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**CEER Status Review Report on
Regulatory Frameworks for Innovation
in Electricity Transmission
Infrastructure**

A CEER task for the Energy Infrastructure Forum 2020

**Infrastructure Work Stream
of
Electricity Working Group**

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INFORMATION PAGE

Abstract

This document (C20-INF-74-03) presents a progress report on regulatory frameworks for innovation in electricity infrastructure. It follows up on the conclusions of the Energy Infrastructure Forum 2019. The conclusions invited National Regulatory Authorities (NRAs) to review their regulatory practice in light of the recommendations of a consultancy study on regulatory frameworks on innovation and security and supply and which agreed that regulatory frameworks are largely in place to allow projects contributing to security of supply to be implemented.

CEER and NRAs were invited to present a progress report on regulatory frameworks for innovation in consideration of the recommendations of the consultancy study. This document provides such a progress report and seeks to support discussions of the upcoming Energy Infrastructure Fora regarding innovation in electricity infrastructure.

Target audience

European Commission; Member States; Regulatory Authorities; network operators.

Keywords

innovation; infrastructure; electricity; regulatory frameworks; Energy Infrastructure Forum, TSO; Transmission System Operator.

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Related documents

CEER Documents

- [ACER-CEER Position on Revision of the Trans-European Energy Networks Regulation \(TEN-E\) and Infrastructure Governance](#), June 2020
- [6th CEER Benchmarking Report on the Quality of Electricity and Gas Supply](#), September 2016, Ref. C16-EQS-72-03
- [CEER Status Review on Regulatory Approaches to Enabling Smart Grids Solutions](#), February 2014, Ref. C13-EQS-57-04
- [CEER Status Review of Regulatory Approaches to Smart Electricity Grids](#), July 2011, Ref. C11-EQS-45-04
- [EREGG Conclusions Paper: Position Paper on Smart Grids](#), June 2010, Ref: E10-EQS-38-05a

External Documents

- ACER, Consolidated report on the progress of electricity and gas Projects of Common Interest, 30 June 2020. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20%282020%29.pdf
- ACER Practice report on transmission tariff methodologies in Europe, December 2019 https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Practice%20report%20on%20transmission%20tariff%20methodologies%20in%20Europe.pdf
- Opinion No 13/2019 of the Agency for the Cooperation of Energy Regulators of 22 May 2019 on the national electricity network development plans and their consistency with the EU ten-year network development plan https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2013-2019%20on%20national%20electricity%20TYNDP-NDP%20consistency.pdf
- Ecorys, Ramboll, Shepherd & Wedderburn, Energy Law Group, Consentec, TU Wien, Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure?, 2019, Retrieved from: <https://op.europa.eu/en/publication-detail/-/publication/6700ba89-713f-11e9-9f05-01aa75ed71a1/language-en>
- Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex%3A32013R0347>
- Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions “Smart Grids: from innovation to deployment”, 12.4.2011, COM(2011) 202 final. <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0202:FIN:EN:PDF>

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EXECUTIVE SUMMARY

Background

The [Energy Infrastructure \('Copenhagen'\) Forum 2019](#) discussed the findings of a European Commission's consultancy study investigating the support of national regulatory frameworks to innovation and to security of supply¹. After a discussion that mostly focused on the electricity sector, the Energy Infrastructure Forum 2019 agreed that regulatory frameworks are generally sufficiently in place to allow projects contributing to security of supply to be implemented, while it invited National Regulatory Authorities (NRAs) to review their regulatory practice regarding innovation in light of the recommendations of the consultancy study. The Council of European Energy Regulators (CEER) and NRAs were invited to present a progress report on the regulatory practices at the [2020 Forum](#).

Objectives and contents of the document

This document presents a progress report on regulatory frameworks for innovation in electricity transmission². It also provides CEER's and NRAs' considerations on the recommendations of the Ecorys consultancy study.

The document seeks to support discussions of the upcoming Energy Infrastructure Forum regarding innovation in electricity infrastructure, by:

- Discussing existing and possible definitions of innovation;
- Analysing the current implementation of the study recommendations, as well as broader measures for promoting innovation;
- Reflecting on the potential need for innovation-specific regulatory measures; and
- Identifying barriers to the implementation of the study recommendations, as well as other barriers to innovation.

Brief summary of the conclusions

Regarding definitions and understanding of innovation, the contributions of NRAs identified the substantial lack of formal definitions of innovation in legislative or regulatory frameworks. The lack of a clear definition in the Ecorys consultancy study further evidenced this finding.

However, there seems to be a broad common understanding of innovation in electricity transmission across NRAs. Innovation is mostly correlated with developments that increase grid efficiency and benefits for consumers at the same (or at even lower) cost. Many NRAs provided examples of technologies and solutions which are deemed to be innovative, and are already being implemented across EU countries. Given this broad understanding, the lack of formal harmonised definitions of innovation in electricity transmission does not appear to be a major problem for regulatory frameworks to support innovation.

¹ Ecorys, Ramboll, Shepherd & Wedderburn, Energy Law Group, Consentec, TU Wien, [Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure?](#), 2019.

² A similar report on gas transmission is also being prepared.

In CEER's view, the implementation of some options for improvement proposed in the Ecorys consultancy study is not straightforward, while other recommendations have already been implemented in many countries. Some of the recommendations are being assessed by the NRAs or will be implemented in upcoming regulatory updates.

The survey among NRAs, launched for this report, revealed that innovation is mostly promoted indirectly via the general regulatory framework and/or via specific features regarding incentives for network performance (output-based regulation). In addition, specific activities for innovation have been or are being adopted in several countries.

About half of NRAs surveyed consider that specific regulatory measures for innovation are appropriate, while the other half deems that the general regulatory framework already provides a major stimulus to developing innovative solutions.

The NRA review also identified legislative barriers to innovation (and to implementing some of the study recommendations), in particular:

- The lack of NRA powers to implement certain decisions regarding tariffs (in a few countries); and
- The lack of NRA powers/duties (in some countries) to consult the network development plan and to approve it.

In this regard, as recently recommended in the EU Agency for the Cooperation of Energy Regulators (ACER) and CEER documents³, CEER deems that:

- It is essential to provide NRAs with sufficient leverage and regulatory control of tariff setting; and
- NRAs should be empowered to approve and to amend the national transmission network development plans.

³ E.g. the [ACER-CEER Position on Revision of the Trans-European Energy Networks Regulation \(TEN-E\) and Infrastructure Governance](#), June 2020 and the ACER Practice report on transmission tariff methodologies in Europe, December 2019.

1 Introduction

The [2018 Energy Infrastructure Forum](#) concluded that the national regulatory frameworks and/or their practical implementation should enable necessary and efficient investments in innovation and new technologies and/or promote security of supply.

The European Commission contracted Ecorys and other consultancy firms to carry out a study to assess how the existing framework in regulation of electricity and gas transmission system operators (TSOs) supports and incentivises energy infrastructure investments, with a specific focus on investments in innovation and security of supply⁴ (“Ecorys consultancy study”).

The Ecorys consultancy study indicates that “NRAs and TSOs are generally satisfied with the regulatory framework when it comes to security of supply. Security of supply is seen as the core TSO business and most TSO projects are perceived as security of supply projects (...) NRAs and TSOs see more room for improvement when it comes to innovation. Innovation is in many Member States not explicitly incentivised or recognised in the regulatory framework. This is an issue where the gains from innovative approaches are uncertain or hard to quantify. Moreover, where innovative approaches over time would reduce the asset base or do not directly benefit the TSO, TSOs have less to gain from pursuing innovative approaches”⁵.

The Energy Infrastructure Forum 2019 discussed the findings of the consultancy study. After a discussion mostly focused on the electricity sector, the Forum agreed that regulatory frameworks are generally sufficiently in place to allow projects contributing to security of supply to be implemented, while it invited NRAs to review their regulatory practice regarding innovation in light of the recommendations of the consultancy study. CEER and NRAs were invited to present a progress report on the regulatory practices.

Against such background, this document presents a progress report on regulatory frameworks for innovation in electricity transmission⁶. It provides CEER’s and NRAs’ considerations of the recommendations of the Ecorys consultancy study. It seeks to support discussions of the upcoming Energy Infrastructure Fora regarding innovation in electricity infrastructure.

The remainder of this document is structured as follows:

- Chapter 2 discusses the possible definitions of innovation, including with regard to the frequently used term “smart grids”; and
- Chapter 3 recaps the recommendations of the Ecorys consultancy study; analyses the current implementation of these recommendations, as well as broader measures for promoting innovation; discusses the potential need for innovation-specific regulatory measures and identifies some barriers to the implementation of the recommendations, as well as other barriers to innovation.

⁴ Ecorys, Ramboll, Shepherd & Wedderburn, Energy Law Group, Consentec, TU Wien, [Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure?](#), 2019.

⁵ Ibid., p.10.”

⁶ A similar report on gas transmission is also being prepared.

2 Definitions and understanding of innovation

Innovation in the electricity sector is frequently labelled under the term “smart grids”. The Clean Energy for All Europeans Package indicates increased innovation as one of the aims of the Electricity Regulation (EU) 2019/943, and refers to smart grids in several instances⁷, but does not provide any definitions of smart grids or innovation⁸.

Regulation (EU) No 347/2013 on guidelines for Trans-European Energy Infrastructure introduced smart grids as a thematic area for European Projects of Common Interest and provides a definition for it. It refers, in its recitals, to the European Commission communication “Smart grids: from innovation to deployment”⁹.

2.1 Definition in the Trans-European Energy Networks Regulation

Article 2(7) of Regulation (EU) No 347/2013 defines that “...‘*smart grid*’ means an electricity network that can integrate in a cost efficient manner the behaviour and actions of all users connected to it, including generators, consumers and those that both generate and consume, in order to ensure an economically efficient and sustainable power system with low losses and high levels of quality, security of supply and safety.”.

This definition is directly derived from the 2010 definition by the European Energy Regulators¹⁰, which was later confirmed by CEER in two status review reports^{11,12}: “A *smart grid* is an electricity network that can cost-efficiently integrate the behaviour and actions of all users connected to it – generators, consumers and those that do both – in order to ensure economically-efficient, sustainable power systems with low losses and high levels of quality and security of supply and safety.”

2.2 Understanding of innovation in the Ecorys consultancy study

The Ecorys consultancy study does not provide a concrete definition of innovation. It introduces the notion of “typological investments” and provides some examples for the electricity sector, as follows:

- New transmission lines based on innovative technology or change in the technology of existing lines, e.g. new High Voltage Direct Current (HVDC) lines;
- Introduction of dynamic line rating with the aim of utilising existing transmission lines at higher levels;

⁷ Regulation (EU) 2019/943 requires the tariff methodologies to facilitate innovation in the interest of consumers (Article 18(2)), tasks ENTSO-E and the EU DSO entity to promote the digitalisation of transmission networks including deployment of smart grids and to contribute to the digitalisation of distribution systems including deployment of smart grids, respectively (Articles 30(1) and 55(1)). Directive (EU) 2019/944 assigns to NRAs the duty of monitoring and assessing the performance of transmission system operators and distribution system operators in relation to the development of a smart grid that promotes energy efficiency and the integration of energy from renewable sources.

⁸ The only definition in the Clean Energy for all Europeans Package is ‘demonstration project’ as a project which demonstrates a technology as a first of its kind in the Union and represents a significant innovation that goes well beyond the state of the art.

⁹ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions “Smart Grids: from innovation to deployment”, 12.4.2011, COM(2011) 202 final. <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0202:FIN:EN:PDF>

¹⁰ [Position Paper on Smart Grids - an ERGEG Conclusions Paper](#), E10-EQS-38-05a, June 2010.

¹¹ [CEER Status Review of Regulatory Approaches to Smart electricity Grids](#), C11-EQS-45-04, July 2011.

¹² [CEER Status Review on Regulatory Approaches to Enabling Smart Grids Solutions](#), C13-EQS-57-04, February 2014.

- Installation of power flow control components to better adapt power flow patterns to capacities and topology of the existing grid, e.g. phase-shifting transformers;
- Investment into components contributing to ancillary services provision;
- New or extended power system control and automation technology, e.g. improvements in observability and controllability, wide-area measurement systems and real-time dynamic security assessment tools;
- Partial automation of system operation processes aiming at better utilisation of existing grid capacities; and
- Improvement of approaches to curative congestion management, e.g. generation and demand-side flexibilities, technologies coupling the electricity sector with other sectors (gas, heat, traffic), and storage components.

In the Ecorys consultancy study, innovation is not considered to be research and development (R&D) investments and projects, but rather as putting “innovative” transmission infrastructure investments into practice. The study argues that a specific type of investment may very well be perceived innovative in one Member State, and not in another. According to the study “...*innovation aims at providing the desired level of transmission in a way that is in some way superior to the conventional way. Deployment of innovative solutions is not an aim in itself, but rather deployment of innovation is advisable if the expected benefits outweigh the costs in the longer term.*”.

2.3 NRA considerations on the proposal in the Ecorys consultancy study

Based on the survey conducted among NRAs, several concerns were raised by NRAs in regard to the understanding of innovation proposed in the Ecorys consultancy study.

The Belgian NRA disagreed with the definitions presented in the Ecorys consultancy study, finding them rather vague and suggested that the definition of innovation should include R&D. The Belgian NRA proposed that the definition of innovation should be based on specific criteria, such as innovativeness of new technologies or processes from the point of view of each TSO in its specific context. Other criteria linked to welfare gain and uncertainty, for instance, do not directly relate to innovation itself but are criteria for the support of innovation that could be awarded through the regulatory framework.

The Czech NRA observed that the definitions of the Ecorys consultancy study are vague.

The Danish NRA disagreed with the definition as presented in the Ecorys consultancy study and noted that the definition of innovation as “putting innovative transmission infrastructure investments into practice” is rather vague.

The French NRA disagreed with the definition of innovation in the Ecorys consultancy study. It agreed with the fact that innovative investment should be defined primarily with regard to the target of a gain in social welfare, but the French NRA has a more specific approach, as they primarily define innovation as technological (be it on the network itself or on network management solutions).

The German NRA added that the definition of innovation in the Ecorys consultancy study cannot serve as a replacement for a legal definition and that R&D is also an element of innovation.

The Italian NRA indicated that some content of the relevant section (1.3) of the Ecorys consultancy study is reasonable but that no clear and compact definition of innovation is given.

The Lithuanian NRA noted that the definition of innovation should not be too broad. The definition should be clarified by providing specific criteria for the innovativeness of technology, such as clarifying if the technology is not yet implemented in a specific country but used elsewhere it should be recognised as innovation in that specific country.

Regarding the proposed definition of innovation, the Portuguese NRA considered that the TSO has already implemented automation solutions to reduce their operational expenditures (OPEX) and increase the quality of service.

The Romanian NRA disagreed with the definitions presented in the Ecorys consultancy study. It indicated that the section where the definitions are listed is only descriptive in terms of capturing the specificity of the notion of innovation applied to electricity transmission systems but that the definition as such is missing. Furthermore, it indicated that innovation in transmission systems should be regarded as use of technical and technological solutions. The aim here would be to improve the functional performances, the degree of observability and controllability and the degree of "self-healing" of the system by creating new functionalities or increasing the degree of sensitivity of the system to environmental stimulus and stimulus received from loads/consumers/users. The application of these innovative solutions should lead to improvement of key performance indicators of the system, increase of welfare (in monetised and/or non-monetised terms) and increase of flexibility and adaptability of the system for a successful and timely integration of production and consumption units, as well as the dynamic interaction with distribution systems.

The Slovene NRA agreed with the definition in the Ecorys consultancy study but noted that there should be more focus on implementing new technology and/or operational strategies to utilise existing transmission assets closer to their technical limits rather than building new assets.

Other NRAs broadly agreed with or did not raise comments on the proposals of the Ecorys consultancy study.

2.4 Definitions in the national legislative or regulatory frameworks

The use of a legal or regulatory definition of innovation in electricity transmission is not common in the responding countries.

The only country that seems to have some kind of definition of innovation in electricity is Slovenia. In the "Legal Act on the methodology for determining the regulatory framework and network charges for the electricity system operators", the definition of costs related to innovation is as follows: "costs of research and innovation" are the costs of original and planned research and also include the cost of experimental development and are carried out in the hope that it will lead to new scientific or technical knowledge and understanding.

Belgium does not have a definition in their national regulatory system, but the Belgian NRA distinguishes between two types of innovation. First, there are innovation projects with clear and short-term Return on Investment (ROI) for the TSO and its shareholders. Second, there are innovation projects with a longer and/or more uncertain ROI, with a clear benefit for consumers and society. While the former type of innovation is not required to be explicitly promoted by regulators, as it already incentivised through the general OPEX efficiency incentive, the latter definitely is. To foster this second type of innovation, one could align the benefits of shareholders and the benefits of consumers/society by altering the TSO remuneration scheme.

In Denmark, the primary legislation does mention "R&D" even though there is no explicit definition.

In France, the regulatory framework encourages the TSO to develop R&D projects and innovative investments needed for the construction of transmission networks, without giving any specific definition of innovation.

In Lithuania, an amendment of Energy Law regarding references of innovation is waiting for approval but there is no agreed or approved definition yet.

In Great Britain, while there is no explicit definition, the NRA drive to push the industry towards innovation is considered an implicit obligation under its commitment towards current and future consumers.

2.5 NRA understanding of innovation

Nearly all responding NRAs provided their understanding of innovation. Most respondents see innovation as developments that increase grid efficiency and benefits for consumers.

In Austria, innovation is understood as development of new solutions to efficiently increase the usage of existing or new infrastructure in terms of operations and future needs. Monetary incentives are not seen as a prerequisite for innovation.

The Belgian NRA provided their understanding of innovation in electricity transmission: developing and/or applying new technologies to increase efficiency and reduce costs. As an example, this could include optimising the use of existing assets through improved forecasting methods, stochastic-based risk management and decision making, application of Dynamic Line Rating, optimisation of non-costly remedial actions, etc.

For Cyprus, innovation builds upon existing networks by applying new, flexible and smarter technologies and helps the transmission and distribution operators better understand how to integrate the new technologies into their networks. The integration of innovative projects eventually leads to a more efficient, secure and stable electricity network.

The Czech NRA sees innovation as new innovative projects that aim to improve the security of supply, lower the costs for network users and enable participation of new technologies (such as batteries) and renewables.

The Danish NRA understands innovative solutions as technical or market-based solutions that replace, supplement or significantly improve the current infrastructure catalogue by providing additional services or noticeable cost savings to the users of the transmission/distribution systems.

The Estonian NRA considers being more efficient as innovative.

In France, innovation is primarily understood as technical innovation which could be technological or digital change. Technological change amounts to offering new technical development solutions by fostering the emergence of new components which take advantage of nanotechnology development, power electronics and superconductivity. Digital change involves developing a methodology to facilitate infrastructure maintenance and optimisation and contributing to the development of smart grids.

The Greek NRA sees innovation as novel infrastructure solutions which are adequately reliable in terms of security of supply – already tested to some extent as HVDC and Dynamic Line Rating (DLR) in the electricity sector – and proved to be more cost and/or energy-efficient and socially beneficial in relation to conventional solutions.

The Hungarian NRA understands innovation as defined in the Ecorys consultancy study.

While Ireland does not have a legal definition of innovation, the NRA has a working definition that is used as part of the innovation incentives in place for operators: innovation is new ways of doing things that bring/promote enduring benefits for current and future customers.

The Italian NRA could not come to a common proposal for electricity and gas and thus chose not to provide an understanding of innovation.

The Latvian NRA sees innovations as investments that differ from previous investments and that do not merely replace older infrastructure but also allow to cut expenses in the long term and work more efficiently or securely.

In Luxembourg, innovation can be described as the creation or development of infrastructure, services or internal processes, with the objective of improving efficiency and effectiveness.

In the Netherlands, innovation is understood as the ability of a network operator to act adequately and cost-efficiently to new developments in the production and consumption of electricity in the short and long term.

The Portuguese NRA considers innovation to be the deployment of demonstration pilot projects after the R&D stage.

The Slovak NRA provided a few examples of where innovative solutions could be considered: carbon emissions reduction, sector integration (electricity-gas-heating), utilisation of aggregation in order to reduce electricity consumption, accommodation of increase of renewable energy sources (RES) in the grid, digitalisation, deployment of Integrated Management Systems, demand response, e-mobility.

In Slovenia, innovation is seen as original and planned research, includes experimental development and is carried out in the hope that it will lead to new scientific or technical knowledge and understanding.

The Swedish NRA's opinion is that it is more efficient from a socio-economic point of view that projects concerning research and development are coordinated (financed by governmental means or cooperation between different performers on the market). The word innovation means that a product has passed research and development and is established on the market. Since this product is still considered innovative there are expectations on continued technical development affecting not only sustainability but also the price of the product.

The GB NRA believes that innovation is important to ensure that network companies support the transition to a smarter, more flexible, sustainable low-carbon energy system and reduce costs to consumers by finding new ways of operating and developing their networks.

Last but not least, the Lithuanian and Romanian NRA provided the same answers as they did when commenting on the proposed understanding in the Ecorys consultancy study (see their answers in subchapter 2.3 above).

2.6 Examples of innovative solutions in Member States

A mapping of the implementation of new technologies in each country was not among the objectives of this CEER-NRA review. However, the contributions of NRAs indicated many different innovative solutions are already being implemented across EU countries.

Nearly all responding NRAs provided examples of implementation of innovative solutions such as dynamic line rating, high-temperature transmission lines, transmission/interconnection projects with special features, phase shifting transformers, storage, solutions for increased integration of renewables (e.g. TSO observability and controllability of distribution-connected RES), wide-area management systems, special protection schemes and innovative solutions for maintenance, digitalisation, automation, data treatment and data exchange.

The Ecorys consultancy study itself confirmed this finding. For instance (country report Germany, p. 21) "*Many projects for which investment measures are available are innovative products and help to develop new technologies: in particular, measures regarding underground cables as well as temperature monitoring and high temperature conductor cables refer to innovative technologies and foster the development of renewable energy sources.*"

2.7 Concluding remarks

The contributions of NRAs (as well as the lack of a clear definition in the Ecorys consultancy study) allowed identification of the substantial lack of formal definitions of innovation in legislative or regulatory frameworks.

However, there seems to be a broad common understanding of innovation in electricity transmission across the NRAs. Innovation is mostly correlated with developments that increase grid efficiency and benefits for consumers at the same (or at even lower) cost. Many NRAs provided examples of technologies and solutions which are deemed to be innovative, and are already being implemented across EU countries. Given this broad understanding, the lack of formal harmonised definitions of innovation in electricity transmission does not appear to be a major problem for regulatory frameworks to support innovation.

3 Analysis of recommendations of the Ecorys consultancy study, of their implementation and of the barriers for it

3.1 Recommendations of the Ecorys consultancy study

The Ecorys consultancy study identifies recommended options for improvement and specific recommendations for each country.

Out of the recommendations addressed to the countries, the most recommended options for improvement¹³, according to the Ecorys consultancy study, are:

- Requirement to consider innovative solutions, in the frame of tariff decisions;
- Requirement to consider options based on operational expenditures (OPEX), in network development plans;
- Mitigation of bias towards capital expenditures (CAPEX) by encouraging a balanced consideration of OPEX-based solutions (in regulatory frameworks);
- Application of Cost Benefit Analysis (CBA) for larger projects¹⁴; and
- Consultation on National Development Plan/investment plans and on a project level with stakeholders.

3.2 Implementation of the recommendations in Member States

In CEER's view, the implementation of some options for improvement in the Ecorys consultancy study is not straightforward, while other recommendations are already implemented in many countries. Some of the recommendations are being assessed by the NRAs or will be implemented in upcoming regulatory updates.

The Ecorys consultancy study (p. 50) suggested an explicit reference to innovation in the regulatory framework and/or the inclusion of duties for innovation and an obligation to (explicitly) consider innovative options in the network development plan (NDP), while noting that “...to bolster “non-conventional” type of investments, in fact, different countries have underlined a close collaboration between NRA and TSO in adapting measures or provisions of the frameworks to the case at hand.”.

In CEER's view, the potential requirements to consider innovative solutions (in the tariff decisions) may require a detailed planning of upcoming expenditures, including the analysis of alternative solutions.

As regards OPEX-based options (in network development plans), the analysis of innovative solutions, at the level of network planning, may already be carried out in some countries, in order to propose the most cost-effective solution in the national network development plan.

In general, for both recommendations above, it remains unclear how the recommendation could change the TSO behaviour in instances where the problem is the TSO's reluctance to implement innovative solutions.

¹³ The “most recommended” options for improvements are applicable to a number of countries ranging from seven to fifteen, depending on the option.

¹⁴ This is named “Social Cost Benefit Analysis” in the Ecorys consultancy study. However, as all cost benefit analyses are, by definition, from a social point of view, the need for adding the adjective “social” is unclear and potentially confusing.

Regarding the CAPEX-bias barrier, as noted in the Ecorys consultancy study (p. 41), this is only a potential barrier in some countries “...as the practical relevance of the potential bias is felt to be very small due to the majority of today’s projects being infrastructure investments with a high CAPEX nature”.

Where present, the mitigation of a CAPEX bias seems an appropriate objective, as several NRAs flagged this aspect as a barrier to innovative solutions and because the regulatory frameworks should aim at avoiding biases in the investment decisions.

However, as noted in the Ecorys consultancy study (p. 48 and p. 57) the concretely proposed options (a total-expenditure (TOTEX) regulation and/or specific OPEX-oriented incentives) “...are difficult to be implemented well balanced without introducing new distortions ... the risk of introducing new distortions must be carefully weighed against the effort of necessary changes to the law that are often needed to implement larger changes to the national regulatory framework such as turning to (a yardstick based) TOTEX regulation” and “...care needs to be taken that specific incentives for OPEX-based solutions do not create an ‘OPEX-bias’ and may result in inefficient investment decisions.”.

The recommendation of the Ecorys Consultancy Study to mitigate a CAPEX bias has been addressed to ten countries. Among them:

- The German NRA observes that most innovative solutions also include a considerable share of CAPEX. For instance, software used to improve the utilisation of existing assets will be part of CAPEX in the German regulatory framework depending on the network operator’s activation policy. The TOTEX approach used for benchmarking incentivises the reduction of overall network costs;
- In Luxembourg, one of the set objectives of the NRA tariff methodology focuses on this subject. The NRA aims to reinforce and expand the mitigation mechanisms currently in place. Regular exchanges with network operators were held in order to take into account the contributions from their side;
- In Slovenia, updated incentives have been defined (see subchapter 3.3 below). Still, the NRA flagged the risk that these incentives may be too low to redirect the TSO from CAPEX-based solutions which ensure high financial return to them;
- The Swedish NRA has proposed amendments to the current Electricity Act (1997:857) and a resulting amendment to the Electricity Code (2018:1520) in a memorandum transmitted to the Government in February 2020. The proposed amendment refers to including TOTEX in the revenue cap decision. When the cost efficiency is measured on a TOTEX perspective, it is expected that companies seek more innovative solutions in order to be more efficient than the other companies. This will also give incentives for less favouring of CAPEX-intensive projects over OPEX-focused ones; and
- This topic is under NRA review in Austria, Slovakia and Slovenia.

Regarding the last two recommended options of the Ecorys consultancy study, the cost-benefit analyses and the consultation on national development plans are increasingly used across the European countries, as regularly reported in the ACER Opinions on National Development Plans.

It is somewhat bewildering that in the Ecorys consultancy study the recommendation for public consultation is addressed to seven countries (p. 12 and p. 55), including five where the public consultation on NDP (and therefore, on its projects) is actually carried out. ACER Opinion No 13/2019 on national development plans¹⁵ finds that in 19 out of 27 EU Member States public consultations are carried on the transmission network development plan. This is not the case in Cyprus, Denmark, Estonia, Hungary, Luxembourg, the Netherlands, Slovenia, Sweden. However, in most of these countries there are related public consultations (on the NDP scenarios and/or on large projects) or specific consultations with some stakeholder groups. Also, in one of the country reports (Germany, p. 30), Ecorys states that “consultations as instrument need to be used wisely” because of the organisational burden of the TSOs and/or NRAs.

A cost-benefit analysis is conducted for all projects of the ENTSO-E Ten Year Network Development Plan (TYNDP) and, according to the ACER Opinion No 13/2019, is carried out at project level in the transmission network development plans of the majority EU Member States (15 out of 27), with different scope of application (e.g. a minimum size of the project). It is unclear if the recommendation in the Ecorys consultancy study is mainly referring to gas and to security of supply projects (as may be understood from a text in Section 3.4.2 of the Ecorys consultancy study).

In CEER’s view, the recommendation for a CBA may not be particularly fit for innovative projects as complexities may arise when quantifying and monetising the impacts (when they are not just an increase of capacity at network boundaries, e.g. the possibility to replicate similar solutions in the future at a decreasing cost). As noted in the Ecorys consultancy study (p. 48) “...a challenge during the implementation of the solution will be to find adequate but simple metrics to value the wider benefits in order to decide whether the wider benefits outweigh the higher specific cost.”.

3.3 Regulatory mechanisms promoting innovation

The survey among NRAs revealed that innovation is mostly promoted indirectly via the general regulatory framework and/or some specific features regarding incentives for network performance (output-based regulation). Specific actions for innovation have been or are being adopted in several countries.

NRAs indicated that:

- In many countries, innovation is stimulated via the efficiency targets;
- Incentives schemes for reliability of supply are used in several countries¹⁶; in addition to continuity of supply for network users, they may promote innovation in network operations;
- In Belgium, the ongoing evolution from the regulated asset-based remuneration to a performance-based remuneration (OPEX, capacity given to the market in Long Term, Day-ahead, Intraday..., Reduction of balancing needs etc.) is in fact a regulatory support for innovation. However, there is also a specific incentive toward innovation (OPEX). The aim is to reduce the risk borne by the TSO when innovating;
- In Denmark, the evolution of the regulatory TSO regulation is expected to change from a cost-plus regime to revenue cap regulation from the year 2022. The new regulation is expected to contain elements similar to the recommendations of the Ecorys consultancy

¹⁵ [Opinion No 13/2019](#) of the Agency for the Cooperation of Energy Regulators of 22 May 2019 on the national electricity network development plans and their consistency with the EU ten-year network development plan.

¹⁶ [6th CEER Benchmarking Report on the Quality of Electricity and Gas Supply](#), C16-EQS-72-03, September 2016.

study: innovation, mitigation of CAPEX bias through mandatory comparison to market-based solutions, strengthened national infrastructure development plans;

- In Greece, a premium rate of return (ranging from 1% to 2.5%) is foreseen, in addition to the rate of return for capital employed, for specific projects that are characterised as Projects of Major Importance in the NDP. The premiums last from commissioning until the 12th year after the scheduled year of commissioning according to the NDP;
- In Italy, as already mentioned in the Ecorys consultancy study, the NRA started the transition to a new regulatory framework with same treatment of CAPEX and OPEX; in addition, in Italy, two output-based incentive mechanisms promoting the increase of transmission network capacity were adopted in 2018 and in 2019: one provides a premium in relation to the capacity increase, the other one increases the premium if the implementation is at lower cost than reference costs. The combined effect of these schemes would strongly incentivise low-CAPEX innovative solutions, such as dynamic line rating; and
- In Lithuania, if a project has synergies with another sector's project and there are savings due to implementation of the two projects, then the project promoter gets 50% of the savings as an award.

Some experiences of direct incentives or other measures for innovation (including upcoming ones) were reported, as follows:

- In Belgium, from 2020, there has been an incentive related to innovation activities. At the completion of previously approved projects included in a four-year R&D plan, the TSO is granted with an extra remuneration;
- In France, innovative projects are fostered through an incentive mechanism (financial incentives on project CAPEX and installation use). The operator can also obtain additional budgets during the tariff period for financing smart grid projects, subject to confirmation of its socio-economic value based on a cost-benefit analysis. Extra costs related to smart grids exploitation are also offset from the tariff when leading to a decrease in investment costs;
- In Hungary, the methodological guide for network tariff setting ensures that the investment value of any innovative solution is taken into account with a 1.1 multiplier. Furthermore, in Hungary, dynamic line rating as an innovative solution is being considered and examples of other member states are being studied by the NRA;
- In Ireland, there are financial strategic incentives (SI) that relate to the TSO's capacity to promote positive outcomes for customers and market participants in the context of a rapid transition towards an electricity system with a large penetration of renewable energy. The SI capture innovative solutions/initiatives that promote delivering the energy transition and managing costs and impact. There is scope in the incentives framework for the TSO to submit a business case for additional funding for new innovation projects that help in supporting and accelerating progress against national strategic objectives;
- In Lithuania, the amendment of Energy Law regarding references of innovation is waiting for approval. This amendment will let the NRA set a methodology for incentivising innovation;
- In Luxembourg, the current regulatory mechanisms that should have triggered further innovative projects were not used as expected by the NRA. The reasons for the shortcomings were discussed with the network operator and changes have been proposed for the coming regulatory period. It turned out that the framework for innovative projects was too restrictive and should be opened up further. The proposed new framework for the coming regulatory period would also include demonstration projects as well as innovative Information Technology (IT) development projects;

- In Slovenia, the "Legal Act on the methodology for determining the regulatory framework and network charges for the electricity system operators" for the regulatory period 2019-2021 introduces eligible costs for research and innovation in the fields of research, experimental development and demonstration. The duration of the scheme is a regulatory period for pre-qualified projects and the scheme is capped at 0.5% of the planned incomes in the previous regulatory period; and
- In the GB regulatory framework, a number of mechanisms encourage innovation. These include the UK's Network Innovation Allowance, Network Innovation Competition and Innovation Link. The Ecorys consultancy study noted that "*...this package of UK measures appears to be the most developed NRA approach to incentivising both TSO and third-party innovation activity as it incentivises innovation to a level not seen in most other Member States.*".

NRAs were also separately asked whether there is limited regulatory support for innovation. Most NRAs responded "no" to this question, with a few positive answers from those NRAs which are currently modifying some aspects of the regulatory framework or awaiting legislative measures before doing so.

3.4 Need for specific regulatory support for innovation

About half of NRAs consider that specific regulatory measures for innovation are appropriate, while the other half deems that the general regulatory framework already provides a major stimulus to developing innovative solutions.

In line with the findings presented in the previous subchapter to a question about the opportunity of specific incentives for innovation, NRAs were more or less equally divided about the opportunity for them. Some NRAs also indicated that the opportunity may depend on specific conditions, the possible presence of barriers and the possibilities for pilot projects.

The reasons for specific incentives or other measures, as indicated by one or more NRAs, include:

- The possibility to activate regulatory sandboxes or to promote pilot projects or specific technologies that are expected to bring benefits/savings for customers;
- A need to correct potential disincentives for innovation (e.g. offsetting some costs of specific smart grid solutions); and
- The possible need for incentives for significantly uncertain projects to materialise.

The reasons to avoid specific incentives mostly links to the possibility that the general regulatory frameworks (via TOTEX approaches and general performance-based regulation) already sufficiently stimulate innovation. Fewer responses referred to the lack of any stated concern regarding innovative projects at country level and to possible risks of biases and distortions in TSO decisions when introducing specific regulatory mechanisms.

3.5 Barriers for implementation of the recommendations

In addition to the complexities reported in subchapter 3.2 above, when implementing some of the proposal for improvements in the Ecorys consultancy study, some barriers for the implementation of the recommendations (or more generally to facilitate innovation) have been identified in the answers of NRAs. They relate in particular to legislative barriers, such as:

- The lack of NRA powers to implement certain decisions regarding tariffs (in a few countries); and
- The lack of NRA powers/duties (in some countries) to consult the network development plan and to approve it.

In addition, constraints related to the cycles of the regulatory periods (which in most countries range between three and five years) were noted, when major changes to the regulatory framework are under discussion. They need to be properly prepared, assessed after a close interaction with the operators involved and duly discussed in consultation with all stakeholders.

Lastly, regarding additional recommendations provided at country-specific level, some answers observed that improvements regarding permitting are likely difficult to implement, as permitting delays remain a significant problem, as also witnessed by the ACER monitoring activities on projects of common interest¹⁷ and by the electricity TYNDP, and it is largely outside the scope of responsibilities of NRAs.

As already recommended in recent documents by ACER¹⁸ and CEER¹⁹, CEER deems that:

- It is essential to provide NRAs with sufficient leverage and regulatory control of tariff setting; and
- NRAs should be empowered to approve and to amend the national network development plans

The leverage on tariff methodologies appears to be ensured in the vast majority of the jurisdictions by legally granted powers directly to define or approve the tariff methodology. The powers to approve or amend electricity transmission network development plans are given to NRAs in more than half of EU Member States. In the countries where these powers are not yet available to the NRAs, a corresponding update of national legislation is recommended.

3.6 Concluding remarks

In CEER's view, the implementation of some options for improvement in the Ecorys consultancy study is not straightforward, while other recommendations are already implemented in many countries. Some of the recommendations are being assessed by the surveyed NRAs or will be implemented in upcoming regulatory updates.

The survey among NRAs revealed that innovation is mostly promoted indirectly via the general regulatory framework and/or some specific features regarding incentives for network performance (output-based regulation). Specific actions for innovation have been or are being adopted in several countries.

About half of NRAs consider that specific regulatory measures for innovation are appropriate, while the other half deems that the general regulatory framework already provides a major stimulus to developing innovative solutions.

¹⁷ The latest ACER yearly report on monitoring projects of common interest is the "Consolidated report on the progress of electricity and gas Projects of Common Interest", adopted on 30 June 2020. Retrieved from: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20%282020%29.pdf

¹⁸ [ACER Practice report on transmission tariff methodologies in Europe](#), December 2019.

¹⁹ [ACER-CEER Position on Revision of the Trans-European Energy Networks Regulation \(TEN-E\) and Infrastructure Governance](#), July 2020.

The NRA review also identified legislative barriers to innovation (and to implement some of the study recommendations), in particular:

- The lack of NRA powers to implement certain decisions regarding tariffs (in a few countries); and
- The lack of NRA powers/duties (in some countries) to consult the network development plan and to approve it.

In this regard, as recently recommended in ACER and CEER documents, CEER deems that:

- It is essential to provide NRAs with sufficient leverage and regulatory control of tariff setting;
- NRAs should be empowered to approve and to amend the national transmission network development plans.

Annex 1 – List of abbreviations

Term	Definition
ACER	European Union Agency for the Cooperation of Energy Regulators
CAPEX	CAPital EXpenditures
CBA	Cost Benefit Analysis
CEER	Council of European Energy Regulators
DLR	Dynamic Line Rating
DSO	Distribution System Operator
ENTSO-E	European Network of Transmission System Operators for Electricity
EREGG	European Regulators Group for Electricity and Gas
EU	European Union
HVDC	High Voltage Direct Current
INF WS	Electricity Infrastructure Work Stream under the CEER Electricity Working Group
IT	Information Technology
NDP	Network Development Plan
NRAs	National Regulatory Authorities
OPEX	OPerational EXpenditures
R&D	Research and Development
RES	Renewable Energy Sources
ROI	Return On Investment
SI	Strategic Incentives (in the Irish regulatory framework)
TEN-E	Trans-European Networks for Energy
TOTEX	TOTAL EXpenditures
TSO	Transmission System Operator
TYNDP	(European) Ten Year Network Development Plan

Annex 2 – About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national energy regulators. CEER's members and observers comprise 39 national energy regulatory authorities (NRAs) from across Europe.

CEER is legally established as a not-for-profit association under Belgian law, with a small Secretariat based in Brussels to assist the organisation.

CEER supports its NRA members/observers in their responsibilities, sharing experience and developing regulatory capacity and best practices. It does so by facilitating expert working group meetings, hosting workshops and events, supporting the development and publication of regulatory papers, and through an in-house Training Academy. Through CEER, European NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses.

In terms of policy, CEER actively promotes an investment friendly, harmonised regulatory environment and the consistent application of existing EU legislation. A key objective of CEER is to facilitate the creation of a single, competitive, efficient and sustainable Internal Energy Market in Europe that works in the consumer interest.

Specifically, CEER deals with a range of energy regulatory issues including wholesale and retail markets; consumer issues; distribution networks; smart grids; flexibility; sustainability; and international cooperation.

CEER wishes to thank in particular the regulatory experts for the national submissions and for their work in preparing this report.

More information is available at www.ceer.eu.