



Fostering energy markets, empowering **consumers**.

Status Review Report on Regulatory Frameworks for Innovation and Security of Supply in Gas Transmission Infrastructure

A CEER task for the Copenhagen Forum

**Gas Infrastructure Work Stream
of
Gas Working Group**

**Ref: C20-GI-63-03
21 December 2020**

INFORMATION PAGE

Abstract

This document (C20-GI-63-03) presents a progress report on regulatory frameworks for innovation and security of supply in gas infrastructure. It follows the conclusions of the Energy Infrastructure Forum 2019, which invited National Regulatory Authorities (NRAs) to review their regulatory practices in light of the recommendations of a consultancy study on regulatory frameworks on innovation and security and supply. The study concluded 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 that also takes into consideration 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 and security of supply in gas infrastructure.

Target audience

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

Keywords

Innovation; security of supply; infrastructure; regulatory frameworks; Energy Infrastructure Forum.

If you have any queries relating to this paper, please contact:

CEER Secretariat

Tel. +32 (0)2 788 73 30

Email: brussels@ceer.eu

Related documents

CEER Documents

- [CEER Status Review Report on Regulatory Frameworks for Innovation in Electricity Transmission Infrastructure](#), October 2020.
- [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.

External Documents

- [ACER, Consolidated report on the progress of electricity and gas Projects of Common Interest, 30 June 2020.](#)
- [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.](#)
- [Regulation \(EU\) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure.](#)

Table of contents

EXECUTIVE SUMMARY	6
1 INTRODUCTION.....	8
2 DEFINITIONS AND UNDERSTANDING OF INNOVATION AND SECURITY OF SUPPLY	10
2.1 Understanding of innovation and security of supply in the Ecorys consultancy study 10	
2.2 NRA considerations on the proposal in the Ecorys consultancy study.....	10
2.3 Definitions in the national legislative or regulatory frameworks.....	11
2.4 NRA understanding of innovation.....	12
2.5 Examples of implementation, planning and considerations of cost-effective innovative solutions in Member States.....	13
2.6 Concluding remarks	14
3 ANALYSIS OF RECOMMENDATIONS OF THE ECORYS CONSULTANCY STUDY, OF THEIR IMPLEMENTATION AND THE BARRIERS FOR IT.....	16
3.1 Recommendations of the Ecorys consultancy study.....	16
3.2 Implementation of the recommendations in Member States	17
3.2.1 Requirement to consider innovative solutions.....	17
3.2.2 Implementation of option for improvement 1: Perform Social Cost Benefit Analysis (SCBA) for both security of supply and innovation of larger projects	17
3.2.3 Mitigation of CAPEX bias by encouraging a balanced consideration of OPEX-based solutions	18
3.2.4 Consultation with stakeholders on National Development Plan/investment plans and on a project level.....	18
3.2.5 Requirement to consider OPEX-based options	18
3.3 Barriers for implementation of the recommendations	18
3.4 Concluding remarks	19
4 REGULATORY MECHANISMS PROMOTING SECURITY OF SUPPLY AND INNOVATION	20
4.1 Main features of the regulatory mechanisms promoting security of supply and innovation in Member States	20
4.2 Need for specific regulatory support for innovation and/or security of supply.....	22
4.3 Barriers to the development of cost-effective innovative solutions.....	26
4.4 Concluding remarks	28
ANNEX 1 – LIST OF ABBREVIATIONS	29

ANNEX 2 – ABOUT CEER..... 30

EXECUTIVE SUMMARY

Background

The Energy Infrastructure (Copenhagen) Forum 2019 discussed the findings of a consultancy study (by Ecorys) investigating the support of national regulatory frameworks to innovation and to security of supply. After a discussion mostly focused on the electricity sector, the Energy Infrastructure Forum 2019 agreed that regulatory frameworks are largely in place to allow the implementation of projects contributing to security of supply, while it invited national regulatory authorities (NRAs) to review their regulatory practices regarding innovation in light of the recommendations of the consultancy study. CEER and NRAs were invited to present a progress report on regulatory practices. Some of the material in this paper was presented in a preliminary way to the Energy Infrastructure Forum 2020.

Objectives and contents of the document

This document presents a progress report on regulatory frameworks for innovation and security of supply in gas transmission, based on a survey of NRAs. It also provides CEER's and NRAs' considerations on the recommendations of the Ecorys consultancy study.

The document seeks to support discussions of the Copenhagen Energy Infrastructure Forum on innovation and security of supply in gas transmission infrastructure, by:

- discussing existing and possible definitions of innovation and security of supply;
- analysing the current implementation of the study recommendations, as well as broader measures for promoting innovation and security of supply;
- reflecting on the potential need for innovation-specific regulatory measures; and
- identifying some barriers to the implementation of the study recommendations, as well as other barriers to innovation.

Brief summary of the conclusions

A substantial lack of formal definitions for innovation in legislative or regulatory frameworks was identified among the NRAs, in addition to the lack of a clear definition in the Ecorys consultancy study. Nevertheless, there seems to be a broad common understanding of security of supply.

According to responses to the questionnaire, innovation is mostly correlated with the concepts of carbon neutrality (e.g. injection of non-conventional gases into the grid), sector coupling (e.g. Power to Gas, P2G) and digitalisation (e.g. smart metering). Additionally, a number of NRAs refer to technologies aimed at cost savings and system efficiency while some NRAs refer to research and development (R&D) and new ways of operating the energy system. Many NRAs provided examples of technologies and solutions which are deemed to be innovative already being implemented across European countries. No clear consensus has emerged in regard to certain technologies such as P2G or smart meters. These are deemed, by some NRAs, as already mature enough to be classified as innovative. Given this lack of common understanding, the absence of formal harmonised definitions of innovation in gas transmission does appear to be a major problem for the regulatory frameworks that address innovation.

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

In most regulatory systems, innovation is promoted indirectly via the general regulatory framework and/or some specific features regarding incentives for network performance (output-based regulation). In some cases, additional specific incentives schemes for innovation are in place. The same applies to security of supply, which is mostly dealt with through legal obligations of network operators and/or market parties. Therefore, most NRAs do not see a significant need for further regulatory support for innovation and/or security of supply, as they are already sufficiently addressed under the current frameworks.

Regarding the existence of potential barriers for the development of cost-effective, innovative solutions, some NRAs see barriers in the future uncertainties and the still-unclear role of gas in the context of decarbonisation; the consequent short-term perspective for investments; and in the absence of explicit legislation concerning innovation. The majority of NRAs, however, do not see barriers for the development of cost-effective innovative solutions.

1 Introduction

The 2018 Energy Infrastructure Forum¹ concluded that national regulatory frameworks and/or their practical implementation should enable necessary and efficient investments in innovation and new technologies and/or security of supply.

The European Commission contracted Ecorys and other consultancy firms to carry out a study to assess how the existing framework in the regulation of electricity and gas transmission system operators (TSOs) supports and incentivises energy infrastructure investments, with a specific focus on innovative and security of supply investments² (“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”*.

The Energy Infrastructure Forum 2019³ discussed the findings of the consultancy study. After a discussion mostly focused on the electricity sector, the Forum agreed that regulatory frameworks is largely 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 regulatory practices. Some of the material in this paper was presented in a preliminary way to the Energy Infrastructure Forum 2020.⁴

Against such background, this document presents a progress report on regulatory frameworks for innovation and security of supply in gas transmission.⁵ It provides CEER’s and NRAs’ considerations of the recommendations of the Ecorys consultancy study.

The report is structured as follows:

- Chapter 2 discusses the possible definitions of innovation and security of supply;

¹ https://ec.europa.eu/info/events/energy-infrastructure-forum/energy-infrastructure-forum-2018-2018-may-24_en

² [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,](#)

³ https://ec.europa.eu/info/events/energy-infrastructure-forum-2019-2019-may-23_en

⁴ https://ec.europa.eu/info/events/energy-infrastructure-forum/energy-infrastructure-forum-2020-2020-oct-29_en

⁵ For the corresponding report on electricity transmission, see the [“CEER Status Review Report on Regulatory Frameworks for Innovation in Electricity Transmission Infrastructure”](#), Ref: C20-INF-74-03, 27 October 2020.

- Chapter 3 recaps the recommendations of the Ecorys consultancy study, analyses the current implementation of these recommendations and identifies some barriers to their implementation; and
- Chapter 4 assesses the regulatory mechanisms in place to promote security of supply and innovation and discusses the potential need for innovation-specific regulatory measures, as well as other barriers to innovation namely to the development of cost-effective, innovative solutions.

2 Definitions and understanding of innovation and security of supply

2.1 Understanding of innovation and security of supply in the Ecorys consultancy study

To arrive at a common definition and understanding of innovation and security of supply (SoS) in the context of the study, the notion of “typological investments” was introduced. Typological investments are categories of investments (defined separately for electricity and gas) that can be undertaken by a TSO. They are infrastructure-related and do not cover investments in financial innovation or social innovation. Examples of typological investments in gas are:

- Increasing flexibility for market development and security of supply, e.g. through power to gas;
- Incentivising and facilitating the upgrade of biogas to the transmission system;
- Digitalisation of operations, e.g. through drone inspections and artificial intelligence (AI); and
- Building or upgrading of interconnectors, e.g. reverse flow systems.

Security of supply-related investments are defined as technical solutions that foster efficient supply and maintain/enhance the required level of security of supply. The technical solutions contribute to fulfilling the objective of improving or maintaining the level of security of supply by, for example, constructing new transmission assets to provide additional transmission capacity; maintaining, upgrading or replacing existing transmission assets to avoid a decrease of existing capacity or a degradation of the quality level of its provision; and implementing new technology and/or operational strategies to utilise existing transmission assets closer to their technical limits.

In the study, **innovation** is not considered to be R&D investments and projects, but rather as putting “innovative” transmission infrastructure investments into practice. Innovation aims at providing the desired level of transmission – determined by the objectives of security of supply – in a way that is somehow 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.

2.2 NRA considerations on the proposal in the Ecorys consultancy study

Concerning the definition of **security of supply** (SoS), 20 out of 25 NRAs agreed with the definition provided in the consultancy study, three NRAs objected, and two NRAs did not answer.

- **Austria’s** NRA questions the need for additional flexibility in the gas sector.
- **Germany’s** NRA considers that SoS should also touch upon the field of resource adequacy (exceeding TSOs’ duties), in addition to infrastructure-related topics.
- **Portugal’s** NRA suggests using a less vague definition of SoS, built upon a methodology similar to the one considered in Regulation (EU) 2017/1938.

Concerning the definition of **innovation**, 11 out of 25 NRAs agreed with the definition provided in the consultancy study, 12 NRAs objected, and two NRAs did not answer.

- **Austria's** NRA questions the inclusion, within the typological investments related to innovation, of new interconnectors (e.g. reverse flow systems), biogas upgrading facilities, as well as investments for flexibility, market development and security of supply (e.g. power to gas), given that such technologies are already mature.
- **Belgium's** NRA advocates the inclusion of power-to-hydrogen, H₂/biomethane injection and blending/upgrading installations.
- **Denmark's** NRA finds the definition itself rather vague, particularly in regard to the distinction between innovation and R&D.
- **Finland's** NRA only relates innovation to R&D.
- **France's** NRA suggests also including a technical progress component, as a consequence of defining innovative investment as primarily concerning the target of a gain in social welfare.
- **Germany's** NRA notes that, depending on the overall context, R&D is also an element of innovation.
- **Hungary's** NRA finds the definition too focused on monetary benefits for TSOs as opposed to social benefits, mainly those related to environmental externalities/the advancement of decarbonisation and climate goals.
- **Lithuania's** NRA finds the definition too wide and thinks it should be clarified by providing specific criteria for the innovativeness of technology and/or processes, and also stresses that labelling certain technologies as innovative could be a country-specific exercise depending on the stage of implementation (e.g. smart meter roll out).
- **Poland's** NRA believes investments to increase the acceptance of H₂ should be added; also, calls for greater clarity over the compliance of TSO/DSO activity with unbundling requirements.
- **Portugal's** NRA has the view that TSOs and DSOs have already implemented solutions to reduce OPEX and increase the quality of service.
- **Romania's** NRA notes that a definition as such is missing.
- **Spain's** NRA considers some of the typological investments (reverse flows, automatisisation, transmission, technical limits) are already mature as they have been in place for a long time.

2.3 Definitions in the national legislative or regulatory frameworks

With the exception of Finland, all NRAs report no legal definition of "innovation" in their respective regulatory systems. In Finland, acceptable research and development costs must be directly based on the generation of new information, technologies, products or operating methods in network operations; they may also be associated with the planning of such a project.

2.4 NRA understanding of innovation

Nearly all responding NRAs provided their view on what is their understanding of innovation.

- **Austria's** NRA considers innovation as the way existing technologies can be put together to create new solutions or completely new technologies (e.g. intelligent pigging); therefore, monetary incentives are no prerequisite for innovation.
- **Belgium's** NRA defines innovation in the context of gas transmission as the application of new technologies to increase efficiency and to reduce costs, and the stimulation of projects that pave the way to a net-zero carbon economy in Europe by allowing TSOs to play a role in market coupling. Examples of innovative projects include blending hydrogen in the gas grids, operating power-to-gas (P2G) installations for storing green electricity in the form of H₂ and releasing it into the electricity network on demand of users.
- **Croatia's** NRA includes in the definition of innovation all the infrastructure investments that improve quality of service and SoS, including P2G; projects for combining green and natural gases and delivering them to end-users; digitalisation of operations, improvement or regeneration of infrastructure with new technologies or materials at lower costs while maintaining high-quality service; and enhancing balancing operations, automation of the process, technologies for lowering gas losses.
- The **Czech Republic's** NRA believes new innovative technologies should help to achieve the goals set by EC, namely in terms of carbon neutrality, and improve the efficiency of system operation or sector-coupling problematics.
- **Denmark's** NRA defines innovation as technical or market-based solutions that replace, supplement or significantly improve the current infrastructure catalogue, providing additional services or noticeable cost savings to the users of the transmission/distribution systems.
- **Finland's** NRA understands innovation as new information, technologies, products or operating methods in network operations.
- **France's** NRA understands innovation as technological change (offering new technical development solutions by fostering the emergence of new components which take advantage of new technologies), and digital change (opportunities offered by the digital revolution which are a lever to optimise the costs associated with network transformations). France's NRA also stresses that the regulatory framework promotes the use of these innovative solutions if they reduce the total costs for the community and/or the risks of over-investment or even stranded costs.
- **Great Britain's** NRA believes that innovation should 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.
- **Hungary's** NRA mainly considers innovative projects those related to digitalisation, decarbonisation, enhancement of SoS, decrease of per unit costs, or those significantly improving the efficiency of the TSO's operations.
- **Ireland's** NRA reports the following working definition used by the electricity SOs: "Innovation is new ways of doing things that bring/promote enduring benefits for current and future customers".

- **Luxembourg's** NRA generally describes innovation as the creation or development of infrastructure, services or internal processes, with the objective of improving efficiency and effectiveness.
- **Latvia's** NRA considers "innovations" to be investments that differ from previously performed investments and that do not just replace older infrastructure but also allow for cutting expenses in the long term and working more efficiently or securely.
- **Poland's** NRA defines innovation as "implementation of projects to the extent and in a manner that has not yet occurred, for the benefit of society", including smart metering, cost-reducing technologies, IT forecasting solutions and flexible products related to demand development.
- **Portugal's** NRA considers innovation as the deployment of demonstration pilot projects after the R&D stage.
- **Romania's** NRA suggests that innovation in this context should be regarded as "application/use of technical and technological solutions, with or without the integration of classical or advanced computer technologies, with the aim of improving the functional performances, the degree of observability and controllability and the degree of self-healing of the system by creating new functionalities and/or increasing the degree of receptivity/sensitivity of the system to environmental stimulus and received stimulus from loads/consumers/users served". Additionally, the application of these innovative solutions must lead to: improving the key performance indicators of the system; increasing the welfare of the beneficiaries (in monetised and/or non-monetised terms); increasing the flexibility and adaptability of the system for the successful and timely integration of production and production and consumption units, as well as the dynamic interaction with distribution systems with stochastic operating regimes.
- **Slovakia's** NRA finds innovative solutions to include solutions to reduce energy consumption, reduce CO₂ emissions and to use technologies effectively.
- **Slovenia's** NRA considers that innovation is an action that increases benefits (lower costs, higher quality – safer and more reliable gas grid operation, more environmentally friendly operation, etc.).
- **Spain's** NRA focuses the meaning of innovation on the production and transmission of renewable gases that is not yet implemented.
- **Sweden's** NRA understands the word innovation as a product which has passed the R&D stage, and it is still undergoing technical development affecting not only sustainability but also its price.

2.5 Examples of implementation, planning and considerations of cost-effective innovative solutions in Member States

Several NRAs reported that so far, innovative solutions are not part of infrastructure planning; for example, due to it still being very early in the planning stage. Half of the NRAs provided examples of such type of investments.

- In **Belgium**, Open Rack Vaporisers, using the temperature of the sea water to regasify liquid gas, have been built and are operational, leading to lower CO₂ emissions.
- In **Croatia**, the TSO regenerates old steel pipelines with new flexible pipes of lower diameter that are inserted into old pipelines.

- In the **Czech Republic** there are several examples of projects which include a combination of P2G (H₂, electrolysis) and biomethanisation devices led by the TSO and the DSO on a private basis and one example of partial pipeline refurbishment for hydrogen transmission. There are also other projects including biomethane production using wastewater treatment or food waste digestion.
- In **Estonia**, all metering points with consumption higher than 750 standard m³/year are to be equipped with a metering system that takes into account the temperature of the gas and allows remote reading.
- In **Finland** new software and new technical devices to supervise network conditions were mentioned.
- In **France**, projects are ongoing in several fields: power-to-gas (Jupiter 1000); hydrogen (FenHYx); smart grids (West Grid Synergy); improvement of transmission efficiency (a project to collect heat when gas pressure is lowered in transmission stations); integration of renewable gas (biogas) by using the compressor on the network to push gas into the upper part of the network (low pressure to medium pressure); and using flexible solutions to integrate green gas (local storage on the biogas production site, control of the consumption to match with the production, etc.).
- In the regulatory framework of **Great Britain**, while innovative solutions have been numerous throughout RIIO-1, the most notable example in the gas sector is the adoption of cast-iron sealing robot (CISBOT).
- In **Hungary** smart meter reading solutions, as well as P2G projects are being initiated under a sandbox approach.
- In **Ireland**, a gas innovation fund is in place to provide support for research and demonstration projects, with a priority on delivering significant carbon savings, increasing throughput through the gas system, assisting in the transition to a low carbon economy, and providing measurable value to all gas customers.
- In **Latvia**, the TSO is focused on the operation of a multi-country entry-exit system.
- In **Poland**, examples include: the substitution of plane/helicopter inspections is done by drone inspections, smart metering, IT software, transmission system performance forecasting (including system balancing), DSO forecasting of clients' performance, H₂ injection and storing, flexible transmission services available on demand, sector coupling and electromobility.
- In **Portugal**, a pilot project of H₂ admixture is currently being assessed.
- In **Slovakia** the possibility to accept biomethane in natural gas distribution networks was mentioned as an example.
- In **Spain** the modification of technical legislation to allow injection of non-conventional gases into the natural gas network, the digitalisation of networks surveillance and maintenance, and the upgrading of infrastructures was implemented.

2.6 Concluding remarks

NRAs broadly agree with definition of security of supply as defined in the consultancy study, while NRAs that object either advocate for a broader (including generation adequacy) or stricter (excluding flexibility) interpretation. In general, NRAs focused more on the definition of innovation than the definition of the security of supply when answering the survey.

On the definition of innovation, several NRAs find it vague or totally missing the mark and question the inclusion of typological investments related to innovation of already mature technologies (e.g. reverse flows). Instead, many NRAs suggest a broader definition of typological investments which includes projects such as those to increase the acceptance of non-conventional gases in the network. A few NRAs also note that R&D is an element of innovation.

The findings of this progress report make it clear that, compared to security of supply, there is less agreement among NRAs on the understanding of innovation, and even less agreement on the types of innovative projects it includes. The existence of Regulation (EU) 2017/1938 (SoS regulation) might answer why the understanding of security of supply among NRAs is more uniform. Only in the case of Finland is a legal definition included in a country's regulatory framework.

The understanding of innovation is often linked to the concepts of carbon neutrality and sector coupling. Accordingly, most innovative projects as reported by NRAs fall into the categories of P2G and injection of non-conventional gases (hydrogen, biomethane).

Several NRAs also link innovation to digitalisation, thus reporting projects such as smart meter reading, and digital and automated surveillance.

A number of NRAs refer to technologies aimed at cost savings and system efficiency, and in some cases the definition provided is vaguer or broader and refers to R&D and new ways of operating the energy system.

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

3.1 Recommendations of the Ecorys consultancy study

The consultancy study identified several options for improvements for countries described, although it also specifies that the amount of recommendations is not correlated to the severity of regulatory barriers identified. No option for improvement was identified for Member States in the case where stakeholders' feedback did not enable the establishment of any evidence of such a need or when stakeholders perceived the national framework as already sufficient to incentivise innovation and security of supply.

According to the consultancy study, five countries had five or six options for improvements (**Luxembourg, Denmark, Germany, the Netherlands, Slovenia**), nine countries had three or four options for improvements (**Austria, Belgium, Italy, Portugal, Croatia, Ireland, Latvia, Spain, Bulgaria**) and eight countries had one or two options for improvements (**Estonia, Finland, France, Lithuania, Slovakia, Sweden, Ireland, Czech Republic**).

The most frequently recommended options for improvement include:

- **Requirement to consider innovative solutions.** This option for improvement is recommended to make it explicit that TSOs have a duty to consider innovative options, while innovative options chosen might be funded through tariffs, subject to NRA decision;
- **Perform Social Cost-Benefit Analyses (SCBA) for larger projects.** This option for improvement aims to ensure that wider societal benefits are taken into account in order to justify a project being built;
- **Mitigation of CAPEX bias by encouraging a balanced consideration of OPEX-based solutions.** Encouraging investment in OPEX-based solutions may involve introducing incentives or a specific budget for OPEX-based solutions or other regulatory incentives aimed to ensure a balanced consideration of both OPEX and CAPEX when considering potential projects;
- **Consultation on National Development Plan/Investment plans and on a project level with stakeholders.** Including a stakeholder consultation as part of the process of establishing a national development plan, an investment plan or decision-making on large projects would require the TSO to explain the alternatives considered when developing projects. This recommendation could be combined with a requirement to consider innovative technologies or approaches (and to report on considerations made) if thought desirable;
- **Requirement to consider OPEX-based options.** A general approach to foster OPEX-based solutions in the long-term would be the introduction of an obligation to consider and report on considered OPEX-related innovative options in the network development plan or investment plan.

In some cases, options for improvements were adapted to address national specificities, such as mitigation of authorisation obstacles in Italy or integration of extra-financial benefits in the solutions benchmark undertaken in Ireland.

3.2 Implementation of the recommendations in Member States

Several NRAs declared having directly implemented or being in the process of implementing some of the recommendations set up by the European Commission, whilst a majority of them considered that these options for improvements were at least partially implemented under an implicit form. In **Great Britain**, no options for improvement were identified as the current regulatory framework is considered accommodating to both security of supply and innovative investments. Three NRAs (those of **Hungary**, the **Netherlands**, and **Slovakia**) declared that they did not implement the recommendations of the Commission. The NRA of the **Netherlands** expressed a divergence of view regarding the diagnosis set up in the consultancy study for its country, as it considers that its regulatory framework does not prevent TSO from implementing innovative solutions. Some NRAs also pointed out that further changes could only be implemented in the next tariff regulatory period.

3.2.1 Requirement to consider innovative solutions

This option for improvement was considered as being already implicitly present in the regulatory framework by several NRAs (those of **Romania**, **Poland**, **Great Britain**, and **Denmark**) whilst others declared that they did not yet implement it (those of **Czech Republic**, **Portugal**, **Ireland**, and **Slovakia**). The **Portuguese** NRA specified that innovation is, however, being supported under the decarbonisation target in the country, whilst the **Slovakian** NRA noted a missing legal basis to implement this requirement. The **Croatian**, **Danish** and **German** NRAs expressed their willingness to develop this requirement or to make it more explicit in the law.

3.2.2 Implementation of option for improvement 1: Perform Social Cost Benefit Analysis (SCBA) for both security of supply and innovation of larger projects

Several NRAs to which this recommendation was made stated that SCBAs were already performed in several cases, in particular for large and/or interconnection projects (**Germany**, **Croatia**, **Poland**, **Great Britain**). In **Germany**, SCBAs are also performed for internal projects, e.g. assessing the notably technical impact on redispatching. In **Croatia**, the NRA pointed out that a PCI (the LNG terminal in the Island of Krk) has been subject to an extensive stakeholder's consultation and to a detailed CBA which assessed a wide range of societal impacts, such as pollution, waste management, socio-economic impact and numerous other indirect effects; in addition, environmental studies, as part of the documentation for any infrastructure project in Croatia, are a prerequisite to receive building permits, thereby internalising this issue. In **Romania**, the NRA issued a regulation stating that all investment projects integrated in the long- (10 years), medium- (5 years) and short-term (1 year) investment plans must now be based on technical-economic analysis and quantify the benefits pursued by achieving them. The **Polish** NRA pointed out that it did not identify any legal basis to undertake a social CBA for projects other than the PCIs.

3.2.3 Mitigation of CAPEX bias by encouraging a balanced consideration of OPEX-based solutions

This recommendation was considered as already having been implemented in current tariff or network planning assessment practices by **Germany, Poland and Denmark**. The **Danish NRA** expressed its willingness to undertake further methodological development on this point. The NRAs of **Romania, the Czech Republic and Slovakia** declared that they did not implement this recommendation yet.

3.2.4 Consultation with stakeholders on National Development Plan/investment plans and on a project level

All concerned NRAs considered that the necessary consultation requirements were already implemented in the framework of the National Development Plans (NDPs) processes, although they were not specific to innovation and security of supply. In **Slovakia**, consultations are run for TYNDP projects only. The **Romanian NRA** specified that a public consultation is now foreseen regarding the 10-year investment plans.

3.2.5 Requirement to consider OPEX-based options

The NRAs of **Denmark and Poland** indicated that this requirement was already implicitly implemented in their respective regulatory framework, although the **Danish NRA** expressed its willingness to undertake further methodological development on this point. This recommendation was not yet implemented in **Czech Republic, Germany** (where an efficiency benchmark is considered for CAPEX but does not include a comparison with OPEX-based solutions), **Portugal, Romania and Slovakia**.

3.3 Barriers for implementation of the recommendations

Four NRAs did not identify specific barriers to implementation (**Croatia, France, Portugal, Great Britain**). For those that did, the identified barriers were the following:

- *Consistency concerns over the tariff regulatory period* In **Germany, Hungary and Ireland**, the NRAs did not deem it appropriate to introduce regulatory changes within the current tariff period, as they considered that it would lead to unpredictability in the regulatory framework.
- *Lack of competency in some areas tackled in the consultancy study* The **Italian NRA** also indicated that the recommendations made on clarification of technical and commercial rules and simplification and acceleration of permitting processes, both at the EU and Member State level, are topics that are not NRA competences.
- *Lack of a legislative framework to provide a legal basis for implementing options for improvements* The **Czech, Slovak and Polish NRAs** identified missing legal basis as an issue for the implementation of some of the options for improvements, notably the undertaking of CBA, including societal aspects for all projects or the integration of a legal requirement to consider innovative solutions.

3.4 Concluding remarks

In CEER's view, the implementation of some options for improvement in the Ecorys consultancy study is not straightforward, while other recommendations already have 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 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 surveyed consider that specific regulatory measures for innovation are appropriate, while the other half deem 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 implementation of some of the study's recommendations), in particular:

- The lack of NRA powers to implement certain decisions regarding tariffs (country-specific problem); 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 documents⁶, CEER deems that:

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

⁶ The ACER-CEER [Bridge Beyond 2025 Conclusions Paper](#), 19 November 2019; ACER-CEER position paper on [Revision of the Trans-European Energy Networks Regulation \(TEN-E\) and Infrastructure Governance](#), 19 June 2020.

4 Regulatory mechanisms promoting security of supply and innovation

4.1 Main features of the regulatory mechanisms promoting security of supply and innovation in Member States

In the majority of the countries surveyed no specific incentives schemes for innovation are in place. Nevertheless, the following schemes or particularities exist or are being considered:

- In **Austria**, a new methodology was introduced that will start in January 2021, which foresees an incentive scheme for investments in efficiency.
- In **Belgium**, shorter depreciation periods are foreseen for important replacement investments. Innovation is stimulated but not necessarily by higher remuneration or subsidies.
- In **Croatia**, incentive schemes for innovation currently under consideration, and several project studies on this topic are in the planning phase. An SoS incentive includes discounts in tariffs for entry and exit to and from gas storage; an additional risk premium could be approved to the LNG terminal operator, as incentive for new infrastructure for enhancing national and EU security of supply; also, there are obligations for gas suppliers to secure underground storage facilities sufficient for public service gas supply until 31 March 2021.
- In the **Czech Republic**, there are no incentive schemes for innovation. For SoS, a higher discount in tariffs for entry and exit to/from gas storages is granted.
- In **Denmark**, no specific incentive for innovation or SoS is foreseen.
- In **Finland**, only innovation incentives on R&D costs are foreseen. An SoS incentive is applied in situations where an existing network is decommissioned during its lifespan and replaced with more reliable solutions.
- In **France**, a decision regarding the connection of green gases was adopted in November 2019. Its purpose is to achieve the national objective of green gas integration, while following a principle of economic efficiency in order to minimise the costs for the consumers. Green gas producers have a legal right to be connected to the network as stated by the "Egalim" law from 2018, provided that investments to reinforce the network are technically and economically sound. They also benefit from a reduction of their connection costs (40%, maximum €400,000). The NRA's decision also put in place a mechanism to share reinforcement costs between producers when relevant. System Operators have the obligation to establish a zoning defining the most pertinent connection mode for producers. Investments in the network are approved by the NRA (CRE).
- In **Germany**, R&D-Projects by network operators that are subject to state funding are additionally supported through regulation by giving the possibility to include, in the allowed revenue, half of the costs that are not financed by state funding.

- In **Great Britain**, there are a number of mechanisms in the regulatory framework that encourage innovation. These include the UK's Network Innovation Allowance, Network Innovation Competition and Innovation Link. The role of Innovation Link is to help innovators understand what the regulatory framework means for them and to help them find ways of bringing new products and services to market, by providing feedback on the regulatory implications of their propositions and by providing an Energy Regulation Innovation Sandbox to facilitate trials (pilots and demonstrations) or new propositions where current rules may be barriers to making this happen. The sandbox has a range of tools to aid innovators including bespoke guidance, comfort for trials, confirmations (that an activity is permissible) and derogations where a specific rule might be unsuited to a proposition.
- In **Hungary**, there are no specific incentives for innovation or SoS granted to the TSO. To foster SoS, a strategic storage facility holds Hungary's strategic stocks, and there are also storage discounts applied to the transmission tariffs.
- In **Ireland**, the current price control for gas (referred to as PC4) runs from October 2017 to September 2022. In determining the allowed revenue for Gas Network Ireland (GNI) the NRA CRU imposed incentives that encourage the company to efficiently and safely operate, maintain and develop in the gas network. CAPEX incentives are in place to increase efficient capital expenditure. A review on CAPEX spend is conducted at the end of the price control period, and any inefficient spend is returned to the customer. Currently, there are financial incentives in place for GNI, which links directly to customer key performance indicators – known as the Customer Service Incentive. These customer performance indicators are used to incentivise GNI over the period of the current price control (PC4). Additionally, as part of this price control period, CRU approved funding of up to €20 million for innovation over the five-year term, with €17.5 million approved initially and with a potential for a further release of €2.5 million (subject to performance).
- In **Italy**, there are no incentive schemes other than those already described in the consultancy study. The tariff system, which provides a fixed percentage of return on invested capital, seeks to create a balance between the costs of maintaining and developing the network and remuneration of the service. Currently, regulatory mechanisms specifically designed to encourage innovation are under consultation. Concerning security of supply, there is no specific incentive scheme, but the overall framework and regulatory practices are deemed as suitable; for gas transmission, in particular, investments included in the National Development Plan yielding a Benefit/Cost ratio higher than 1.5 can benefit from an additional remuneration (+1.5% granted for 10 years), and security of supply is one of the benefits that can be included in the assessment.
- In **Lithuania**, there are no specific schemes for SoS and innovation. But if the project synergises with another sector's project, and there are savings due to the implementation of two different projects from different sectors, then the project promoter gets 50% award of the savings. There is also awards system due to efficiency (50% of savings is awarded to the company).
- In **Luxembourg**, SoS projects generally fall under an incentive scheme whereby the network operator can keep 30% of the savings compared to the originally planned budget. In addition, work in progress is remunerated for the duration of the realisation of the project (limitations exist in case the realisation takes longer than planned). Innovation was less incentivised during the current regulatory period but is a main driver for the proposed changes in the framework for the next regulation period.

- In the **Netherlands**, the Dutch Gas Act prescribes how the network operator should ensure security of supply. This task for the network operator is currently outside the scope of tariff regulation.
- In **Poland**, an incentive scheme is in place. For ensuring security of supply, a minimum rate of return (6%) for investment in underground gas storage is foreseen.
- In **Portugal**, there are no schemes for natural gas, as the legislation and regulation in Portugal do not consider any incentive scheme for innovation. For security of supply, Regulation (EU) 2017/1938 the analysis and plans that it implies are also present in the regulation and are implemented.
- In **Slovenia**, there are schemes that have been proposed but the procedure to approve/implement them is still ongoing. A report was published after the beginning of the current regulatory period 2019-2021.
- In **Slovakia**, there is no specific incentive scheme. However, projects, especially those of national interest and with a wide range of benefits, are assessed and discussed with stakeholders on a case-by-case basis. For example, the Polish-Slovak gas interconnector which has been incentivised by the NRA RONI as a project which serves, inter alia, the goal of security of supply by building an interconnector with a reverse flow system.
- In **Spain**, an additional remuneration due to innovative projects (though related to conventional natural gas projects) is granted; previously, innovation costs were just included in operation and maintenance costs. Other innovative projects, e.g., renewable gas production plants, are out of the scope of the NRA's competences.

4.2 Need for specific regulatory support for innovation and/or security of supply

The majority of the NRAs do not see a need for further regulatory support for innovation and/or security of supply. Other NRAs informed CEER that they are evaluating the introduction of such schemes.

- **Austria's** NRA does not consider security of supply to be an issue for Austria. The Austrian legal framework only permits additional TSO incentives if they increase efficiency, under tight scrutiny of the NRA.
- **Belgium's** NRA believes that there is no lack of regulatory support for security of supply and that no additional incentives are needed. The current framework enables innovative TSO behaviour and cost cuts while a mature transport grid is made available for Third Party Access (TPA).
- **Croatia's** NRA believes that, to some extent, specific measures for innovation in national gas legislation framework are missing. The reasoning for this could be that taking into account national economic and energy market development, as well as on the wider EU level, that there is a lack of clear regulatory recommendations and guidelines sometimes as the country regularly and in due time harmonises national regulation with EU regulation. An EU policy guideline, rather than regulation, would be a clear basis for national policies in this area. Currently, there are no support schemes for innovation. However, they are under constant consideration. Several project studies on this topic are in the planning phase (e.g. smart metering in distribution). On SoS, an additional risk premium could be approved for the LNG terminal operator, as an incentive for new infrastructure for enhancing national and EU SoS.

- The **Czech Republic's** NRA states that, so far, innovative projects have been considered as experimental and carried out by private researchers or the TSO on a private basis. However, with the passage of time, market participants have started to mention it is a hindrance to not have a legislative framework which would at least basically describe functioning of such projects and their incorporation into the gas market and its rules. The NRA believes that changes of the legislative framework – amendment of the Energy Act, covering new types of gases, new technologies/devices, financial support scheme(s) for renewables, establishing the position of experimental and testing projects, etc. – could be introduced to enhance the framework. On the other hand, it believes that DSOs/TSO should actively bear the risk connected with innovations, if it is those system operators who gain from its operation, i.e. the profit is mainly on their site, not the on customer or system site. In the case of 100% remuneration, there is the risk of realisation of ineffective/risky projects. Also, the main task of TSOs/DSOs is to secure uninterrupted and safe operation of the system – to maintain it and innovate it – in order to do so, it is up to them to fulfil the legal requirements based on the Energy Act. For the NRA, it seems vital to distinguish between mature and immature projects (or to divide projects into certain categories) according to the CBA analysis in order to decide whether to include them to the regulatory asset base or not. If the CBA is not positive, there is the risk of investment into ineffective projects with possible negative impacts for the end-customer who ultimately pays for systems costs.
- **Germany's** NRA believes that there is no lack of regulatory support for innovation and/or security of supply.
- **Denmark's** NRA believes that the regulatory support for innovation could probably be improved with separate obligations and budgets for the TSOs. They think that the regulatory framework (and performance) on SoS is already relatively strong in the current regulation. In 2022, there will be a change in the regulatory framework with the introduction of a revenue cap regulation and strengthening of the National Development Plans concerning investments. The NRA believes that it is likely that a combination of legal requirements, economic and non-economic incentives would provide the strongest framework in the context of innovation and security of supply.
- **Estonia's** NRA believes that there is no lack of regulatory support and that innovation and SoS should not be particularly incentivised.
- **Finland's** NRA believes that there is no lack of regulatory support and that SoS and innovation are both already sufficiently incentivised.
- **France's** NRA believes that there is no lack of regulatory support. Regarding incentives for innovation and SoS, there are already projects ongoing in several fields. A new incentive mechanism for IT expenses has also been put in place: an experimental TOTEX (common OPEX and CAPEX trajectory) incentive mechanism that would serve to assess the feasibility of a solution which consists of consuming industrial and standardised services whenever possible and in building and maintaining only core business solutions specific to the activity (which results in a substitution of CAPEX towards more OPEX). This experiment can meet the flexibility needs identified within the framework of the digital transformation of information systems.

- **Great Britain's** NRA does not believe there is a lack of support for innovation under its current regulatory structure. However, the NRA (Ofgem) continues to improve the regulatory tools in order to strengthen innovation. Through RIIO-2, there is a desire to push companies to become more innovative and consider it as business-as-usual (BAU), focusing on the transitioning network and co-ordinating with other public funders and third parties. Many innovations tools within the price control will be retained from RIIO-1 to RIIO-2, with a sharper focus on energy system transition, protecting vulnerable consumers and increased levels of public reporting on these innovative projects.
- **Hungary's** NRA considers that for projects related to security of supply, the current framework is adequate. In 2019, the methodology for the determination of the TSO's regulatory asset base was adjusted to include a possibility for ex-ante inclusion of certain projects under construction subject to the NRA's approval. Projects that are essential to the security of supply are now eligible for ex-ante inclusion, thus reducing the TSO's risk and providing reassurance and incentivising these projects. Regarding incentive schemes, MEKH is investigating the possibility of the introducing of a "regulatory sandbox" in order to incentivise innovative projects.
- **Ireland's** NRA states that the regulatory model will likely have to change to accommodate the increased pace of innovation. There are questions on how to best facilitate this, and it may take some time before best practice emerges. The NRA will be considering the best approach for incentivising innovation and SoS in the next price control period. The NRA (CRU) continues to measure the effectiveness of the measures in place. The CRU is coming towards the end of the price control period (PC4) and will carry out a review as a part of the next price control process. In addition to that, the CRU thinks that innovation and SoS should be incentivised; however, this is dependent on the maturity of the innovation programmes or technologies used by the system operators. For example, specific incentives for innovation might be required initially to promote the development of innovative programmes or specific technologies that will bring benefits/savings for customers. Similarly, initial incentives for security of supply might be required in order to enhance the systems/processes for SoS. Once output-based metrics are well established and business process in place (BAU), incentives may no longer be required.
- **Italy's** NRA believes that there is no lack of regulatory support for innovation or for security of supply. The NRA (ARERA) is currently carrying out further consultation on support for innovation. The document (of 11 February 2020, n. 39/2020/R/gas, "*Reti di trasporto e distribuzione del gas naturale: progetti pilota di ottimizzazione della gestione e utilizzi innovativi*") confirms the intention to introduce incentive mechanisms for projects or applications at both transmission and distribution level having a particularly innovative nature and, specifically, aimed at achieving environmental targets or supporting energy transition. The scope includes projects for: (i) optimised management of networks, including bidirectional pipelines, use of pipelines for storage purpose (through dynamic pressure), methane emissions reduction; (ii) innovative solutions for existing infrastructure, including use of the gas network to transport biomethane and other green gases, hydrogen and power to gas projects, Carbon Capture Storage (CCS)/Carbon Capture Usage (CCU) applications; (iii) digitalisation of operations. Candidate projects can be carried out by both regulated and non-regulated entities. Following a positive assessment by the NRA ARERA, the proposal is to grant projects a contribution as a share of the total expenses (OPEX + CAPEX). The NRA ARERA is also planning to grant such projects possible temporary exemptions from existing regulation in case certain provisions are perceived as a barrier by the promoter (a 'sandbox' approach). ARERA is currently assessing an approach to innovation which considers the risk profile of investments in comparison with BAU solutions and aims at giving a proportionate incentive.

- **Latvia's** NRA is doing research on innovation and security of supply support practices in other EU countries and, in the future, is planning to include such support schemes in its tariff setting methodologies. Innovation or security of supply investments should be additionally stimulated, for example, with a higher WACC rate.
- **Lithuania's** NRA thinks that there is a lack of innovation regulation in national law. The amendment of the Energy Law regarding references to innovation is waiting for approval. This amendment will let the NRA set a methodology for innovation incentivisation. After that, all the incentives would be discussed and set by the NRA. However, the NRA follows a conservative approach regarding additional incentivisation of innovation or SoS projects.
- **Luxembourg's** NRA thinks that there is a lack of innovation regulation in national law, considering the fact that 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 network operators, and changes are proposed for the coming regulatory period. It turned out that the framework for innovative projects was too restrictive and should be opened up further. In addition, the proposed new framework would also include demonstration projects as well as innovative IT development projects. The current regulatory framework is about to be revised for the next regulation period, and one main objective is to improve the regulatory support for innovation. Security of supply is a key TSO responsibility and even more in a small country that is dependent on energy imports.
- The **Netherlands'** NRA is of the opinion that there is no lack of regulatory support for innovation or for security of supply as with a reasonable return for network operators, there should be no barriers to innovate.
- **Poland's** NRA states that in case of gas, there is sufficient regulatory support for security of supply projects. This is the case because, inter alia, the issue is sufficiently addressed in Poland's "Energy Policy", which is a formal document whose provisions must be respected in taking regulatory decisions. A similar situation may also be true in the case of innovation projects, as they often appear, and obtain due attention in respective policies. Regarding the possibility to incentivise innovation or security of supply in addition to remuneration guaranteed, Poland states that gas security of supply should be incentivised, in addition to the remuneration provided by general rules of regulated tariffs through EU or state subsidies; cost socialisation; adjustment of tariffs at exit points to and entry points from storage facilities; and entry points from LNG terminals and infrastructure ending isolation, all of which contributes to a long-term stable regulatory framework. In the case of innovation projects, it is also necessary to define which level of TSO/DSO involvement is allowed, in order to comply with unbundling requirements and not to deteriorate conditions and run the risk of ongoing projects related to essential activities might be negatively affected.
- **Portugal's** NRA believes that there is no lack of regulatory support for innovation or for security of supply. As far as the security of supply is concerned, the European regulatory framework is in place. The innovation side is not considered in the case of natural gas and the experiences of attempting to introduce schemes in the electricity sector were not successful. Regarding the possibility to incentivise innovation or security of supply in addition to remuneration guaranteed, Portugal's NRA states that it is not necessary.

- **Romania's** NRA informs CEER that network operators apply innovative technical and technological solutions in investment projects. The legal provisions and the specific regulations provide for obligations to modernise and upgrade the networks. These provisions can be considered as indirect support to sustain innovation. Regarding the possibility to incentivise innovation or security of supply in addition to remuneration guaranteed, Romania's NRA states that it is already a legal obligation.
- **Slovenia's** NRA states that there is a lack of regulatory support for innovation but not for SoS. Solutions to stimulate innovation are under consideration.
- **Slovakia's** NRA states that there are no legislative barriers which would prevent the NRA (RONI) from supporting the TSO in its efforts to make use of innovation and ensure SoS. However, it could be feasible that new decarbonisation efforts and commitments could bring new needs for the National Regulatory Framework's modification in the future. Regarding the possibility to incentivise innovation or security of supply in addition to remuneration guaranteed, Slovakia's NRA states that in case of innovation projects incentives seem to be useful and necessary. The Slovakian TSO is working on a proposal to diversify imports by using different projects and existing routes. Innovative projects related to decarbonisation should be particularly incentivised. In addition, it should be stated that mainly DSOs are working on development of innovations, and these are only in testing phase so far, as the legislative changes in the Regulatory Framework are foreseen in 2021.
- **Spain's** NRA acknowledges that the Ministry of Ecological Transition is currently working on the promotion of renewable gas projects and on clarifications on the roles of conventional gas, neither of which are an NRA competence. Regarding incentives for innovation and SoS for TSOs and DSOs, these have been already implemented.
- **Sweden's** NRA believes that innovation should be incentivised not as a specific incentive but as part of a TOTEX-based approach. In such an approach, there are incentives to invest in innovative solutions when these are the most cost-efficient ones from a long-term perspective.

4.3 Barriers to the development of cost-effective innovative solutions

The majority of NRAs do not see barriers to the development of cost-effective innovative solutions. Some NRAs see a barrier in missing legislation.

- In **Austria**, the situation is still currently under evaluation, but the NRA has not identified any barriers in the Austrian framework so far.
- **Belgium**, at this point, anticipates a new European law to integrate the decarbonisation and energy transition in order to provide a legal basis for the integration of TSO related projects in the National Development Plan.

- The **Czech Republic** has identified the first barrier to be missing legislation and the second barrier to be a lack of underlying development of cost-effective solutions. Regarding the latter, this is because although the experimental solutions developed so far have proven to be functional; however, the experimental solutions have not yet demonstrated cost-effectiveness. To support them in regulation – to add them into the regulated asset base – would require the consensus of the NRA and regulated subjects. This matter is complicated though, since the main task is to provide end customers with cost-effective energy supply. It can be supposed that changing this approach requires changes in the legislative framework (Energy Act). One way to overcome this challenge is to prepare a strategy for a pan-European scheme to support innovative solutions, with the aim of constructing the regulatory regime so that innovation in the energy will be competitive and publicly supported.
- **Denmark's** NRA sees a barrier in the fact that there are no separate obligations nor funding of research and development given to the TSOs. R&D is expected to be funded by public budgets and in commercially driven companies (the market).
- The NRAs of **Estonia, France, Latvia, Poland, Portugal and Romania** assert that there are no barriers.
- In **Finland**, the innovation incentive is built so that only the firstcomer gets the benefit through the incentive. Only the costs of the projects that are new for the whole industry can be accepted as R&D costs within the parameters of the innovation incentive.
- **Great Britain's** NRA acknowledges that the major barrier to innovation under the RIIO price controls is the implicit short-term philosophy that deals with how network companies are rewarded. This disincentivises longer-term innovative investments. The NRA has tried to counter this through innovation stimulus and other regulatory tools, which aim to incentivise innovation in the network.
- **Hungary's** NRA states that while the identification of possible innovative solutions and adjusting the regulatory framework is an ongoing process, no unsurmountable barriers have yet been encountered.
- **Ireland's** NRA sees a main barrier in the uncertainty of the role of gas in decarbonisation. The electricity infrastructure has the Clean Energy Package and there are discussions ongoing at the European level regarding the future role of gas including decarbonisation of the gas industry and more on the Green Deal. The outcome of national discussions and any relevant legislative changes (which the EC aims to deliver by June 2021) will, of course, have a bearing on the future role of gas and will have to be considered.
- In **Italy**, the NRA (ARERA) is still investigating the main barriers in this respect, including pursuing findings based on the outcome of a still-ongoing consultation (consultation document of 11 February 2020, n. 39/2020/R/gas).
- **Lithuania's** companies, in general, have been implementing innovative solutions. However, from a regulatory perspective, additional incentives could be approved. For this reason, legal amendments are needed.
- **Luxembourg's** NRA views the main barrier to be the uncertainty of the future of natural gas. Until a clear political position is taken and a long-term target is defined, further projects are not likely to be developed.
- The **Netherlands' NRA** considers that information asymmetry represents a barrier. There is a grey area between what are investments in innovations and what are regular investments.

- **Slovakia's NRA** informs CEER that the TSO and DSOs do not foresee any projects in the National Development Plan that require innovative projects in order to take into account decarbonisation and the energy transition. The question is whether cost-effective innovative solutions for gas infrastructure are mature and cost-effective enough to not impose an unreasonable financial burden on market participants.
- **Slovenia's NRA** asserts that in the past, innovations were not common in gas transmission and distribution, but decarbonisation brings new challenges where innovative technology will be needed.
- **Spain's NRA** states that the lack of specific legislation for innovation in the natural gas sector in order to promote innovative solutions may be the main barrier. There are several initiatives – local subsidies – but not a common national legal framework for innovation in natural and renewable gases.
- In **Sweden**, it is considered that a prerequisite for introducing cost-effective innovative solutions is that the Swedish government selects legislative amendments which may be proposed by the Swedish NRA. Otherwise, under current legislation, the NRA Ei has no powers to implement some changes, such as using a TOTEX-based approach. So far, no legislative amendments were proposed by Ei for gas, because gas plays a minor role as an energy source in Sweden.

4.4 Concluding remarks

In the majority of the countries surveyed, no specific incentive schemes for innovation are in place, and the NRAs do not see a need for further regulatory support for innovation and/or security of supply. Generally, the interviewed NRAs that assert that there is no need for further regulatory support, state that either the present regulatory framework is sufficient, or that innovation is not a task for TSOs.

Several NRAs provided examples of incentives for SoS investments (and the use of storage) as well as for the improvement of efficiency. Generally, it emerges from the survey that SoS schemes are already sufficiently incentivised in most countries surveyed, while some NRAs reported that they see a necessity to incentivise innovative solutions. Other NRAs informed CEER that they are evaluating the introduction of schemes for incentivising innovative solutions, while still others stated that they see no need for it.

Regarding the existence of potential barriers for the development of cost-effective innovative solutions, some NRAs see barriers in the future's uncertainties: the still unclear role of gas in the decarbonisation; the consequent short-term perspective for investments; and in the lack of legislation concerning innovation. The majority NRAs, however, do not see barriers for the development of cost-effective innovative solutions.

Annex 1 – List of abbreviations

Term	Definition
ACER	European Union Agency for the Cooperation of Energy Regulators
AI	Artificial Intelligence
BAU	Business as usual
CAPEX	CAPital EXpenditures
CBA	Cost-Benefit Analysis
CCS	Carbon Capture Storage
CCU	Carbon Capture Usage
CEER	Council of European Energy Regulators
CEP	Clean Energy Package
DSO	Distribution System Operator
EC	European Commission
EU	European Union
GI WS	Gas Infrastructure Work Stream under the CEER Gas Working Group
GNI	Gas Network Ireland
IT	Information Technology
LNG	Liquefied Natural Gas
MS	Member State
NDP	Network Development Plan
NRAs	National Regulatory Authorities
OPEX	OPerational EXpenditures
P2G	Power-to-gas
PCI	Project of Common Interest
R&D	Research and Development
ROI	Return on Investment
SO	System Operator
SoS	Security of supply
TEN-E	Trans-European Networks for Energy
TOTEX	TOTAL EXpenditures
TPA	Third Party Access
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.