
Stimulating Effect of Financial Assistance	Catalytic effect of Union financial assistance on investment	Extent to which funding will ensure/accelerate the implementation of the proposed action, e.g. via ratio of “benefit per required grant”		
Priority and urgency of the action	European added value Consistency with Union and national energy and climate plans	Contribution to the cost-effective achievement of Union binding RES target of 32% until 2030, i.e. including to what extent the action is consistent with Union and national energy and climate plans,		
		Contribution to enhancing European technical leadership, e.g. by deploying of innovations previously funded by EU programmes for low-carbon innovation (e.g. NER 300/IF, Horizon 2020) and alignment with Energy Technology (SET) Plan (i.e. contribution towards SET key actions and technology-specific strategic targets).		
		Alignment with EU long-term decarbonisation strategy, e.g. by facilitating RES integration through energy storage facilities		
		Contribution to completing the internal energy market, e.g. extent to which action engages new market players such as local energy communities		
		Contribution towards enhancing the security of supply, e.g. in terms of reducing import dependence via the local deployment of RES		

3 TASK 2 PROCESS AND TEMPLATES

3.1 Subtask 2.1 Detailed selection process

This chapter describes our recommendation of the detailed selection processes for

- grants for pre-feasibility studies (section 3.1.1)
- the status as c-b RES project (section 3.1.2)
- grants for studies and grants for works (section 3.1.3)

3.1.1 Selection process for grants for pre-feasibility studies

Given the comparatively low grant volumes involved (i.e. between €60,000 and €200,000) as well as the likely prematurity in project implementation for applicants interested to apply for pre-feasibility studies, we recommend **a simple, low-threshold procedure** for selecting projects to receive grants for pre-feasibility studies outside of the more comprehensive CEF selection procedures for grants for works and technical studies. Such an approach is to ensure sufficient uptake of the foreseen funds and making full use of their opportunity to help sharpen project ideas and to create momentum among the required stakeholders for a specific c-b RES project.

One option to implement this low-threshold approach would be organizing yearly calls for proposals to receive grants for pre-feasibility studies with a pre-defined maximum budget to be allocated per year on a rolling and first-come-first-served basis until the call's budget is depleted. Calls for proposals would specify the focus, structure and minimum content requirements of studies to be funded, maximum and minimum grant amounts to be allocated as well as potential additional pre-requisites at the discretion of the Commission. As such, applicant projects would have to comply with a few simple eligibility criteria to be considered for grants for pre-feasibility studies and defined in the calls for proposals without having to pass through a comprehensive evaluation and scoring process. One of the key criteria to determine a project's eligibility in this context should be that applicants clearly outline which elements would be covered by the pre-feasibility study, that these comply with the requirements in the respective call for proposals and that they adequately reflect the elements required by the CBA. In other words, to be eligible for funding in this application stage the planned pre-feasibility study should provide the grounds for the subsequent application for grants for works or technical studies in case the preliminary assessment demonstrates the project's likely overall added value. Projects demonstrating their eligibility to receive grants for pre-feasibility studies would eventually be able to benefit from a pool of a range of consultants with which the Commission has previously set up a framework contract and on the basis of which it can commission the preparation of pre-feasibility studies for eligible applicants. Alternatively, grants for early feasibility studies may be transferred to the applicant directly who can then choose their consultant freely. The advantage is a larger number of consultants to choose from. The disadvantage is that the proper use of the funds and minimum quality standards are more difficult to oversee for the Commission compared to a framework contract approach with pre-selected consultants. In any case, the final product would be the preliminary study for which funds have been requested.

To mitigate the risk of disbursing excessively high grant amounts to private project promoters, we would advise in favour of incorporating minimum thresholds in terms of the degree of Member State commitment that can be presented by the applicant and which are tied to maximum grant amounts to be disbursed in each case. More specifically, in case a private project promoter applying for a pre-feasibility study can provide a support letter by one Member State at the time of the application or if that Member State is a co-applicant, the maximum amount could be set at €100,000, while no restrictions (up to the maximum amount to be disbursed per applicant as defined in the call for proposals) would pertain to project promoters able to demonstrate some form of commitment by two Member States (or in case these Member States are co-applicants). In case no Member State commitment can be presented by the applicant, the maximum grant amount for a pre-feasibility study could be set at €70,000.

3.1.2 Selection process for receiving the status as c-b RES project

The recommended selection process for receiving the status as c-b RES project is based on the process description mapped out in part IV of the Annex to the CEF Regulation proposal and extended where necessary. Table 14 summarises the proposed selection process accordingly.

We structure the selection process for receiving the status as c-b RES project along five main stages:

Stage I: The Commission sets up a **Group for c-b RES projects** composed of Member State representatives and a Commission representative. Its main aim is to ensure adequate Member State representation in the process of awarding the status as c-b RES project and thus being eligible for Union funding in the form of grants for works or technical studies.

Stage II: The Commission launches a **call for proposals** after conducting an interservice consultation, inviting project promoters to submit their proposals to apply for the status as c-b RES project. In line with the CEF Regulation provision, such a call for proposals is to take place at least once a year.

Stage III: In the **application phase**, project promoters submit all necessary application forms, including their previously conducted CBA. The Commission or a respective implementing agency (e.g. INEA) receives and manages applications. Project promoters are allowed to jointly apply for the status as c-b RES project and grants for works or technical studies. The higher application requirements for grants for works or studies apply in this case. Given the streamlining of the timing of selection procedures outlined below, a proposal will first pass the selection process for the status and, upon receipt of the status, will then be automatically transferred to the selection process for the chosen grant type (i.e. for technical studies or works) within the same year. Note in this context that while project promoters can apply for several stages at the same time in case they want to quickly advance in the process (e.g. joint application of c-b RES status and grants for technical studies or even grants for works), this entails higher risks of sunk cost for the project promoter, given that the outcome of the application process is open and may lead to a negative decision for the project promoter already at the stage of receiving the status as c-b RES project. We therefore recommend for project developers to apply for grants for works only once the c-b RES status has been given.

Stage IV: The actual **selection process** starts with eligibility checks of the submitted proposals on the basis the criteria outlined in section 2.7.2 and conducted by an implementing agency (e.g. INEA). A first scoring (and potentially ranking) done by the Commission (and external evaluators) follows on the basis of the evaluation against individual award criteria as outlined in section 2.7.3 and 2.7.4. Based on this first scoring of projects and the compilation of relevant information (see below), the Group elaborates on a draft list of c-b RES projects. We recommend this to be mainly done by scrutinizing the projects and their scores arising from the previous evaluation exercise against the condensed information provided by the Commission, ranking the projects according to their confirmed scores and by adjusting this ranking, where deemed necessary through a unanimous decision in the Group, in line with regional diversification considerations, e.g. by applying country or regional quotas. Given that the Commission is part of the Group, this procedure can be considered to comply with the CEF Regulation's requirement "to ensure an appropriate geographical balance in the identification of […] such projects". Alternatively, the Group could be required to conduct an additional full-fledged evaluation on the basis of the same or different evaluation criteria than in the previous evaluation round. However, this is likely to lead to substantial transactions costs on all sides and may prolong the selection process significantly. In case the Group were to use the same evaluation criteria as previously applied by the Commission and external evaluators, the added value of an additional evaluation conducted by the Group would be questionable more generally, as this should usually lead to the same or a very similar scoring of projects. Note that relevant stakeholders may be invited to the Group meeting, which is to guarantee an adequate consultation of the latter in the process of selecting projects receiving the status as c-b RES project. On the basis of the draft list elaborated by the Group, the Commission eventually adopts a final list of projects to receive the status as c-b RES project via a delegated act procedure and publishes the list to inform applicants on the outcome of the selection process.

Stage V: As set out in the CEF Regulation, the Group is also responsible for **monitoring project implementation** and to make recommendations on how to overcome possible delays. In doing so, it may be assisted by an implementing agency (e.g. INEA). This requires regular (e.g. annual) updates on project implementation and on changes in the project design compared to the initial application documents. Such information may be provided by project promoters via (annual) progress reports. The Group, supported by the implementing agency (e.g. INEA), monitors implementation on the basis of these progress reports as well as informal bilateral interactions with project promoters and on-site visits. Where necessary, the Group or the implementing agency can provide support to individual projects to overcome potential implementation issues.

Stage VI: Besides the continuous monitoring of project implementation, the **list of projects with c-b RES status should be reviewed** by the Group in regular two-year intervals. For this purpose, the Commission (facilitated by INEA) will submit to the Group a condensed summary report for the respective two-year reporting period that is based on the individual annual progress reports as well as own project assessments (e.g. on-site visits). It should provide sufficient information on all c-b RES projects to vet the criteria for exclusion from the list, such as whether false information has been provided by the applicant, whether major changes in the project design make the project ineligible or require its re-evaluation or whether it is no longer being pursued.

Table 14 Overview of selection process (status as c-b RES project)

Step	Description / discussion of step	Responsible parties
I. Set up of Group for c-b RES projects		
(1) Set up and chair a group for c-b RES projects ("the Group")	Composed of one representative of each Member State and one representative of the European Commission	European Commission
II. Call for proposals (status)		
(1) Draft call for proposal	To take place at least once a year	European Commission (DG ENER)
(2) Consultation of other DGs		European Commission
(3) Adoption and publication of final call for proposal		European Commission
III. Application phase		
(1) Conduct CBA	See CBA guideline (section 2.3)	Project promoter
(2) Fill-in application forms and submit to European Commission	See templates (to be developed)	Project promoter
(3) Receive and manage applications		European Commission (facilitated by implementing agency)
IV. Process for selection as c-b RES projects		

Step	Description / discussion of step	Responsible parties
(1) Check of compliance of applications with the eligibility criteria and selection criteria	See section 2.7.2	Implementing agency (INEA)
(2) Evaluation/assessment of projects	Scoring of applications based on award criteria (informed by CBA and templates), determining overall project score.	European Commission (facilitated by implementing agency) and external evaluators
(3) First scoring of projects and establishing a first (ranked) list of projects to receive the status as c-b RES project		European Commission (facilitated by implementing agency) and external evaluators
(4) Compilation of relevant information from applications for the Group		European Commission (facilitated by implementing agency)
(5) Submission of list of eligible (and scored) projects to Group, including relevant information on eligible projects unless commercially sensitive as well as results of stakeholder consultation	The following information should be submitted to the Group: - a confirmation of the compliance with the eligibility and selection criteria for all projects; - information on the cooperation mechanism that a project pertains to and information regarding to what extent a project has the support of one or several Member States; - description of the objective of the project, including the estimated capacity (in kW) and, where available, renewable energy production (in kWh per annum), as well as its total project costs and eligible costs referred, in euro; - information on the expected EU-added value in line with paragraph 2 (b) of this Annex and on the expected costs and benefits and the expected EU-added value in line with paragraph 2 (c) of this Annex.	European Commission (facilitated by implementing agency)

Step	Description / discussion of step	Responsible parties
(6) Group meeting	Scrutiny of projects and their scores arising from the previous evaluation exercise against the condensed information provided by the Commission, ranking the projects according to their confirmed scores and adjustment of list of projects submitted by Commission in line with regional diversification criteria, e.g. by applying country quotas. Relevant stakeholders and third countries involved in eligible projects may be invited to the Group meetings. Potential non-Member State stakeholders include RES associations, JRC, EIB, ENTSO-E and ACER, existing regional groupings such as PENTA, NSCOGI, CESEC.	Group (i.e. European Commission and Member States)
(7) Elaboration of a draft list of c-b RES projects	Projects to become c-b RES projects	Group (i.e. European Commission and Member States)
(8) Adoption of a final list of selected c-b RES projects via delegated act procedure	Possibility to modify list within strict boundaries, e.g. setting a maximum number of projects in line with a “manageable” number or due to budgetary constraints.	European Commission
(9) Information to applicants / publication on website		European Commission or implementing agency
V. Monitoring of project implementation		
(1) Provide regular (e.g. annual) information on the implementation of their projects	Promoters of projects on the list provide annual progress reports informing about relevant changes or deviations compared to initial application as well as on the progress in project implementation, e.g. in terms of compliance with all relevant eligibility and selection criteria, major changes in the project’s expected EU-added value and the expected costs and benefits.	Project promoters

Step	Description / discussion of step	Responsible parties
(2) Monitor implementation of projects and make recommendations on how to overcome possible delays in their implementation	Implementing agency monitors implementation on the basis of annual progress reports, bilateral interaction with project promoters and on-site visits and provides support to individual projects where necessary. The implementing agency reports back to the Group on the implementation status of projects on the list and on the actions taken to support projects.	Group (i.e. European Commission and Member States) and implementing agency
VI. Review of list of projects with c-b RES status		
(1) Preparation of summary report to be submitted to Group	Summary of annual progress reports submitted by project promoters as well as own assessments (e.g. on-site visits by implementing agency) in a condensed form that contains the relevant information to review the list, i.e. to check relevant criteria for exclusion from the list (see below).	European Commission (facilitated by implementing agency)
(2) Biennial review of list of c-b RES projects	To be conducted at least every two years on the basis of a summary report prepared by the Commission. Criteria for the exclusion from the list: False information provided by the applicant, major changes in the project design that makes project ineligible or that requires a re-evaluation, project has been completed or has already received cross-border RES funding from CEF, project is not being pursued any longer, project does not comply with EU legislation.	Group (i.e. European Commission and Member States)

3.1.3 Selection process for grants for studies and grants for works

For the **selection process for grants for technical studies and grants for works,** we recommend a process resting on best practices of similar procedures in other CEF funding lines that is extended and adapted where necessary to account for the specificities of c-b RES projects. Table 15 summarises the proposed selection process accordingly.

We structure the selection process for receiving grants for studies and grants for works along five main stages:

Stage I: In line with established CEF procedures, the process for the selection of projects for either grant type starts with the **drafting and adoption of a multiannual work programme** by the Commission, including available indicative budgets, schedule of selection rounds, objectives, scope as well as award and selection criteria. Member State participation in this process is ensured through the consultation of the CEF coordination committee as provided for by the CEF Regulation proposal.

Stage II: The Commission launches a **call for proposals** after conducting an interservice consultation, inviting project promoters to submit their proposals to receive grants for studies or grants for works. Compared to the work programmes, calls for proposals for specific selection rounds include further details, prioritisations relevant for the call in question as well information about the submission process, e.g. deadlines and relevant application forms to be submitted.

Stage III: In the **application phase**, project promoters submit all necessary application forms, including their previously conducted CBA. The Commission or a respective implementing agency receives and manages applications.

Stage IV: The actual **selection process** starts with eligibility checks of the submitted proposals on the basis the criteria outlined in section 2.7.2 and conducted by the Commission or an implementing agency. Besides these eligibility criteria, compliance of the applicant project with EU policy and law, such as state aid, public procurement and environmental law may also be checked by the responsible implementing agency in line with past CEF selection practice (mainly relevant for grants for works). The Commission (and external evaluators) evaluate and score eligible projects against individual award criteria as outlined in section 2.7.3 and 2.7.4. Based on the attributed scores, the Commission takes a draft selection decision on projects receiving grants for studies or grants for works. After conducting an interservice consultation and consulting the CEF coordination committee in line with the examination procedure as set out in Article 5 of Regulation (EU) No 182/2011, the Commission adopts a final selection decision on projects receiving either form of grant. Lastly, applicants are informed about the selection decision and grant agreements with successful applicants are prepared and signed.

Stage V: The Commission or an implementing agency **disburses grants and monitors the implementation** of c-b RES projects receiving Union funds. Monitoring of project implementation is based on regular (e.g. annual) progress reports submitted to the Commission by beneficiaries. The Commission provides access to these reports to Member States for projects located on their territories. Moreover, progress towards the achievement of the objectives in the field of c-b RES projects is measured against the indicators reported in part I of the CEF Regulation Annex. This monitoring and evaluation framework may be supplemented via delegated acts. Based on this, the Commission publishes a real-time map on a dedicated webpage to inform about currently funded projects. In addition, the CEF Regulation obliges the Commission to publish biennial progress reports on the implementation of the overall CEF program in line with its (sectoral) objectives, e.g. in terms of the aggregate progress in project implementation currently funded

We suggest that the basic set up for the selection of projects along the five steps proposed should, in principle, remain the same for grants for works and grants for studies. A differentiation between to the stages pertains, however, to the fact that the evaluation design differs slightly between these two grant types (see section 2.6), as some of the award criteria cannot be assessed for grants for studies.

Finally, since only projects possessing the status as c-b RES project are eligible to apply for grants for studies or works, the sequential timing or staging of the selection procedures for different application stages is crucial to avoid project delays and increase the policy's effectiveness. As such, it should generally be ensured that projects applying for the status as c-b RES project should, upon receiving the status, be able to apply for grants for studies or works in that same year. The selection procedure for receiving the status as c-b RES project should therefore take place sufficiently in advance of the selection rounds for grants for studies and works, should follow a regular schedule (i.e. at least once a year) and be completed within a reliably short period (i.e. ideally not longer than 4 to 5 months). Moreover, it should be possible that applicants jointly apply for the status as well as for grants for studies or works at the same time and automatically pass through both selection processes (upon previously receiving the status as c-b RES project) without having to apply for either step separately. In this case, the higher application requirements to receive grants for studies or works apply. As such, timing could, for example, be as such that selection of projects receiving the status as c-b RES project starts at the beginning of a year, successful projects receive the status 2-3 months later and are then able to participate in any of the following selection rounds for grants for works or studies in the same year. This is to ensure that delays in project implementation are avoided, e.g. in case projects are not able to participate in calls for proposals for grants in a specific year because the selection procedure to receive the status is not terminated sufficiently in advance, and to increase overall effectiveness of the CEF funding line.

Table 15 Overview of selection process (grants for studies, grants for works – only projects with c-b RES status are eligible)

Step	Description / discussion of step	Responsible parties
I. Work programme		
(1) Draft of multiannual work programme		European Commission (DG ENER)
(2) Interservice consultation		European Commission
(3) Consultation of CEF coordination committee	Opinion by CEF coordination committee in line with examination procedure of Article 5 of Regulation (EU) No 182/2011	European Commission and Member States (CEF coordination committee)
(4) Adoption and publication of work programme via implementing act	To be adopted by 31 December 2020 Including timetable of calls for proposals for the first three years of the programme, their topics and indicative budget, prospective framework covering entire programming period; award and selection criteria.	European Commission
II. Calls for proposals		
(1) Draft call for proposal based on working programme		European Commission (DG ENER)
(2) Interservice consultation		European Commission
(3) Adoption and publication of final call for proposal	Including further details, prioritisation and information about submission and selection process	European Commission (facilitated by implementing agency)

Step	Description / discussion of step	Responsible parties
III. Application phase		
(1) Conduct CBA	See detailed CBA guideline (section 2.3)	Project promoter
(2) Fill-in application forms and submit to European Commission	See templates (to be developed)	Project promoter
(3) Receive and manage applications		European Commission/implementing agency
IV. Selection process		
(1) Check of compliance of applications with the eligibility criteria and selection criteria		Implementing agency (INEA)
(2) Evaluation/scoring of projects	Scoring of applications based on award criteria (informed by CBA and templates) determining overall project score (section 2.7.4)	European Commission & external evaluators
(3) Draft selection decision	Projects recommended to receive grants for works or grants for studies	European Commission (facilitated by implementing agency)
(4) Interservice consultation		European Commission
(5) Consultation of CEF coordination committee	Opinion by CEF coordination committee in line with examination procedure of Article 5 of Regulation (EU) No 182/2011 Participants: European Commission and Member States and as appropriate promoters of eligible projects, third countries involved in eligible projects and participation any other relevant stakeholders	European Commission and Member States (CEF coordination committee)

Step	Description / discussion of step	Responsible parties
(6) Adoption of a final selection decision via delegated act	Possibility to modify list within strict boundaries, e.g. need for budgetary adjustments due to budgetary constraints.	European Commission
(7) Information to applicants / publication on website		European Commission (facilitated by implementing agency)
(8) Grant agreement preparation and signature		European Commission (facilitated by implementing agency)
V. Grant disbursement and monitoring of project implementation		
(1) Disbursement of grants		European Commission (facilitated by implementing agency)
(2) Beneficiaries submit (annual) reports to the Commission as defined in the respective grant agreements	Beneficiaries provide progress reports e.g. informing about project implementation and relevant changes or deviations compared to initial application, in particular in terms of changes to costs and benefits as well as the eligible funding gap (basis of grant amount).	Project promoters
(3) Provide access to reports to Member States regarding actions located on their territories		European Commission (facilitated by implementing agency)
(4) Monitor implementation of projects and report progress towards the achievement of objectives	Assess progress against indicators reported in part I of Annex to CEF Regulation; possibility to review and complement the indicators as well as to supplement Regulation with provisions on the establishment of a monitoring and evaluation framework via delegated acts.	European Commission (facilitated by implementing agency)

Step	Description / discussion of step	Responsible parties
(5) Publication of real time map on dedicated internet site with the projects in implementation together with relevant data	Data includes e.g. impact assessment, value, beneficiary, implementing entity, state of play.	European Commission (facilitated by implementing agency)
(6) Publication of biennial progress reports	Report implementation of program in line with objectives laid out in Article 3 of CEF Regulation, clarifying whether sector is on track, whether budgetary commitment is in line with the total amount allocated, if on-going projects reached a sufficient degree of completeness, if they are still feasible and convenient to be delivered.	European Commission (facilitated by implementing agency)

3.2 Subtask 2.2 Standard application format and comparison grid

In consultation with the Commission and given that standard application formats will be developed centrally as part of the new harmonised CEF e-grant application procedure, we will not elaborate in detail on the required standard application format as part of this project.

In general, the application format should be comprehensible, include all relevant information to quickly assess the project's eligibility and be as concise as possible to limit transaction costs for applicants. In particular, all necessary information and elements to be provided in the CBA and later on evaluated in the award criteria should be clearly reflected in the structure and the content of the application format. In our view, the templates currently used for CEF Energy projects provide a good starting point in this respect.

4 CASE STUDIES

In this chapter, we describe four case studies that illustrate how the methodology outlined in chapter 2 can be applied. The case studies and numbers are hypothetical. To reflect the heterogenous nature of potential applicants to CEF funding, the following case studies were chosen with each representing a different type of project:

- Case study 1: A joint CSP project between Portugal and Germany driven by a technological rationale
- Case study 2: A district heating project as a physical project, but policy-driven due to envisaged statistical RES transfers between Bulgaria and Luxemburg
- Case study 3: Opening of the technology-neutral Dutch support scheme to projects in Romania
- Case study 4: A joint support scheme for innovative electric vehicle charging, involving Austria and Slovenia

In principle, each case study follows the four application stages and implements all 9 elements of the CBA. However, to reduce the complexity of the case studies and to avoid redundancy between them, each case study focuses on different aspects: case study 1 provides a detailed walk-through the process (which is not repeated in such detail in the subsequent case studies; case study 2 focuses on the application of a joint project and the heating sector; case study 3 elaborates on the specificities of a joint support scheme and case study 4 seeks to explore options for a project in the transport sector which is not a joint support scheme in the strict sense of Article 13 of the REDII, but rather "another kind of agreement" as provided for in the CEF regulation.

4.1 Case study 1: Joint CSP project between Portugal and Germany

The hypothetical c-b project project is a CSP project with storage capacity, located in Portugal. It seeks to export high-value electricity to Germany. The project is initially put forward by the project developer.

This chapter illustrates how the project would pass the four application stages to access grants for works.

4.1.1 Stage I: Application for pre-feasibility studies

- A draft call for proposals for pre-feasibility studies had been published by DG Ener.
- Subsequently, the project developer submitted the application forms to the European Commission to receive a grant for a study within the framework contract.
- INEA has checked the application's eligibility and completeness.

The CBA and the further application documents reveal the following information:

4.1.1.1 Presentation of the socio-economic, institutional and political context

The project is being developed in the following socio-economic, institutional and political context:

- Germany:
  - 2016 RES share: 14.8%, electricity 32.2%
  - 2020 target of 18%, there is a chance of missing the target

- The energy market is liberalised for investments, production, trade, supply and retail segments, and market entry is possible.
- There are structural grid congestions between northern and southern Germany, resulting significant redispatch costs.

- Portugal:
  - 2016 RES share: 28.5%, electricity 54.1%
  - 2020 target of 31%, there is a chance of missing the target
  - The energy market is liberalised for investments, production, trade, supply and retail segments, and market entry is possible.
  - RES share is relatively high and in some periods 100% with significant exports to Spain, i.e. there is some level of stress on the grid and redispatch measures (incl. curtailment) occur. Interconnection capacities with Spain are well developed, but interconnections between Spain and France are limited and subject to discussions between both Member States.

4.1.1.2 Definition of objectives

- The project aims to
  - Facilitate cross-border cooperation
  - Increase European competitiveness
  - Support social and economic cohesion
  - Support the access to and integration of the internal market
  - Facilitate the decarbonisation of the economy
  - Support security of supply
  - Support the cost-effective exploitation of renewable energy sources as well as facilitate their integration through energy storage facilities and with the aim of contributing to the Union's long term decarbonisation strategy
  - Enable the strategic uptake of innovative renewables technologies

4.1.1.3 Project identification

- Initial project description:
  - A Concentrating Solar Power plant with a Thermal Energy Storage System
  - The envisaged project size is 25 MW
  - The project will be using either parabolic trough or solar tower technology.
  - Thermal energy storage (TES) will be included into the project and will be based on molten salt storage with a total capacity to be settled during the technical design stage. However, a storage capacity above 6 hours is envisaged.
  - The project was identified in the Strategic Energy Technology Plan (SET-Plan) and within this in the CSP Implementation Plan. It is part of the scope of demonstration projects at commercial scale, i.e. the First of-a-kind commercial-scale plants (FOAKs).
  - The plant aims to provide high-value dispatchable electricity to an off-taker located in a central European country (probably Germany), i.e. provide electricity at times of high wholesale market prices in Germany.

- Responsible and affected bodies include:
  - The project developer
  - The Member States Germany and Portugal, represented by the Portuguese Ministry for the Environment and Energy Transition and the German Ministry for the Economy and Energy
  - Portugal's TSO (Redes Energéticas Nacionais, REN),

- The relevant DSO (EDP Distribuição) ,
- The Portuguese national issuing body for the GOs: LNEG (National Laboratory of Energy and Geology), REN, Direção-Geral de Energia e Geologia (DGEG), third party? Issue remains to be solved as no GOs have been issued so far.
- The local community where the project would be located
- Public entities responsible for the EIA
- Etc.

4.1.1.4 Technical feasibility & Environmental sustainability

- The technical design of the project: see above
- High-level cost estimate: ~€ 200 m total cost, high level estimate of necessary € 40m grant size
- Implementation schedule: Project is at conceptual stage.
  - Pre-feasibility 2020-2021
  - Feasibility 2021
  - Technical design 2022
  - Permitting and pre-construction 2023-2024
  - Construction 2024-2025
  - Operation 2025

- Demand analysis:
  - Demand for the output estimated by project developer is very high as Germany is in need of electricity at time with low RES infeed (i.e. high energy prices)

- Environmental considerations, including climate change considerations and environmental impact considerations
  - Project will contribute significantly to climate change mitigation as it will provide electricity for Germany when RES infeed in Germany is low and thus it will replace especially coal and gas use in Germany (this assumption will be corrected at a later stage in the process).
  - The project will have limited environmental impact (similar to other CSP projects) and will be scrutinised in the regular EIA process.

4.1.1.5 Cooperation mechanism involved

- The envisaged Cooperation Mechanism is a Joint Project. So far, the Portuguese Ministry for the Environment and Energy Transition and the German Ministry for the Economy and Energy have met at the sides of various CA-RES meetings and other fora and are jointly discussing the concept put forward by the project developer.

4.1.1.6 Added value of cooperation

- The key aspects in which this project will provide added value include:
  - Slightly reduced cost of support for Germany's target achievement compared to national deployment (when CEF funding is provided)
  - Reduced GHG emissions (see above)
  - Improved security of supply, as Germany is supplied with electricity when prices are high
  - Innovation, as a new technology in line with the SET plan is used
  - Policy coordination, as Portugal would implement the GO system and enable the issuing of GOs

- I.e. the project promoter presents a clear case of a wide range of positive externalities of the project (to be considered in the project assessment)

4.1.1.7 Economic analysis (social welfare)

Counterfactual: The economic analysis is conducted against a case-specific counterfactual: Germany would otherwise achieve its targets nationally (mainly onshore wind and PV) and the project would not be built as such.

CBA indicator	Net effect	Explanation
(a) costs of energy generation	0	Better resource availability in Portugal is offset with higher financing costs and costly technology
(b) system integration costs	++	Initial assumption (to be corrected below): Cost savings as plant will be dispatchable, improving market values and providing balancing services in Germany (i.e. reducing redispatch costs)
(c) cost of support	+	Cost savings for Germany as CSP + storage allows feed in of electricity at times of higher market value compared to wind onshore and PV in Germany (i.e. lower support costs)
(d) greenhouse gas emissions	+	Initial assumption (to be corrected below): Delivery of electricity to Germany especially when prices are high implies replacement of coal and gas, i.e. positive effect compared to national target achievement.
(e) security of supply	+	Initial assumption (to be corrected below): Delivery of electricity to Germany especially when prices are high implies improved contribution to limiting the quantity of Energy Not Supplied (ENS), as well as increasing resilience/margin in the energy system.
(f) air and other local pollution	0	
(g) Innovation effect	+	Effect is positive but cannot be monetised. The CSP installation with storage is in line with the relevant SET plan.

Social NPV of the project is expected to be clearly positive.

The application has been assessed by the European Commission is granted a study with the amount of € 80.000 in the form of:

- *a pre-feasibility study to further develop the concept*
- *a workshop to be implemented with the project developer, relevant entities from Germany and Portugal and representatives of the European Commission.*

As a result of the pre-feasibility study and the workshop, several aspects of the project are refined. A key issue was the assumption that electricity and even balancing services can directly be sold from a

project in Portugal to Germany, thus creating additional value in times of high-electricity prices in Germany.

This assumption does not hold because:

- providing cross-border balancing services is not possible as this is organised nationally,
- ensuring the physical delivery of electricity during certain times through interconnectors is not feasible, as these are largely operated in the context of market coupling, i.e. outcomes at electricity exchanges in CWE/NEW define the use of Germany's interconnectors with its neighbours.

As a result, the high-level estimate of the economic NPV has slightly changed:

CBA indicator	Net effect	Explanation
(a) costs of energy generation	0	Better resource availability in Portugal compared to Germany is offset with higher financing costs and costly technology option.
(b) system integration costs	+	Cost savings as plant will be dispatchable (higher market value and lower redispatch costs). *However, these savings are now provided in Portugal,* still resulting in societal benefits (the comparable case would have been wind onshore and solar in Germany without storage).
(c) cost of support	0	Cost savings for Germany as market value of electricity with storage is higher (now calculated for Portugal as electricity is not to exported anymore to Germany via explicit physical transfer). Higher technology-costs offset this advantage, roughly resulting in net zero effect.
(d) greenhouse gas emissions	+	Delivery of electricity to Germany especially when prices are high does not hold anymore – however, the project still implies replacement of coal and gas (*now in Portugal*), and still has a positive effect compared to the CF of target achievement in Germany by wind onshore and PV in Germany. However, the net effect is slightly lower.
(e) security of supply	+	No delivery of electricity to Germany, however, storage contributes to limiting the quantity of Energy Not Supplied (ENS), as well as increasing resilience/margin in the energy system also in Portugal. The overall effect is still positive compared to the counter factual.
(f) air and other local pollution	0	
(g) Innovation effect	+	Effect is positive but cannot be monetised. The CSP installation with storage is in line with the relevant SET plan.

The social NPV of the project is still slightly positive although less evident than in the previous high-level assessment.

4.1.1.8 Assessment of commercial viability and determination of grant size

- A high-level statement is provided: The project expects not to be commercially viable as the higher market values based on the addition of storage will not offset the high technology costs of the installation.

4.1.1.9 Sensitivity and risk assessment

The sensitivity is not yet conducted, the qualitative risk assessment has identified the main risks for the project realisation:

- No cooperation agreement between Portugal and Germany implemented (based on complexity of cost-benefit distribution and because Germany ultimately opts to put money into the financing mechanism based on political preferences)

- Administrative barriers in the permitting procedure in Portugal, as the technology is new and grid connection as well as the environmental impact assessment result in massive delays of the project realisation.

The project has returned to stage I once more to ask for additional studies to be supported in the application for the CB-RES status. The project is of considerable size and makes claims on system integration and on innovation.

European Commission decides to grant the project more substantial studies to cover some of the costs for quantification and support in the application process.

The outcome of this study has directly supported the details required in stage II.

4.1.2 Stage II: Application for CB-RES project status

Following the previous preparation, the project responds to a call for proposals according in line with the work programme. It provides high-level statements, however, making reference to all CBA elements (1-9).

INEA checked the compliance of the application with formal requirements.

The following information was revealed in the application:

4.1.2.1 Presentation of the socio-economic, institutional and political context

- More detailed description of the RES market in Portugal and what role the project would play therein (e.g. consortium of market incumbent with new market entrant).

4.1.2.2 Definition of objectives

More detailed and yet more precise description of the objectives of the project:

- Facilitate cross-border cooperation between Portugal (with massive resources, experience in high shares of RES, need for storage to integrate the production into the market, interest in

local value creation) and Germany (with a lack of target achievement, the political will to continue the opening of its support scheme, interest in technology cooperation to provide German technology providers with potential markets)

- Increase European competitiveness:
  - the storage addition will provide better market values and thus lower energy costs for consumers
  - the technological leadership role is support by innovative technology, making European technology providers more competitive globally
- Support social and economic cohesion: creating local value in Portugal
- Support the access to and integration of the internal market: Participation of the plant in balancing markets opens new segment for RES and consortium set up allows new market player to enter the market.
- Facilitate the decarbonisation of the economy
- Support security of supply by means of limiting the quantity of ENS and increasing resilience/margin in the energy system in Portugal
- Support the cost-effective exploitation of renewable energy sources (by means of using Portugal's excellent resources) as well as facilitate their integration through energy storage facilities (by means of adding molten sand storage technology to the project)
- Enable the strategic uptake of innovative renewables technologies

4.1.2.3 Project identification

- As above, but the plant is now envisaged to use parabolic trough technology, to allow for storage capacity of 12 hours.
- The plant does not aim to provide high-value dispatchable electricity to an off-taker located in a central European country anymore but serves local power market in Portugal.
- Bodies responsible and necessary for the project implementation: as above (now including contact details of specific persons to be contacted in case of questions or need of coordination).

4.1.2.4 Technical feasibility & Environmental sustainability

- Technical design: As above but more detailed description provided
- Implementation plan: as above but more detailed
- Demand analysis: More detailed than above and refined focus: Demand for the output (dispatchable electricity) is now described with a view to local demand in Portugal
- Environmental considerations, including climate change considerations and environmental impact considerations now revised (focus on Portugal):
  - Project will contribute significantly to climate change mitigation as it will provide electricity for Portugal when RES infeed is low and thus it will replace especially coal and gas use in Portugal
  - The project will have limited environmental impact (similar to other CSP projects) and will be scrutinised in the regular EIA process.

4.1.2.5 Cooperation mechanism involved

- The envisaged Cooperation Mechanism is still a Joint Project.

- In the meantime, the Portuguese Ministry for the Environment and Energy Transition and the German Ministry for the Economy and Energy have each provided LoIs, mentioning the cooperation for a CSP project with storage.

4.1.2.6 Added value of cooperation

- Added value for the EU
  - According to high-level statements in the economic analysis (slightly positive social NPV)
  - In addition, intensified political cooperation among Member States
- Cost for EU: CEF funding

The costs and benefits may look different for each of the involved parties as the societal benefits will be distributed between the cooperating partners:

- Added value for Portugal
  - Improved system integration/operation costs
  - Reduced GHG emissions (see above)
  - Improved security of supply
  - Reduced local air pollution
  - Local added value (jobs)
- Costs for Portugal:
  - Grid reinforcement
  - Use of good site

- Added value for Germany
  - Target achievement statistics
  - Slightly reduced cost of support for Germany's target achievement compared to national deployment. This effect is significant when CEF grants are mobilised.
  - Market for technology from companies based in Germany
- Costs for Germany
  - Partial support costs for the plant (the remainder to be covered by CEF)

These costs and benefits remain to be distributed in detail between Portugal and Germany, which is subject to detailed negotiations on the cooperation agreement between both countries.

4.1.2.7 Economic analysis (social welfare)

The economic analysis is still providing the high-level statements as outlined in the early feasibility study above.

4.1.2.8 Assessment of commercial viability and determination of grant size

- A high-level statement is provided, showing that the project has a negative FNPV, i.e. needs additional funding.

The external evaluators and the European Commission (facilitated by INEA) assessed the project (see for an exemplary assessment section 4.1.5) and scored it with 20 (out of 25). The project was ranked no 6 in a draft list of 25 projects. The Group endorsed the draft list and the stakeholder consultation did not reveal any opposition to the project. The project was included into the final published list and thus granted the status of a c-b RES project.

4.1.3 Stage III: Application for grants for technical studies

The project promoter does not seek grants for technical studies, as these studies are jointly financed by Portugal and Germany, given the advanced status of the cooperation agreement negotiations and the outlook to access actual funding for the works.

4.1.4 Stage IV: Application for grants for works

The project applies for grants for works in 2023 (according to the initial plan). It's application is based on a detailed CBA (financed by Germany and Portugal) and reveals the following information:

- The objectives are as above (now slightly further elaborated, but focus is the same)
- The project identification now includes a detailed description of the project and the works to be funded
- Technical feasibility and environmental sustainability are described in detail. It includes a preliminary EIA.

4.1.4.1 Cooperation mechanism involved

- The application includes a draft cooperation agreement between Portugal and Germany, including detailed statements on the distribution of costs and benefits. However, the implementation of the agreement is subject to accessing 25m€ of funding from the CEF line or other funding opportunities.
- The added value of the cooperation (compared to non-cooperation) is the same as above.

4.1.4.2 Economic analysis (social welfare)

The economic analysis is now providing quantifications on most elements and is still applying the detailed assessment as suggested in the guideline.

The outcome of the analysis is a net social benefit of 28 m€. This benefit needs to be seen in light of the additional added value of the cooperation that cannot be monetised (see above).

The counterfactual has not changed: The economic analysis is conducted against a case-specific counterfactual: Germany would otherwise achieve its targets nationally (mainly onshore wind and PV) and the project would not be built as such.

CBA indicator	Net effect (m€)	Explanation
(a) costs of energy generation	0	Better resource availability in Portugal compared to Germany is offset with higher financing costs and costly technology option.
(b) system integration costs	10	Cost savings as plant will be dispatchable (higher market value and lower redispatch costs). However, these savings are now provided in Portugal, still resulting in societal benefits (the comparable case would have been wind onshore and solar in Germany without storage).
(c) cost of support	0	Cost savings for Germany as market value of electricity with storage is higher (now calculated for Portugal as electricity is not to exported anymore to Germany via explicit physical transfer). Higher technology-costs offset this advantage, roughly resulting in net zero effect.
(d) greenhouse gas emissions	8	Delivery of electricity to Germany especially when prices are high does not hold anymore – however, the project still implies replacement of coal and gas (now in Portugal), and still has a positive effect compared to the CF of target achievement in Germany by wind onshore and PV in Germany. However, the net effect is slightly lower.
(e) security of supply	10	No delivery of electricity to Germany, however, storage contributes to limiting the quantity of Energy Not Supplied (ENS), as well as increasing resilience/margin in the energy system also in Portugal. The overall effect is still positive compared to the counter factual.
(f) air and other local pollution	0	
(g) Innovation effect	0	Not monetised, but plant is in line with set plan.
Sum of net effects	28 m€	

4.1.4.3 Assessment of commercial viability and determination of grant size

In the financial analysis, the project promoter does not need to perform fundamentally new modelling but can use the financial modelling they have conducted in the past while planning the project.

First, the project promoter demonstrates through a discounted cash flow analysis that the project would not be conducted in absence of the grant: In real terms, the project experiences 98 m€ negative investing cash flows in year one and 2.9 m€ negative operating cash flows per year subsequently. Positive cash flows are 25 m€ support payment from the Germany government and estimated 8 m€ per year as market revenues. The project promoter proves that financing costs in Portugal exceed the DG REGIO recommended WACC rate of 4% and uses a discount rate of 5%.

The resulting net present value stands at -11 m€, making the project commercially non-viable and hence eligible for a CEF grant in this aspect.

For calculating the amount of grants, the promoter submits a financial model including profit & loss statements and balance sheets. The model contains largely the 154 m€ expenditure and 177 m€ revenue listed in the DCF analysis of the previous step. Additionally, however, the model contains a full financing plan (including interest payments of 29 m€) and the required CEF grant. Assuming a CEF grant of 25 m€, the model yields a return on equity of 6% which would be required to realise the project as this value corresponds to investors' expectations in the Portuguese market.

In the third step, all non-eligible costs are subtracted from the total expenditure. In this case, only financing costs and some corporate overhead of 2 m€ are not eligible, leading to 152 m€ eligible costs. Assuming the CEF grant size of 25 m€ calculated before and the support payment by Germany of 25 m€, this leads to a co-financing rate of 32.8% of eligible costs. This is compliant with the CEF regulation which states a co-financing limit of up to 50%.

Finally, the project promoter needs to demonstrate that the cash balance will always be positive. The corresponding liquidity planning shows all project cash flows for every year. The critical point from a cash perspective is the first year with a negative investing cash flow of 98 m€. Liquidity at this point however is ensured through 25 m€ German support payments, 25 m€ CEF grant, 30 m€ cash equity investments and a 40 m€ commercial bank loan. In subsequent years, positive operating cash flows exceed negative financing cash flows while investing cash flows are close to zero, leading to a permanently positive cash balance.

All in all, the project promoter has successfully demonstrated commercial non-viability, compliance with co-financing limits and financial sustainability while determining the amount of grants for works to be awarded at 25 m€.

4.1.4.4 Sensitivity and risk assessment

Based on the economic and financial analyses, the project promoter presents a sensitivity and risk analysis that is partly based on studies conducted under grants by the Portuguese and German ministries.

For the economic analysis, critical input parameters that have been identified, including investment costs and the assumption around emission reductions. If investment costs are 5% higher than expected, indicator (a) (cost of energy generation) would present a negative net effect of -1 m€ instead of net zero.

For the financial analysis, the WACC of 5% is varied to test commercial non-viability, but even with a WACC of only 3% the project presents a slightly negative FNPV of -0.5 m€. If higher investment costs were occurred, they could be covered by the company's loan facilities and are unlikely to lead to project termination since additional costs will most likely be lower than writing off investments made up to that point. Similarly, lower power market prices could make the project unprofitable. The thermal storage system however allows the plant to circumvent adverse power market conditions to some extent through optimised dispatch. Also, even in the worst-case scenario the project will still have positive operating cash flows which means that it will not be terminated even if it is not profitable.

Qualitative risks are mostly about the cooperation mechanism and permitting procedures. If Portugal or Germany would withdraw from the envisaged cooperation, the project would likely be terminated. Since the draft cooperation agreement is not yet legally binding, this is theoretically possible, and the project promoter does not have meaningful options to mitigate this risk. On the other hand, negotiations between the governments have proceeded well and the draft agreement is already in an advanced stage including detailed statements on the distribution of costs and benefits. In this light it is

reasonable to assume that the risk of non-cooperation is sufficiently low. The risk of major delays due to issues in the environmental permitting procedures has been addressed in a study conducted by a construction consulting firm. They inspected the site, reviewed applicable permitting procedures and identified applications that should be handed in first to ensure a timely commencement of construction.

The sensitivity analysis demonstrates that this is not a high-risk project so no further probabilistic modelling is required. Qualitative risks can either be accepted (non-cooperation) or mitigated (permits). Therefore, the project is found to have a sound risk management plan.

4.1.5 Final Evaluation

The final evaluation of the project can be seen below, resulting in a score of 18.5 of 25. In the specific year, the project competes with various other projects ranging from 15 to 24 points. It is put on the draft list for funding by DG Ener and passes the interservice consultation. The CEF coordination committee published its opinion in line with the examination procedure of Article 5 of Regulation (EU) No 182/2011. The final selection is adopted via a delegated act.

As a result, the project promoter manages to be selected for the amount of 25m€ of CEF funding.

Award criteria	Elements to be considered (Art. 13)	Sub-indicators (scored from 0 to 5)	Score per element	Average total score per award criteria (0 to 5) (rounded to half points)
Maturity	Maturity of the action in the project development	Status of preparation of the action, i.e. its capacity for implementation in line with the foreseen time plan and technical specifications as well as state of readiness for commencement at short term	4	4.5
		Readiness to reach financial close for the specific project	4	
		Status of the cooperation agreement (concept to signed cooperation agreement)	5	
Quality	Soundness of the implementation plan proposed	Coherence between proposed objectives and planned resources of the action	4	3.5
		Appropriateness of project management	4	
		Adequacy of risk and quality control processes	4	
Impact	Economic, social and environmental impact, including climate impact (project life cycle benefits and costs), soundness, comprehensiveness of the analysis.	Consistency of CBA implementation with quality requirements at the respective stage as outlined in chapter 2.3	5	3
		Extent of positive externalities provided by funded action, i.e. the level of total net benefit as resulting from CBA economic analysis.	3	
	Innovation	Contribution to advancing the current technology readiness level (TRL) of the employed technologies as resulting from CBA economic analysis	5	
		Quantified effect of innovation on target groups via size of target group and marginal social value of the innovation, as resulting from CBA analysis (if applicable) *(optional)*	n.a.	
	Cross-border dimension	Size of project (relative to national RES capacities / RES support / RES share)	4	
		Number of Member States and/or third states involved, or area affected	2	
		Magnitude of cross-border benefits for the energy system	2	

Award criteria	Elements to be considered (Art. 13)	Sub-indicators (scored from 0 to 5)	Score per element	Average total score per award criteria (0 to 5) (rounded to half points)
		Extent of alignment between support schemes or other regulatory conditions	2	
		Coordination requirement between government entities throughout the project	2	
		Reduction of cross-border distortions	2	
Stimulating Effect of Financial Assistance	Catalytic effect of Union financial assistance on investment	Extent to which funding will ensure/accelerate the implementation of the proposed action, e.g. via ratio of “benefit per required grant”	3	3
Priority and urgency of the action	European added value Consistency with Union and national energy and climate plans	Contribution to the cost-effective achievement of Union binding RES target of 32% until 2030, i.e. including to what extent the action is consistent with Union and national energy and climate plans,	4	4.5
		Contribution to enhancing European technical leadership, e.g. by deploying of innovations previously funded by EU programmes for low-carbon innovation (e.g. NER 300/IF, Horizon 2020) and alignment with Energy Technology (SET) Plan (i.e. contribution towards SET key actions and technology-specific strategic targets).	5	
		Alignment with EU long-term decarbonisation strategy, e.g. by facilitating RES integration through energy storage facilities	5	
		Contribution to completing the internal energy market, e.g. extent to which action engages new market players such as local energy communities	4	
		Contribution towards enhancing the security of supply, e.g. in terms of reducing import dependence via the local deployment of RES	5	
Total score				18.5 / 25

4.2 Case study 2: Luxemburg supports a district heating project in Bulgaria

This case study is based on a hypothetical district heating project in Bulgaria. A new geothermal plant with a thermal capacity of 100 MW is to be constructed and connected to the district heating network. At the same time, the network is to be refurbished for better insulation so that the geothermal plant can supply a larger amount of final RES energy. The geothermal plant and the refurbishment of the district heating network are a combined project that is subject of a planned bilateral agreement between Bulgaria and Luxemburg. The project is planned to be financed primarily by Luxemburg, however, it would need additional support.

The undertaking would be promoted as a c-b-RES project jointly by Bulgaria and Luxemburg. The two countries would together hand in applications for feasibility study grants, c-b RES project status, technical study grants and ultimately grants for works (in practice they would probably appoint an agency that does the application for them). This chapter illustrates how the project would be assessed in the corresponding four-stage application methodology described in chapter 2.3.1.

Please note that the description of case study 2 does not reiterate the explanation of the procedural details as done in case study 1 (e.g. "*A draft call for proposals had been submitted by DG Ener")*, but focusses on the project concept, the CBA and the evaluation.

4.2.1 Stage I: Application for a pre-feasibility study

At this stage, most steps of the CBA require little detail or analysis; hence it is conceivable that actual applications will not need to submit documents that are much more in-depth than the hypothetical content in this section.

4.2.1.1 Presentation of the socio-economic, institutional and political context

This element consists partly of a compilation of general country information relevant to the application such as GDP, energy balances, electricity market structure etc. These are usually publicly available through Eurostat or national institutions and not elaborated here in detail.

The other part of this step relates more specifically to the project. Against the background of the context described above, the rationale of Member States to participate and the cooperation mechanisms to be employed shall be outlined. In this case, the motivation would be as follows:

- Bulgaria:
  - In winter, thermal power plants must run to supply heat which creates problems when an increasing share of variable renewables requires system flexibility;
  - Air pollution caused by coal-fired CHP plants is an issue in many regions;
  - Losses in heat transmission are costly and a threat to security of supply;
  - Foreign direct investment is needed to continue economic growth.

- Luxemburg:
  - Achieving RES targets nationally appears challenging, making payments for statistical RES transfers attractive
  - Investing in a specific project is more acceptable to the public in Luxembourg than pure (ex-post) statistical transfers
  - Efficiency gains through refurbishment of the district heating network would turn investment in plant into higher amount of final energy used and thus increase the cost-effectiveness of the support paid by Luxemburg.

4.2.1.2 Definition of objectives

The project addresses several general and energy-specific objectives mentioned in CEF:

- facilitate the decarbonisation of the economy
- facilitate cross-border cooperation
- support social and economic cohesion
- promote energy efficiency

4.2.1.3 Project identification

This section needs to cover some technical characteristics of the project, bodies that would be involved and how the cooperation would be designed.

Physically, the project is centred around the construction, heating grid connection and operation of a geothermal heat supply plant with a thermal capacity of 100 MW. This would supply around 30 thousand households. The geothermal heat supply plant would significantly limit the must run periods of coal-fired CHP plants in the district during winter. At the same time, the refurbishment of parts of the district heating grid, to which the plant will be connected, will leverage the actual usage of renewable heat for households. Insulation losses are to be reduced from roughly 40% to 20%.

District heating is usually not “unbundled” which means that the operator of the network also controls which generation assets receive access to the grid (however, this needs to change with the implementation of REDII). From an administrative perspective, three cases are common: a private operator, a publicly owned operator that is not bound by municipal instructions or a publicly owned operator that is fully subject to municipal directions. In each case, the municipality would determine the cost and conditions of the project with the operator and would not source the geothermal capacity as it would be done with many renewable electricity projects, i.e. issuing a competitive tender.

After having project specifics and costs sufficiently estimated, the Bulgarian municipality approaches the national government asking for help accessing international funds to finance the project. The Bulgarian government enters talks with Luxemburg’s government, which has signalled interest in achieving its RES target through the use of cooperation mechanisms. Bulgaria and Luxemburg discuss on the transfer of statistical RES benefits in exchange for project funding. As investing in a specific project is more acceptable to the public in Luxembourg than pure (ex-post) statistical transfers, Luxemburg signals a willingness to pay to cover parts of the funding gap of the geothermal plant including the refurbishment of the district heating. The willingness to pay is defined and made public at a later stage.

4.2.1.4 Technical feasibility & Environmental sustainability

- The technical design of the project: see above
- High-level cost estimate (to be further detailed in later application stages):
  - ~ 200m€ investment costs for 100 MW geothermal plant based on 2000€/kW
  - ~ 20m€ for network refurbishments based on 1000€/m and 20 km
  - High level estimate of necessary CEF grant size of 35m€

Other features will be presented as well:

- Implementation schedule
- Demand analysis
- High level environmental sustainability assessment estimating a high impact due to the replacement of coal-fired CHP. As a result, the project will contribute significantly to climate change mitigation.

4.2.1.5 Added value of cooperation and Cooperation Mechanism involved

At stage I, a high-level statement on the added value of the project and the envisaged cooperation mechanism is sufficient. The envisaged Cooperation Mechanism is a Joint Project. The complimentary circumstances in the two countries are the basis for cooperation. Luxemburg has no shortage of capital but lags in RES expansion while Bulgaria is in need for investments and at the

same time overachieving its RES targets. Hence, using the statistical transfer of RES generation in exchange for financing as a Cooperation Mechanism would benefit both Member States.

- The key aspects in which this project will provide added value include:
  - Reduced cost of support for Luxemburg's target achievement compared to national deployment (when CEF funding is provided)
  - Reduced GHG emissions (see above)
  - Significant reduction of local air pollution

A qualitative description of the costs and benefits of cooperation is provided in the economic analysis.

4.2.1.6 Economic analysis (social welfare)

A high-level estimation of the economic effects of the proposed project is conducted in comparison to a case-specific counterfactual. In their application, Bulgaria and Luxemburg refrain from presenting a standard counterfactual, i.e. the same project being installed in Luxemburg, as the potential sites for deep geothermal drilling are strongly restricted as a result of unfavourable geological conditions and groundwater protection. Instead, a case-specific counterfactual is presented based on the domestic development of heat pumps in Luxembourg, which is more expensive than the use of geothermal in Bulgaria. The impacts of the project on the Bulgarian heating system, where otherwise no such project would be implemented, is compared to the theoretical costs and benefits of the counterfactual in Luxemburg.

At this stage of the application, the costs and benefits are not quantified, but the effects and the expected net benefit (or cost) are qualitatively described.

Below the high-level CBA comparing the impacts of the project in Bulgaria with the case-specific counterfactual:

CBA indicator	Net effect	Explanation
(a) costs of energy generation	+	Geothermal energy (including the refurbishment of the grid) in Bulgaria is less expensive than heat supply generated by heat pumps in Luxemburg, resulting in savings.
(b) system integration costs	+	The geothermal plant will allow other power plants in Bulgaria that are currently run by heat demand to produce power at times beneficial to the electricity system. No such effect can be expected in the counterfactual, as heat pumps would replace gas boilers at household level in Luxemburg.
(c) cost of support	+	Lower cost of geothermal will require less support since the revenues of the heat supply are expected to be similar in the counterfactual.
(d) greenhouse gas emissions	+	Moderate GHG emission savings due to replacement of low-efficient Bulgarian coal plants and transmission losses in current network versus replacement of gas boilers at household level in Luxemburg.
(e) security of supply	0	No significant difference in the impact on the security of supply is expected between the project and its counterfactual.
(f) air and other local pollution	++	Currently, the region in Bulgaria experiences high air pollution in winter due to coal plants which would be used less as a result of the newly built geothermal plant.
(g) Innovation effect	0	There is no effect on innovation

The social NPV of the project is expected to be positive.

4.2.1.7 Financial analysis

At this point, only a high-level qualitative statement on commercial viability is needed. Geothermal plants are associated with relatively high investment costs of about 2000€ per kW, making it unrealistic to compete against existing coal plants or even new-built gas plants. The revenues from the heat supply are not expected to be sufficient to allow the refinancing of the project, hence the need for support to ensure project materialisation can be assumed at this stage.

4.2.1.8 Sensitivity and risk assessment

At this stage, no sensitivity analysis needs to be conducted and risks are only assessed qualitatively. The main risks are associated with the following geological risks. During the project development/exploration phase, the main risk is not finding sufficient geothermal resource (temperature and flow rate) for a project to be established. The main risk during operation is the depletion of the geothermal resource over time, rendering the whole project unsustainable and threatening the long-term operation of the plant. Both risks can result can also result in an increase in project costs. Another risk is related to the unknown financing costs at the time of project development. An additional risk is the drop in CO2 prices, which would reduce the commercial foundation of the project.

These risks will be considered in the risk management strategy and will be included in a sensitivity analysis conducted at a later stage.

The application receives a positive evaluation. The pre-feasibility study is used to add further detail to the application for CB-RES project status.

4.2.2 Stage II: Application for CB-RES project status

The application requirements in this stage are not higher compared to stage I, with the exception of a Letter of Intent that is required by the involved Member States to indicate their general interest in the project. Nevertheless, based on the pre-feasibility study, the CBA is conducted in more detail and the application presents more detail than in stage I.

No significant changes have been made with regard to the general project set up and the counterfactual that were presented in the application for stage I (TA / pre-feasibility studies). The risk assessment is still at the level of qualitative description, but it does include more detail on the likeliness and impact of the geological risks related to finding sufficient geothermal resource as well as the depletion of the geothermal resource over time.

The main additions compared to the application for stage I are related to the level of preparation of cooperation by Bulgaria and Luxemburg, the economic and the financial analysis.

4.2.2.1 Added value of cooperation and Cooperation Mechanism involved

Building on the outcome of the pre-feasibility study, Bulgaria and Portugal emphasise their interest in cooperating by each providing a Letter of Intent, which mentions the project and the cooperation mechanism envisaged. In its Letter of Intent, Luxembourg also defines its willingness to pay in this project.

Luxemburg's willingness to pay is determined by other alternatives of statistical transfer in the electricity sector plus 30% since the cooperation would result in the materialisation of an additional renewables project. Luxemburg estimates that purchasing the equivalent amount of statistical benefits via the platform for RES statistics that was established under the RED II, would amount to 45m€. However, as Luxemburg is willing to pay a maximum of 30% on top of this amount to enable the materialisation of an additional renewables project, the total maximum willingness to pay of Luxemburg is 58.5m€ (45m€ x 1.3 = 58.5m€). In return, Luxembourg expects that the RES generation from the Bulgarian plant will entirely count towards Luxemburg's RES target achievement.

4.2.2.2 Economic analysis (social welfare)

The economic analysis is still providing the high-level statements as outlined in the early feasibility study above.

4.2.2.3 Financial analysis: assessment of commercial viability and determination of grant size

A high-level statement is provided, showing that the project has a negative FNPV, i.e. needs additional funding.

The external evaluators and the European Commission (facilitated by INEA) assessed the project positively. Based on its score, it was ranked no 8 in a draft list of 25 projects. The Group endorsed the draft list and stakeholders did not reveal any opposition to the project. The project was included into the final published list and thus granted the status of a c-b RES project.

4.2.3 Stage III: Application for grants for technical studies

Bulgaria and Luxemburg seek to further investigate the technical feasibility of the project in the envisaged municipality. The application describes the technical study that shall be performed for the

project and monetises the effort for this study. The main objective of a technical study is to limit the uncertainties regarding the geothermal resource by conducting test drilling and resource modelling as well as environmental assessments. The costs of the technical study are estimated at 1m€. Bulgaria and Luxemburg apply for a grant that covers the entire costs of the study.

In this application stage, a more detailed description of context, objectives and technical feasibility that was handed in in Stage II is carried forward without changes apart from potential adjustments based on feedback. In line with the CBA guideline, the application, however, does contain first simple quantifications for the economic analysis and the risk assessment as well as an indicative assessment of the financial analysis.

4.2.3.1 Added value of cooperation and Cooperation Mechanism involved

As part of the application, Bulgaria and Luxemburg sign a MoU which includes the key details of the project, of the cooperation mechanism, a description of the expected added value for each party as well as clarifications on practical issues (e.g. roles and responsibilities and processes for data exchange and distribution of payments and renewable target accounting). The MoU also includes high-level statements on the envisaged costs be borne by Luxemburg (equivalent to its willingness to pay 58.5m€ as described in stage II) and an estimation of the statistical benefits transferred.

4.2.3.2 Economic analysis (social welfare)

A simple quantification of most indicators is provided, which allows for an indication of the social NPV of the project.

As the counterfactual has not changed, the economic analysis is conducted against the case-specific counterfactual of the replacement of household gas boilers with heat pumps in Luxemburg.

CBA indicator (simple approach)	Net effect (m€)	Explanation
(a) costs of energy generation	4	Geothermal energy (including the refurbishment of the grid) in Bulgaria is less expensive than heat supply generated by heat pumps in Luxemburg
(b) system integration costs	2	The geothermal plant will allow other power plants in Bulgaria that are currently run by heat demand to produce power at times beneficial to the electricity system. No such effect can be expected in the counterfactual, as heat pumps would replace gas boilers at household level.
(c) cost of support	4	Lower cost of geothermal will require less support since the revenues of the heat supply are expected to be similar in the counterfactual.
(d) greenhouse gas emissions	2	Moderate GHG emission savings due to replacement of low-efficient Bulgarian coal plants and transmission losses in current network versus replacement of gas boilers at household level in Luxemburg.
(e) security of supply	0	No significant difference in the impact on the security of supply is expected between the project and its counterfactual.
(f) air and other local pollution	5	Currently, the region in Bulgaria experiences high air pollution in winter due to coal plants
(g) Innovation effect	0	There is no effect on innovation
Sum of net effects	17m€	

The outcome of the analysis is a net social benefit of 17m€. In addition to that, the cooperation would provide further added value that cannot be monetised. These are primarily linked to the intensified political cooperation between Bulgaria and Luxemburg and non-monetised health benefits due to improved air quality. The application discusses these non-monetised indicators in more detail.

4.2.3.3 Financial analysis: assessment of commercial viability and determination of grant size

No full financial analysis is conducted at this point, but a first quantitative estimate of the expected financial gap. The estimate shows that the project has a negative FNPV, i.e. needs additional funding. The total costs of the project are estimated at 230m€. The cost estimations have thus increased slightly compared to stage I. The investment costs for the 100 MW geothermal plant are now estimated at 210m€, whereas the cost estimate for the network refurbishment remained at 20m€.

The assumed revenues from the heat production are 130m€. As indicated in the MoU, Luxemburg commits to pay up to 58.5m€ of support. The funding gap is therefore assumed to be 41.5m€ (230m€ total investment costs – 130m€ revenues – 58.5m€ support from Luxemburg = 41.5m€ funding gap).

The application is assessed positively, and the project is granted 1m€ to conduct the described technical studies.

4.2.4 Stage IV: Application for grants for works

Since Luxemburg's willingness to pay is insufficient to cover the full costs of the project, both governments approach the European Commission applying for CEF funds. The project applies for grants for works in 2024.

In this application stage, the description of context, objectives and added value that was handed in in Stage III is carried forward without adding major changes. The technical studies conducted under stage III confirmed the suitability of the foreseen location of the geothermal plant. It was testified that the likeliness of geothermal resource depletion to occur over the lifetime of the project is negligible. The application now also includes a preliminary EIA.

Bulgaria and Luxembourg produce a draft cooperation agreement that proofs the advanced preparation of the cooperation. The draft cooperation agreement builds on the MoU and provides the basis for a legally binding contractual framework of the cooperation by adding details regarding the rights and obligations of the parties, responsibilities of the contractual parties (risk sharing), monitoring, proof and verification, etc. The added value of the cooperation (compared to non-cooperation) is discussed in more detail, especially with regard to the non-monetised elements.

The economic analysis is elaborated in much more detail. Since the project volume exceeds the threshold of 50m€, the detailed monetisation approaches, as provided in the CBA guidance, are applied. The outcome of the analysis has changed slightly and now shows a net social benefit of 19m€.

Also, the application now contains a detailed assessment of the financial analysis and a detailed risk assessment. The detailed assessment of the commercial viability, financial sustainability and funding gap is conducted based on the most up-to-date capital and operational cost figures, including revised costs of financing as well as projections on revenues. The analysis lowers the expected funding gap by 4m€. The overall CEF grant that would be needed to make the project commercially viable amounts to 37.5m€.

4.2.5 Final Evaluation

The final evaluation of the project results in a score of 18 of 25.

In the specific year, the project competes with various other projects ranging from 14 to 23 points. It is put on the draft list for funding by DG Ener and passes the interservice consultation. The CEF coordination committee published its opinion in line with the examination procedure of Article 5 of Regulation (EU) No 182/2011. The final selection is adopted via a delegated act.

As a result, the project promoter manages to be selected for the amount of 47.5m€ of CEF funding.

4.3 Case study 3: The Netherlands open their technology-neutral RES auction scheme for projects in Romania

This hypothetical c-b RES project project is a cross-border support scheme.

The Netherlands plan to open their technology-neutral RES auction scheme "SDE+" for RES projects in Romania. If Romanian RES projects are awarded support, their RES production is statistically transferred to the Netherlands and counts for the Dutch national RES contribution to the European RES target.

The motivation of the Netherlands is to achieve its national RES target at lower cost than by domestic RES deployment. Romania is interested in additional RES deployment on its territory that it does not need to pay for but that will create local added value.

The project promoter is the Netherlands, closely cooperating with Romania.

4.3.1 Stage I: Application for TA / pre-feasibility studies

After initially discussing the concept, Romania and the Netherlands ask the Netherlands Enterprise Agency RVO (an implementing agency of the Dutch government) to apply for a pre-feasibility study in their name that allows them to define the technical details of the cooperation. The motivation for applying for such a pre-feasibility study is not primarily the European Commission funding but the political balance (both Member States can apply jointly) lower transaction costs than commissioning their own study: the European Commission has a framework contract with a pool of consultants that are prequalified to analyse such cooperation cases.

RVO's application is very concise. This is in line with their objective to limit transaction costs and with the low application requirements for stage I.

4.3.1.1 Presentation of the socio-economic, institutional and political context

- NL: Limited/expensive RES potential in NL; aim to achieve national RES contribution at low costs
- RO: Unused RES potential; interest to develop it without own RES support payments

4.3.1.2 Definition of objectives

- Reach the Dutch renewables contribution to the 2030 target at lower costs
- Job creation in Romania
- Reduce the GHG intensity of the Romanian energy supply

4.3.1.3 Project identification

The Netherlands plan to open their technology-neutral RES auction scheme "SDE+" for RES projects in Romania. The scheme auctions sliding feed-in premiums paid over 15 years and covers RES electricity, RES heat and RES gasification. For each of these sectors, the auction scheme has several rounds with increasing ceiling prices. The auction process closes once the available support budget is used up. RES projects from Romania are only allowed to participate in the first round, i.e. they have to compete against the cheapest RES-E, RES-H and RES gasification projects in the Netherlands. The maximum price for this category is 50 €/MWh for electricity (equivalent values for heat and gasification). There is also a 10% budget cap for Romanian projects, ensuring that Dutch projects are not crowded out of the market. If Romanian RES projects are awarded support, their RES production is statistically transferred to the Netherlands.

Romania will only allow certain technologies to be eligible for the cross-border auction, as it wants to keep its cheapest RES potential for its own target contribution.

4.3.1.4 Technical feasibility & Environmental sustainability

The SDE+ is a well-established auction scheme that provides reliable support conditions. There is sufficient low-cost RES potential in Romania that could produce below the maximum price set by the scheme (50 €/MWh for RES electricity, equivalent values for other sectors). Romanian project developers show significant interest in applying for funding by the Dutch scheme.

4.3.1.5 Cooperation mechanism involved

The cooperation mechanism used is a joint support scheme (in the form of partial opening of a national support scheme). The pre-feasibility study will be used to further specify the cooperation arrangement.

4.3.1.6 Added value of cooperation

The cooperation is expected to provide support cost savings but no innovation or system integration benefits. The effect on greenhouse gas emissions and local air pollution may be positive, but cannot be estimated precisely at this stage, as it depends on the marginal power generation technologies replaced in Romania compared to those replaced in the Netherlands. The main EU added value is lower-cost RES deployment.

4.3.1.7 Economic analysis (social welfare)

Counterfactual: Without the cooperation, the Netherlands would fill up their auction with domestic RES projects at higher costs. Romania would not add any additional capacity. As a result, without the c-b RES project, the same amount of renewables would be awarded at higher cost in the Netherlands. In the counterfactual, cheap projects located in Romania would be replaced with marginal cost technologies in the Netherlands leading to a significant cost increase (assumption: 25 €/MWh) for 10% of the electricity supported through SDE+.

A rough estimation of the costs and benefits of the cooperation compared to the counterfactual looks as follows:

Effect of c-b project on	Positive (benefit) or negative (cost)	Explanation
(a) costs of energy generation	(+)	Lower generation cost
(b) System integration cost	(0)	No change in system integration costs (simplified assumption)
(c) Cost of support	(+)	Lower support costs
(d) Greenhouse gas emissions	(+/-)	The effect on GHG emissions could be slightly negative, since the Romanian power mix is less carbon intensive than the Dutch power mix. However, the marginal power generation technologies replaced will be in both cases fossil generation technologies (coal or gas). Which technology would be replaced needs further analysis for both countries.
(e) Security of supply	(0)	No change in net security of supply (simplified assumption)
(fi) Air and other local pollution	(+/-)	The effect depends on the replaced marginal technology, see effect on GHG emissions
(g) Innovation effect	(0)	There is no effect on innovation

The social NPV of the project is expected to be positive.

4.3.1.8 Assessment of commercial viability and determination of grant size

There is not funding gap to be covered by CEF. The support costs of the c-b RES projects would be fully paid by the Dutch support scheme.

4.3.1.9 Sensitivity and risk assessment

The realisation risk of Romanian projects needs to be assessed and addressed (e.g. through financial penalties).

4.3.2 Stage II: Application for CB-RES project status

After the completion of the pre-feasibility study, NL and RO have a clearer understanding of the cooperation set-up and prepare a cooperation agreement. They consider whether to apply for CB-RES status and grants for studies to support this process but decide against an application as this would create additional transaction costs. In any case, they do not ask for grants for works as the cooperation already implies substantial net benefits for both countries and the additional EU added value in terms of innovation or other aspects is not apparent.

4.4 Case study 4: Austria and Slovenia set up a joint support scheme for innovative electric vehicle charging

Austria and Slovenia plan to set up a support scheme for innovative electric vehicle (EV) charging concepts. They aim to apply for CEF funding as without this funding both countries would not set up the support scheme but choose cheaper RES options.

4.4.1 Stage I: Application for pre-feasibility study

At first, both countries jointly apply for a pre-feasibility study and submit an application that is in line with the requirements set in the CBA guideline. The pre-feasibility study with a volume of 100.000€ is granted. The pre-feasibility study (incl. a workshop) supports the further elaboration of the concept. It provides insights into the following CBA elements, thereby supporting the project promoters (Austria and Slovenia) in preparing the application for the CB-RES status.

4.4.2 Application for Stage II: Application for CB-RES project status and for Stage III: Application for grants for technical studies

In one step, the project applies for both, the c-b RES status and also for grants for technical studies. The technical study supports Austria and Slovenia in designing the support programme they envisage and to define the outcome of the support programme.

In this stage, all steps in the CBA are conducted, based on the pre-feasibility study. Since the project also applies for grants for technical studies, the CBA contains first simple quantifications for the economic analysis. The CBA elements for this project include:

4.4.2.1 Context

The context includes a considerable share of RES-E in Austria (71% envisaged by 2020) and a more modest one for Slovenia (39% envisaged according to NREAP). There is a very limited penetration of EVs in both Member States and charging infrastructure as well as smart charging solutions (system and user-friendly) are still lacking. Both Member States have expressed their commitment in significantly ramping up the share of EVs in their fleets by means of jointly supporting municipalities and local utilities in the rollout of smart EV charging stations.

4.4.2.2 Objectives

The project aims at contributing to a range of general CEF and CB-RES specific objectives:

- Modernise and complete the trans-European networks in the fields of transport
- Improve European competitiveness in the field of sustainable transport
- Creating synergies among transport and energy
- Promote the cross-border cooperation between Member States in the field of planning, development and deployment of relevant infrastructure
- Contribute to the strategic uptake of innovative renewables technologies
- Roll-out of EV charging stations
- Limit negative power system impacts through smart charging concepts
- Maximise the use of renewables for EV charging through time-dependent charging (matching time of charging to availability of RES-E)

4.4.2.3 Project identification

Austria and Slovenia will provide grants for the roll out of EV charging combined with innovative charging concepts. Municipalities and local utilities can apply for grants to the Austrian and Slovenian energy agency; including:

- Grants for developing smart charging concepts and direct use of RES
- Grants for works (e.g. EV charging stations, including a direct connection of RES assets with the charging station)

The responsible bodies for and affected bodies by the implementation are, among others (most of them not yet clearly identified, as this is determined in the national management of the scheme and the related allocation of support):

- Municipalities (not yet defined which ones, as this is determined in the national management of the scheme)
- Energy suppliers (not yet defined which ones, as this is determined in the national management of the scheme)
- Start-ups providing innovative billing approaches and software solutions to smart charging (including user applications).
- Local DSOs, providing grid access and information on grid characteristics, load patterns, congestions (to derive optimised use of charging capacities).

4.4.2.4 Technical feasibility & sustainability

The pre-feasibility study elaborates on various aspects of the technical design of the project (which in this case is a support programme), an implementation schedule, and a demand analysis. In addition, it provides insights into environmental considerations, especially about the potential final effect, if smart charging were to be ramped up in Austria and Slovenia. This includes considerations about the impacts on RES share based on increased EV charging (depending on the forthcoming accounting rules for EV charging), the impact on increased electricity demand, the overall impact on emissions (total emissions can increase, if total demand rises due to increased EV charging) and considerations on additionally needed RES deployment to address the unintended consequences of EV charging on emissions.

4.4.2.5 Cooperation mechanism

In this case initially not a joint support scheme according to Art. 13 of the REDII would be established as this would result in a direct redistribution of RES statistics whereas the envisaged cooperation creates indirect impacts on EV charging and thus on RES shares. Thus, in the short term, each country pays its own share of successful applications (and keeps the respective RES credits). The cooperation aspect focuses on establishing common procedures and standards and on the joint learning curve.

However, still a support scheme will be designed jointly, which is available for both countries and is implemented as “another kind of arrangement”, potentially resulting in a formal joint support scheme as defined in Art. 13 at a later point in time. A Letter of Intent that is signed by both countries outlines the scope of the cooperation and emphasises their willingness to enter into binding agreement.

4.4.2.6 Added value

The application discusses the added value of the project in detail. The project demonstrates a net positive effect in the economic analysis (see below) and in addition provides significant added value in terms of regulatory convergence as one of the envisaged outcomes is the development of joint charging concepts and related standards.

In addition, this project would provide intense knowledge exchange among all involved parties, it would decrease transaction costs compared to purely national approaches to EV charging due to economies of scale and a shared learning curve. In addition, the project would result in higher visibility for EV charging, in turn potentially supporting the uptake of EVs. In sum, the approach would significantly support the uptake of innovative technologies and services and work towards improving the EU's global competitiveness in sustainable transport.

4.4.2.7 Economic analysis

The simple quantifications reveal the following economic impacts against the counterfactual of each country simply increasing least cost RES production assets:

CBA indicator	Net effect (m€)	Explanation
(a) costs of energy generation	- 100	Effect is only indirect as scheme has only indirect impacts on EV charging which in turn has indirect impacts on RES share. But generally speaking, EV charging will be more expensive than other possible solutions of direct RES deployment.
(b) system integration costs	200	The project puts an emphasis on smart charging which is directed towards improving system integration significantly, especially in the mid- to long-term.
(c) cost of support	- 120	Support costs would increase with the uptake of EV use, compared to RES deployment.
(d) greenhouse gas emissions	0	GHG emission may rise if EV charging increases overall demand. For this to be avoided, additional RES capacities will be envisaged.
(e) security of supply	40	Making use of smart approaches to charging and even using car batteries for short-term balancing will increase security of supply.
(f) air and other local pollution	30	Replacing conventional combustion engines with EVs will significantly reduce local pollution, especially when paired with increased RES deployment.
(g) Innovation effect	0	N.a.
Sum of net effects	50m€	

The simple economic analysis shows a positive net benefit of the project of 50 million Euros.

4.4.2.8 Financial analysis

The commercial non-viability does not need to be demonstrated since support schemes are by definition non-profitable one-way cash flows. Also, the financial sustainability does not need to be demonstrated since project failure due to insolvency is massively less likely for governments than for private entities.

The project is evaluated in the selection process and is granted the status of a c-b RES project. In addition, the project also receives the required grants to conduct a technical study that supports the designing of the support programme.

4.4.3 Stage IV: Application for grants for works

Ultimately, after having received the c-b RES status and conducted the technical study, Austria and Slovenia respond to a call for proposals for grants for works published by the European Commission, i.e. they apply for funding to support their envisaged support scheme. In this case determining the amount of grants is the biggest challenge. The grant would cover the gap between the expected cost of the joint support scheme and the willingness-to-pay from Austria and Slovenia, i.e. the costs they would incur in a purely national support scheme for deploying RES capacities. Usually the purpose of joint schemes is to lower support costs, meaning that there would be no gap to be covered and hence no CEF grant needed. However, this joint support scheme seeking a CEF grant for works demonstrates well that it incurs additional costs and that these costs are justified. The justification is derived from the benefits shown in the application on EU added value and the economic analysis.

Slovenia and Austria provide evidence-backed figures on their willingness-to-pay. Their willingness-to-pay is determined by the current level of support for newly installed renewables capacities in the electricity sector of each country. To this effect, each country calculates the volume-weighted average support-level across RES technologies that are deployed, resulting in a figure of xct/kWh for Austria and yct/kWh for Slovenia. To derive a total willingness-to-pay per country, each country estimates the expected amount of RES benefits generated from the joint support programme (i.e. sum of RES benefits in kWh) according to the rules of accounting established at EU-level and multiply this amount with the country-specific level of support. Afterwards, the willingness-to-pay of Austria and Slovenia are combined and compared to a detailed estimate of the expected support costs under the joint support scheme. The remaining gap between the Member States' support and the expected overall support costs would define the funding gap.

After consultation with the European Commission and INEA, Austria's and Slovenia's application for grants for works is transferred into a synergy call issued by DG Ener together with DG Move.

5 TASK 3 PROJECT PIPELINE

In Task 3, Navigant developed and ran a survey among Member States and key stakeholders to gather an initial list of cooperation mechanisms initiatives and project concepts. Overall, by the end of March 2019, we had received 18 responses from Member States and five associations. In the following, we will provide a condensed summary excluding commercially sensitive and/or non-public information. A more comprehensive overview of our findings is provided in a stand-alone Task 3 report.

5.1 Summary: Member States' positions

In total, 18 Member States responded to our survey. Of these, 15 Member States declared their interest in using the cooperation mechanisms (mostly joint projects) and eleven Member States already indicated that they consider applying for pre-feasibility studies and/or funding for studies/works under the CEF facility for RES. Moreover, six countries consider conducting cross-border renewables auctions. Three countries also consider RES cooperation with third countries.

In most cases, Member States declared an interest to use CEF funds to further develop project ideas or the set-up of cross-border auctions that are still at conceptual stage. For the projects, where we managed to identify the development phase, most proposed initiatives are at the early conceptual stage, except: 3 in prefeasibility stage, 2 in feasibility stage, 1 in permitting stage and 1 in technical design stage. Therefore, it is likely that most Member States or project promoters will apply for CEF funds to conduct pre-feasibility studies to assess options for cross-border support schemes and/or projects. Due to the early conceptual stage of the large majority of ideas for cross-border cooperation, no reliable forecasts can be made regarding the RES volumes, financing requirements or timing for the utilisation of CEF funds.

Four Member States have indicated a clear interest and first concrete ideas on the use of CEF funds. One Member State put forward 11 project ideas alone (most located in its own territory), of which four are wind offshore and seven are wind onshore projects. The total estimated capacity of cooperation projects put forward by this country amount to 4,100 – 5,195 MW (2,900 – 3,700 MW for wind offshore and 1,200 – 1,495 MW for wind onshore). However, these project ideas are still at an early conceptual stage. Support for feasibility studies by CEF would complement existing efforts in this respect.

Another Member State intends to use CEF support for the preparation of the opening of its RES auctions, i.e. in form of grants for feasibility studies to identify possible partners and grants for pre-feasibility studies to set up a cooperation agreement. One country provided a list of potential c-b RES projects and intends to obtain assistance under the CEF facility. Technological focus is on non-dispatchable technologies, including wind, solar PV and run-of-river.

In addition, three Member States are proactively pursuing opportunities to establish cross-border cooperation with other Member States and are thus projects for making use of CEF funding. One of these countries, more specifically, indicated its interest in making use of CEF possibilities for technical and financial assistance in its pursuit of cooperation mechanisms, potentially with a view to develop Wind Offshore jointly with North Sea Offshore countries, but also to set up joint tendering schemes with other Member States and third countries for Wind Onshore and Solar PV.

Furthermore, ten Member States have committed to partially open their support schemes as part of the state aid notification procedures. The figure below shows all Member States with opening obligations. These are: Germany, Luxembourg, Estonia, Romania, Greece, Italy, Portugal, Belgium, Hungary and Spain. These Member States may pursue opportunities to make use of CEF funds at early stage, i.e. may apply for grants for works in the first years of the operation of the new CEF funding line.

Figure 13: Ten Member States (green) with obligation to partially open their support scheme

5.2 Summary: Associations' responses

Navigant received responses from five associations. Most informative responses have been obtained from the solar sector. It was indicated that the sector is mainly interested in establishing c-b RES projects in the field of RES electricity and heating involving various Member States. More precisely, they promote hybrid solutions including PV, CSP, storage and biomass. Sector coupling opportunities (power-to-heat) and ancillary services from variable renewables were also indicated. One respondent considers opportunities to apply for grants under the new CEF funding line and provided a list of projects that could become eligible. Another association also expressed its interest in making use of CEF opportunities.

5.3 Summary: Technological focus

In total, we list 44 initiatives/project proposals, of which Member States listed 23 initiatives and associations nine. In addition, we identified 12 supplementary initiatives in the literature review. The initiatives cover four main technology areas: (1) offshore wind (and supporting infrastructure), (2) onshore wind, (3) PV/CSP and (4) RES heat. The two figures below provide an overview.

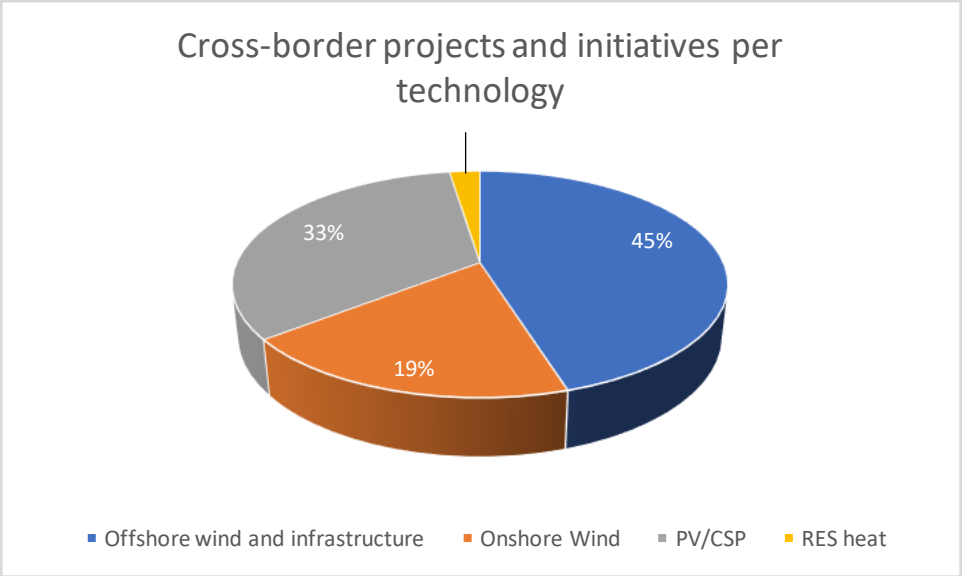

Figure 14: Technology interest for c-b projects (Member States & industry associations)

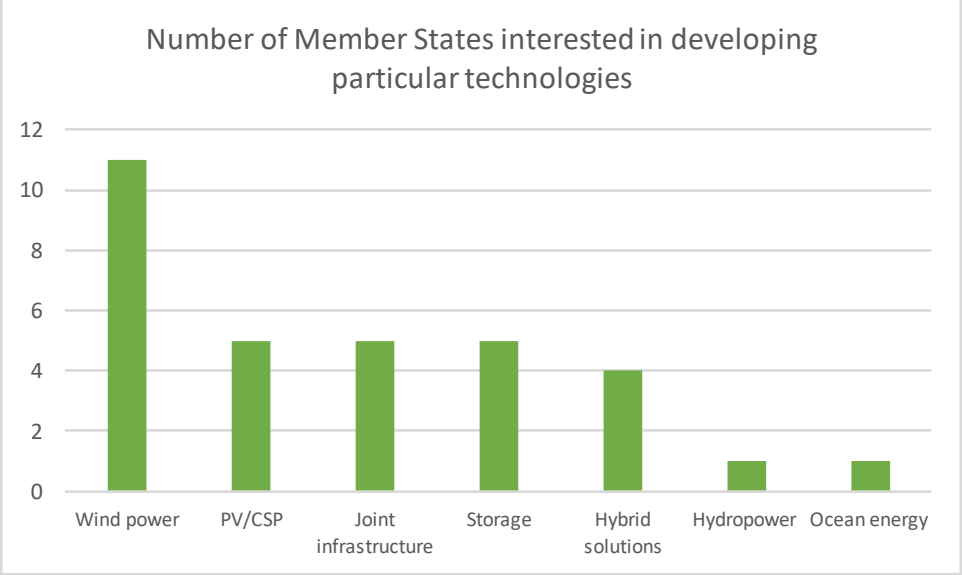

Figure 15: Overview of technology focus expressed by Member States in the surveys

As presented above, wind offshore and accompanying infrastructure are by far the most common technologies considered by Member States. It is followed by PV and CSP. PV/CSP is an interesting cooperation opportunity mainly for South-European Member States. Only one Member State specifically put forward ideas for c-b wind onshore projects. Another Member State also supports cross-border cooperation for hydro power and one country sees floating offshore wind and ocean energy as potential technologies for joint projects with other Member States or third countries in the Mediterranean area. Six countries expressed their interest in developing joint grid infrastructure, storage options and hybrid solutions. One Member State considers applications of CCS, hydrogen, grids and wind power. We have managed to identify only one concrete project idea that is based on RES heating.

5.4 Summary: Sectors

In terms of the energy subsectors, cooperation in the field of renewable electricity is by far the most common option: 12 out of 18 Member States indicated their interest in joint projects/join support schemes in RES-E. Three Member States expressed their interest in RES heating and cooling and RES transport. In most cases, cooperation in green heat and green transport is seen as a concept that requires further assessments.

6 TASK 4 WORKSHOP

The following chapter provides the report on the expert workshop conducted on 3rd June 2019 in Brussels as sent out to participants by the Commission on 12th June 2019.

6.1 Summary

DG ENER organised an informal stakeholder event on 3rd June 2019 in Brussels to prepare future work on the identification process, criteria and assessment methodology for c-b RES projects under the future Connecting Europe Facility (CEF). The meeting was chaired by Paula Abreu Marques, head of unit ENER C1. More than 70 participants attended, including representatives from 16 EU Member States, project promoters, utilities, renewables and storage associations, IRENA, EIB, NGOs and the European Commission.

The consultants (Navigant E&Y) presented their current thinking on application requirements for the different stages of the process (pre-feasibility study, status, grants for technical studies, grants for works), including the requirements for the cost-benefit analysis. The presentation triggered useful interventions from different stakeholder categories (Member States, industry and NGOs), highlighting the following issues as crucial for a rigorous, yet workable approach:

- the degree of Member States' endorsement throughout the application stages must be carefully balanced and the future methodology should provide some guidance on such endorsement
- the methodology must be suitable for a very diverse range of projects from different sectors, project promoters and sizes; it needs to define the right degree of detail for the cost-benefit assessment and establish appropriate thresholds for more thorough assessments.
- the methodology must address the singularity of joint support schemes where details of final projects might not be known at the moment of application
- the need for the financial assessment and underlying assumptions to reflect realistic conditions of private promoters

The feedback received will be integrated into the final report of the consultants due early July 2019. Once the CEF-Regulation has entered into force in mid-2020, the Commission's formal work on the delegated act on c-b RES projects will be launched.

6.2 Detailed report of the meeting

The stakeholder workshop took place in the context of an ongoing supporting study by Navigant/E&Y laying the ground for the Commission's work on the identification process/criteria and the evaluation methodology to be used for c-b RES projects under the 2021-2027 CEF programme. The meeting provided an early opportunity to comment on current thinking; the input received will feed into the final consultants' report due early July 2019.

Invitations were sent out to stakeholders that were considered to have an interest; requests from additional stakeholders to participate were all accepted. More than 70 participants attended, including representatives from 16 EU Member States, project promoters, utilities, renewables and storage associations, IRENA, EIB, NGOs and the European Commission.

An agenda was circulated to all participants prior to the workshop which was endorsed as proposed. The half-day workshop was structured as follows:

- Session 1: Overview on renewables action in CEF (European Commission/Navigant)

- Session 2: Application requirements (Navigant)
- Session 3: Eligibility, selection & award criteria (Navigant)
- Session 4: Selection process (Navigant)
- Session 5: Determination of size of grants for works (Navigant/E&Y)

Session 1: Action on renewables within the new CEF 2021-27 - A general overview

European Commission

- On 8th March 2019, European Parliament and Council reached a common understanding on the proposal for a revised Connecting Europe Facility (CEF) Regulation for 2021-2027. Budget for CEF and a few horizontal provisions still in brackets and to be solved as part of the overall MFF discussions. CEF as one of the EU programmes to support infrastructure development with a specific cross-sectoral and cross-border nature.
- A new window has been introduced under CEF Energy to specifically support renewables project that are being deployed in cooperation with other Member States or also 3rd countries.
- 15 % of CEF Energy (or 1.2 billion Euros in the currently bracketed amount, final decision as part of the overall MFF deal) will be earmarked for this new element, subject to market uptake, and if that amount is reached, the Commission shall increase it to 20 % of CEF energy, again subject to market uptake.
- Main reasons for the new window:
    - more than 55 % of electricity in EU in 2030. → Need for cost-effectiveness in RES deployment and EU target achievement.
    - Cooperation makes sense
    - RES deployment needs to accelerate
    - EU's RES world leader ambition
    - New window is not meant to replace existing national support schemes or private sector investment, but to unlock potential of coordinated approaches
- CEF Regulation allows for the combination of CEF grants with financing under the Invest EU programme ("blending")
- The revised CEF 2021-2027 puts more emphasis on action across the sectors energy, transport, digital ("synergies") by providing for separate work programmes and calls. Renewables investments can, for example, complement CEF projects in transport e.g. e-mobility charging infrastructure. For this, no status of c-b RES project is required.
- The present meeting is not yet part of the formal stakeholder consultation of the delegated act, as the formal legal work can only be launched once the basic act (CEF Regulation) is in force (mid 2020).
- CEF Regulation establishes two processes, one for establishing a list of c-b RES projects in the field of renewables and a general process for awarding CEF grants. Today's focus on the process for the status, CEF award procedure brought in to the extent relevant.

Questions /comments:

- **European Environmental Bureau (EEB):** Will the new window on c-b renewables (generation) have an effect on the PCI process of CEF Energy for transmission network projects?
    - Consistency of processes is crucial. Expectation that e.g. visibility of the status of a c-b RES project will provide timely information to grid operators for future upgrades, adjustment and extension needs.
- **Spain:** Is it necessary to have a cooperation agreement in place for an application for the status?

- No, a lighter form of endorsement suffices at this stage (e.g. letter of intent or memorandum of understanding).

Navigant

- A wide range of possible projects (single vs. multiple projects with joint support scheme) and of eligible applicants (project developers, Member States, subnational authorities etc.)
- Window is open to all RES generation technologies in electricity, heating and transport sector including storage, conversion and grid connection. No exclusive listing and/or capacity thresholds in CEF Regulation.
- Questionnaire sent to Member States and RES stakeholders as part of the ongoing study revealed that initial project/cooperation ideas by Member States and private promoters exist but need to be further developed in time for the programme. 15 Member States intend to make use of cooperation mechanism and 11 Member States intend to use the new window within CEF to facilitate this.
- Case study of a joint CSP plus storage project between DE and PT that will be used to explain the conceptual thinking is purely hypothetical; does not express a technological preference.

Session 2: Current thinking on application requirements (incl. CBA)

In this session, Navigant provided a general overview on the approach taken for the application process and the CBA in order to reflect the criteria set out in the CEF-Regulation, whilst at the same time ensuring requirements are reflective of the benefits per step.

The approach comprises 9 application elements for each of the four application stages (I pre-feasibility study, II status, III grant for studies, IV grant for works). The 9 application elements are:

1. Context of the project
2. Definition of objectives of the project
3. Project identification (technology, size, etc.)
4. Technical feasibility & sustainability
5. Cooperation Mechanism envisaged
6. Added value of cooperation
7. Economic analysis
8. Financial analysis
9. Risk assessment

The envisioned application process builds upon CBA guidelines by DG-Regio[55] and of ENTSO-E[56]. The process needs to be rigorous, yet flexible enough to be applicable for a wide range of different project types, technologies and sizes. The level of detail required for the application, including for the CBA, rises with each stage.

The first six elements of the application process require a qualitative discussion of the project (around cooperation mechanism and benefits of cooperation). Two core elements, the economic and financial analysis require quantification and/or modelling by the project promoters– at least in the later application stages. A differentiated approach is suggested for small-scale projects below 20 million Euros and above - with the main difference being the level of detail of analysis for economic assessment. The last element of the process is a qualitative and quantitative risk assessment.

[55] Guide to Cost-Benefit Analysis of Investment Projects (DG-Regio): https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

[56] 2nd ENTSO-E Guideline For Cost Benefit Analysis of Grid Development Projects: https://tyndp.entsoe.eu/Documents/TYNDP%20documents/Cost%20Benefit%20Analysis/2018-10-11-tyndp-cba-20.pdf

Comments/questions:

- **Ørsted:** Will different weight be given to different forms of cooperation (statistical transfer/joint tendering/joint projects)?
    - Statistical transfer has least added-value, but all four types of cooperation mechanisms are eligible. To note that the programme supports new investments in renewables, and that statistical transfers are often combined with other forms of cooperation.
- **Italy**: It may be a problem that the Commission does not have that much of information available at stage 1-2 compared to stage 3-4. Preparation for applying for status might already require a study, therefore sequencing of different grants might be needed.
    - The intention is to have separate calls for preparatory studies. First call for such studies planned for early 2021, call for application for grants later that year.
- **NERO/EREF:** It may take a long time before government gives political commitment. In every stage, according to the presentation, commitment is needed. In practice that may be difficult.
    - Member State involvement is essential for projects to happen, but for stage I no full Memorandum of Understanding is required. To note that without any Member State commitment/expression of interest by involved Member State, the value of the c-b renewables status is possibly reduced.
    - European Commission expects the new CEF window to make it easier for Member States to set up cooperation; the provisions for opening of support schemes in the revised Renewables Directive, commitments in the National Energy and Climate Plans and the new EU level binding target provide further incentives for Member States to enter into cooperation.
- **EREF/Spain:** A template and/or guidance on forms of Member State endorsement could facilitate Member State commitment. Germany: This cannot be binding.
    - Guidance is always non-binding. European Commission would consider integrating either guidance or template into the methodology.
- **EDSO:** Does also a form of cooperation that implies multiple projects (e.g. joint tender) need to demonstrate EU-added value?
    - Yes, but for the overall cooperation, not single projects.
- **Protermosolar:** European Commission should take active role to get projects endorsed by Member States
    - European Commission intends to support the creation of a pipeline of potential and stands ready to help overcome barriers.

The economic analysis (step 7 of the application process) provides an opportunity to prove cooperation benefits. The economic analysis focuses on societal benefits and costs which can be monetised, but also non-quantifiable indicators are taken into account. The seven impacts stipulated in the CEF regulation are (a) costs of energy generation, (b) system integration costs, (c) costs of support, (d) GHG emissions, (e) security of supply, (f) air and local pollution, (g) innovation. Navigant proposes policy convergence as an additional impact.

Three different approaches for the assessment of the seven impacts are used, depending on application stage and project size, from qualitatively, to simple quantification approaches, to detailed quantification approaches (modelling). To prove a net benefit of cooperation, the project projects are always assessed against a counterfactual project which would be implemented without another Member State involved. Navigant proposes a standard counterfactual, as well as a case-specific counterfactual to be included in the methodology. Proposed threshold between simple and detailed approach: 20 Million Euros.

Comments/questions:

- **Slovakia:** The presentation focused on the assessment of electricity projects. Is the approach also suitable for other sectors that are within the scope?

    - The assessment of most indicators of the economic analysis is also applicable to projects in other sectors. The project report and final CBA guideline will provide guidance on how to assess projects in other sectors.
- **Spain:** The proposed threshold is too low considering the effort required for application stages 3-4, in particular in relation to the resources needed for the modelling requirements.
- **European Commission** (echoing comments received prior to the event): Should wider socioeconomic effects, such as (local and regional) job creation be taken into account in the analysis? They could be one of the major benefits for some projects.
    - Could be included as an additional indicator into the economic analysis. However, assessment and in particular monetisation of such an indicator is probably less robust. Caution as shifting jobs from one Member State to another needs to be carefully assessed.

Session 3: Current thinking on eligibility, selection and award criteria

Navigant presented how eligibility, selection and award criteria may be detailed/defined and applied to evaluate and compare projects and ultimately award projects the status of a c-b RES project and/or award CEF grants. The proposed approach tries to derive award criteria for the status from the CEF grant award criteria established in the CEF-Regulation. It was emphasised that criteria can be further refined in the work programme and calls for proposal.

Stage I (support for pre-feasibility studies) should follow a separate selection process, i.e. the presented approach would not apply for this stage. With regard to the requirement of evidence for "significant" cost savings or benefits which is needed for grants for works, the consultant proposed to refrain from defining a quantitative threshold due to the heterogeneity of projects and project sizes and the fact that certain benefits are not easy to monetise. Furthermore, the idea of an evaluation matrix was presented, including the scoring and potential weighting of relevant award criteria.

Questions/comments:

- **EEB:** Are local authorities eligible entities and can therefore submit an application for either status or CEF support?
    - Subnational public authorities, including municipalities are eligible entities under CEF. However, the general eligibility criteria will also apply, therefore Member States' endorsement as prescribed per application stage.
- **Ørsted:** With regard to the individual assessment of each "project", how is this done for a joint scheme comprised of several decentralised projects?
    - In this case the entire joint scheme will be assessed as one project. The assessment is done per application, not per project that may result from the proposed action.
- **EEB:** In addition to the environmental aspects mentioned in the presentation (GHG and other emissions), will further environmental criteria be evaluated?
    - The total net benefits, including non-quantified benefits, will be taken into account in the evaluation of the application. The applicants should therefore feel encouraged to include positive externalities of their proposed action, including environmental benefits. Projects that have more negative impacts on the environment relative to other projects score lower on this aspect. To note that projects with expected significant effects on the environment are also obliged to perform an Environmental Impact Assessment (EIA) as part of the permitting process.

Session 4: Current thinking on the selection process

Recommendations for the identification process for each of the four application stages were presented in this session. The application process is staged, as the status as c-b RES project is necessary to apply for grants for works and technical studies. Temporal alignment is important to avoid delays for project promoters and increase the effectiveness of the funding line. Joint applications for status and grants for works or technical studies could be envisaged.

Questions/comments:

- **Italy:** Does the applicant need the status as c-b RES project in order to apply for grants for works or studies?
    - Yes. Only preparatory studies (stage I) can be applied for prior to having the status.
- **Slovakia:** How long would the status as c-b RES project be valid?
    - The list of projects to which the RES c-b status is granted will be reviewed every two years. The status would in principle not be taken away unless there are good reasons such as a cooperation mechanism not going ahead, project having been terminated or completed.

Session 5: How to determine the size of grants for works

EY/Navigant presented the financial analysis that constitutes the 8th element of the CBA. The financial analysis consists of four steps:

1. Assessing the commercial viability (on the basis of a discount rate (by default set at 4%) to ensure that only projects that would not be realised without a CEF grant are eligible;
2. Quantifying the amount of grants that the project would receive in case of an award (on the basis of the project proposal real costs calculated in the specific location and financial conditions);
3. Calculating the co-financing rate to prove compliance with the maximum rate of 50% of eligible costs;
4. Examining the financial sustainability to warrant that projects will not be terminated due to lacking liquidity.

Comments/questions:

Several non-state project promoters (Ørsted, EDP, SolarPower Europe) commented that the discount rate of 4% as recommended in DG REGIO's CBA guideline was too low for the projects in question, since most private renewables projects would experience higher WACCs. This would lead to projects appearing more profitable in the commercial viability assessment than they actually are, with a high possibility that projects become falsely ineligible.

    - 4% given as "by default" rate in DG REGIO CBA guidelines, more specific Member States' WACCs are allowed. But the comment that private promoters could face different rate of returns (in particular for less mature technologies) will have to be duly reflected in the final report of the consultants.

- **IRENA:** How will uncertainties be accounted for and information on financial flows be reviewed?
    - The risk analysis (element 9) contains a sensitivity analysis (where parameters used for the economic and financial analysis are altered to identify tipping points). A risk mitigation plan needs to be presented based on the assessment outcome. It will be necessary that applications are reviewed by specialists to ensure that inputs and assumptions are reasonable (as done for other EU programmes).

- **Spain:** How can the size of grants be determined for a joint support Scheme (where the project-specific financial analysis cannot be conducted at the time of application).
    - This aspect indeed needs to be further investigated. In principle, the Member States applying for support would show the overall expected investment need, the overall support need minus own contribution to support, thus showing the viability gap.

Concluding remarks (European Commission)

- Slides and meeting report will be circulated to all participants.
- In addition to the comments made in the workshop, all participants are encouraged to provide written comments within two weeks. Written comments should be sent to: ENER-UNIT-C1@ec.europa.eu
- Next steps in the process are as follows:
    - Adoption of final CEF-Regulation (and budget allocation): mid 2020
    - Delegated Act on selection criteria/process for c-b RES projects; Publication of CBA methodologies (works launched once basic act in force)
    - Publication of first CEF Work Programme: (Sept 2020)
    - Launch of CEF programme: 1 January 2021 (duration 7 years)
    - Current planning: First Call for pre-status supporting studies and for status as c-b RES project (stage I and II) (early 2021), first call for grants for studies/works later 2021.

6.3 Agenda

Draft agenda - Informal stakeholder event on Cross-border projects in the field of renewable energy under the future Connecting Europe Facility Brussels, 3rd June 2019	
13:30 – 13:45	**Welcome and Introduction** by the European Commission (*Paula Abreu Marques*)
13:45 – 14:45	**Action on renewables within the new Connecting Europe Facility 2021-2027 – A general overview** *(Michaela Holl, DG ENER and Navigant)* Cross-border projects in the field of renewable energy and action on renewables as part of synergy work programmes with CEF digital and transport
14:45 – 15:45	**Current thinking on the application requirements (incl. the cost-benefit analysis) for cross-border projects in the field of renewable energy** *(Navigant)* **-** General approach and the economic analysis in detail (including scenarios and counterfactuals)
15:45 – 16:00	**Coffee Break**
16:00 – 16:45	**Current thinking on eligibility, selection and award criteria for cross-border projects in the field of renewable energy** *(Navigant)* Which elements is your project going to be assessed against?
16:45 – 17:15	**Current thinking on the selection process for cross-border projects in the field of renewable energy** *(Navigant)* How a project advances from pre-feasibility to potential grants for works
17:15 – 17:45	**How to determine the size of grants for works for cross-border projects in the field of renewable energy** *(Navigant/EY)* Overview of required steps and analysis (commercial viability, financial sustainability and size of grants)
17:45 – 18:00	**Wrap-up** and next steps *(European Commission, Paula Abreu Marques)*

6.4 List of participants

Overall, 76 stakeholders participated in the workshop. These can be roughly classified in Member State representatives, European institutions and agencies, industry associations and firms as well as think tanks and NGOs. The below table provides the comprehensive list of workshop participants.

Table 16 List of participants (workshop)

Aliyev	Emin	EASE
Álvarez Besteiro	Iria	Permanent Representation of Spain to the EU
Azpiri Irazabal	Iñigo	Iberdrola
Barreto Gomez	Tirso Leonardo	Austrian Energy Agency
Beirão	Francisco	EDP - ENERGIAS DE PORTUGAL, S.A.
Bial	Marcel	ESTELA – European Solar Thermal Electricity Association
Bonadio	Jonathan	European Environmental Bureau
Braun	Pierre	Eurelectric
Caldes Gomez	Natalia	European Commission - DEVCO - Sustainable Energy, Climate Change
Calthrop	Edward	European Investment Bank
Coda	Beatrice	European Commission - Innovation and Networks Executive Agency
Costello	Fergus	Siemens Gamesa Renewable Energy
Crespo	Luis	PROTERMOSOLAR
Creutzburg	Philipp	Navigant
De Bonis	Piero	European Commission - DG RTD D.1
Del Papa	Giuliana	Permanent Representation of Italy to the EU

Finger	Yvonne	Council of European Energy Regulators (CEER)
Foucher	Maud	Permanent Representation of France to the EU
Fouquet	Doerte	EREF
Gabriels	Senne	SPF Economie Ministry, Belgium
Gephart	Malte	Navigant
Garagorri Miota	Miguel	Iberdrola
Giannelli	Elisa	E3G
Glennung	Kirsten	E.DSO
Gonzalez Herraiz	Santiago	IDAE, Spain
Graf	Andreas	Agora Energiewende
Haers	Jan	Permanent Representation of Belgium to the EU
Hartstein	Ewelina	European Commission - DG ENER
Icheva	Petya	Permanent Representation of Bulgaria to the EU
Iljina	Inga	Permanent Representation of Latvia to the EU
Jakab	Marianna	Permanent Representation of Hungary to the EU
James-Smith	Edward	Permanent Representation of Denmark to the EU
Jensen	Nicolas	Eurogas
Jeppesen Mulvad	Lykke	Ørsted
Jourdan-Andersen	Birgitte	Energi Norge
Kavvadias	Konstantinos	European Commission - DG JRC
Kielichowska	Izabela	Navigant
Komusanac	Ivan	WindEurope

Kran Christensen	Simon	Permanent Representation of Denmark to the EU
Kraus	Nicolas	Hydrogen Europe Industry Secretariat
Krevzelj	Željko	Permanent Representation of the Republic of Croatia to the EU
Lança	João	Permanent Representation of Portugal to the EU
Lauridsen	Henrik	European Commission - Innovation and Networks Executive Agency
Lechon	Yolanda	CIEMAT, Spain
Lotz	Bastian	Navigant
Marcos Morrel	Victor	Ecological Transition Ministry, Spain
Martin De Lagarde	Cyril	Ministry for an Ecological and Solidary Transition, France
Mawet	Maïté	Wallonie-Bruxelles auprès de L'UE - Attachée Energie
Mühlenhoff	Jörg	CAN Europe
Navarro Jiménez	María	Permanent Representation of Spain to the EU
Navickaite	Jolanta	Permanent Representation of Lithuania to the EU
Nikkels	Hans	TenneT
Orlović	Ivica	Permanent Representation of the Republic of Croatia to the EU
Panteli	Christos	Permanent Representation of Cyprus to the EU
Päsik	Annika	Permanent Representation of Estonia to the EU

Pirttimaa	Lotta	Ocean Energy Europe
Pitorák	Martin	Permanent Representation of the Slovak Republic to the EU
Pokrovac	Maja	Obnovljivi izvori energije Hrvatske
Posch	Barbara	Federal Ministry for Sustainability and Tourism, Austria
Potestio	Sabina	WindEurope
Richter	Ariane	Permanent Representation of the Federal Republic of Germany to the European Union
Roesch	Roland	IRENA
Runnel	Reesi	Permanent Representation of Estonia to the EU
Sandevoir	Claire	Vattenfall AB
Schröder	Jonas	Navigant
Schroeder	Robert	ENTSO-E
Šef	Gregor	Dravske elektrarne Maribor, d.o.o
Simon	Antoine	Friends of the Earth Europe
Souza	Andrés	ESTELA – European Solar Thermal Electricity Association
Steurer	Michael	Permanent Representation of Austria to the EU
Vainute	Sandra	Permanent Representation of Lithuania to the EU
van Werven	Gerrit	Vaweho
Vasconcelos	António	Directorate General of Energy, Portugal
Vessia	Øyvind	Ørsted

Vrieling	Markus	NERO RENEWABLES N.V.
Zeni	Diletta	WindEurope

7 CONCLUSION

This report provides a basis for the European Commission to develop a methodological framework for handling applications for c-b RES projects under CEF. The presented framework specifies methodologies for evaluating c-b RES project applications and includes, in particular, a fully developed cost-benefit assessment (CBA) methodology. Moreover, it defines transparent criteria and processes for the identification, selection, eligibility and support of c-b RES projects. Eligibility and award criteria need to be defined for the different stages of this process, i.e. (1) for awarding the status of a c-b RES project, (2) for awarding grants for studies, and (3) for awarding grants for works.

Four case studies have illustrated the application of the developed framework, i.e.

- Case study 1: A joint CSP project between Portugal and Germany driven by a technological rationale
- Case study 2: A district heating project as a physical project, but policy-driven due to envisaged statistical RES transfers between Bulgaria and Luxemburg
- Case study 3: Opening of the technology-neutral Dutch support scheme to projects in Romania
- Case study 4: A joint support scheme for innovative electric vehicle charging, involving Austria and Slovenia

As initially discussed, there is a wide range of project types which is in principle eligible for support, including all RES technologies as defined in the REDII and all project sizes. In addition, applicants can not only be project promoters but also Member States and subnational legal entities. As a consequence, the CBA, the evaluation, selection and award process have to be sufficiently flexible in order not to exclude projects which may have been part of the legislators' intention. With the proposed framework, we provide such flexibility while ensuring that each project will be subject to a thorough and fact-based assessment.

It has become apparent in the report that providing such flexibility while maintaining a robust assessment results in transaction costs, both in terms of requirements for the applicant in the CBA as well as for the European Commission and the implementing body (e.g. INEA). Once the process is established and known to the different parties it will become increasingly evident that smaller projects (below a certain threshold, e.g. below 20m€ investment costs), or projects not applying for grants for works but only for grants for pre-feasibility and technical studies will be exposed to much more limited transaction costs. Only large-scale projects (e.g. above 20m€ investment costs) requesting grants for works will have to implement a detailed and fully quantified CBA.

One element which remains to be decided (apart from following the general recommendations or not) is which of these elements are provided for in the delegated act, in an annex thereof, in a separate staff working document, the work programme(s) and the specific calls for tenders.