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

Country Report - Finland

March– 2019

EUROPEAN COMMISSION

Directorate-General for Energy
Directorate B — Internal Energy Market
Unit B.1 — Networks & Regional Initiatives

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Directorate-General for Energy

March 2019

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Luxembourg: Publications Office of the European Union, 2019

ISBN: 978-92-76-03994-5
Doi: 10.2833/81042

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The NRA has the duty to grant licenses, as well as monitor compliance with the terms of the licences. Furthermore, the NRA is engaged in the regulation of reasonable returns for the TSO. The TSO is responsible for long term planning of transmission system development to provide adequate development of infrastructure and ensure reliability within Finland and towards neighbouring countries. Despite the TSO independently prepares an investment plan annually which does not require approval from the NRA, investments encompassing the construction of new transmission lines and cross-border interconnections require the respective approval of the NRA and Ministry of Economic Affairs and Employment.

The Finnish regulatory practice in the electricity sector

The NRF works well in general to support innovation and security of supply, notwithstanding its revenue-cap financing mechanism, which might lead to a bias towards capital intensive projects to the detriment of OPEX-based alternatives. Furthermore, innovative investments should be compatible with the need of the current grid and account for foreseeable needs of the future.

Options for improvement

Favour OPEX based solutions.

Assessment of the NRF and the regulatory practice of the Finnish gas sector

The Finnish gas NRF

The Finnish gas grid is quite limited in its coverage and is currently physically isolated from the rest of the EU, with Russia being the only source of imports.[1] In spite of not yet being fully deregulated, the Finnish gas market will have been opened to competition by 2020 in accordance with the new legislation, which entered into force (the Natural Gas Market Act (587/2017) in the beginning of 2018. The regulatory responsibility within the gas sector is divided between three government agencies: The Energy Authority ("EA"), the regulator for the natural gas market; the state-owned Gasum Oy, the owner and operator of the transmission network; the Ministry of Economic Affairs and Employment, the developer of the natural gas market through legislative initiatives.

The rate-of-return regulatory system is in place in the gas transmission sector.

Both the Natural Gas Market Act and the Monitoring of the Electricity and Gas Markets Act, the primary backbones of legislation governing the NRF in the Finland natural gas transmission sector, do not explicitly assign duties for the TSO and NRA aiming at encouraging innovation. However, research and development is encouraged in the calculation of reasonable returns for the TSO through applying a deduction up to 1% of R&D costs in calculating regulated adjusted profits.

[1] In addition, there are LNG terminals under construction. However, most of these are not connected to the transmission network. There is also to a minor extent production of biogas as well.

The NRA has the duty to grants licenses, as well as monitor compliance with the terms of the licences. Furthermore, the NRA is engaged in the regulation of reasonable returns for the TSO.

The TSO is responsible for long term planning of transmission system development to provide adequate development of infrastructure and ensure reliability within Finland and towards neighbouring countries.

Despite the TSO independently preparing an annual investment plan, which does not require approval from the NRA, investments encompassing the construction of new gas transmission lines and cross-border interconnections require the respective approval of the NRA and Ministry of Economic Affairs and Employment.

The Finnish regulatory practice in the gas sector

The NRF works well in general to support innovation and security of supply. As to the potential shortcomings of the current NRF, focus was drawn to the fact that the financing mechanism might lead to choosing capital intensive projects to the detriment of OPEX-based alternatives.

Options for improvement

Favouring of OPEX based solutions.

1. INTRODUCTION

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

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

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

The Country Report is based on previous study deliverables and analyses. It is divided into two main sections, Section 2, which is related to electricity, and Section 3, which is related to gas. Each of these sections examines the legal framework (Section 1.1 for electricity and Section 1.1 for gas), including specific rights and duties of relevant parties, such as TSOs and NRAs (hereafter also referred to as stakeholders), mechanisms for the financing of investment projects and the regulatory rules regarding innovation and security of supply in particular. Having studied the legal regulatory framework, Section 2.2 for electricity and Section 3.2 for gas examine the regulatory practice in Finland, drawing specifically on stakeholder interviews, and paying particular attention to the regulatory practice related to innovation and security of supply. The functioning of the legal framework and the regulatory practice are illustrated by selected specific projects in the Finland. Lastly, options for improvement of the regulatory practice and the regulatory framework are discussed in Section 2.3 for electricity and Section 3.3 for gas.

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

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

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

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

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

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

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

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

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

2. ELECTRICITY

2.1. Legal analysis of the NRF in Finland

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

The primary pillars of legislations governing the Legal Framework for electricity in Finland, as relevant for transmission network (For the purposes of the Legal Framework in Finland, "transmission" is defined as 110kV or above) development, are the Electricity Market Act (588/2013, as amended) ("EMA") along with the Act on the Monitoring of the Electricity and Gas Markets (2013/590, as amended) ("Monitoring Act").

The duties and powers relevant for the electricity market are set out mainly in the Monitoring Act and, to a more limited extent, in the EMA[2].

The Monitoring Act creates a licensing regime for the electricity market, which is administered by the EA. Activities that require licensing include transmission and distribution. The construction of 110kV transmission lines, or above, requires a permit from the EA, whereas cross-border interconnectors require a permit from the Ministry of Economic Affairs and Employment[3].

The regulatory responsibility within the energy and electricity sector is divided between three government agencies:

1. The Energy Authority ("EA") is the regulator for the electricity market;
2. Fingrid Oyj (public limited company) ("Fingrid", the TSO) is the owner and operator of the transmission network.

The Government's role, through the Ministry of Economic Affairs and Employment is mainly limited to developing the electricity market through legislative initiatives.

Fingrid

Fingrid is the sole Transmission System Operator (TSO) in Finland and carries a permit for its activities issued by the NRA. The permit is issued based on formal requirements, such as being independent from companies that produce electricity, but the permit is not accompanied by any specific standard conditions for operating or developing the transmission network.

The Energy Authority ("EA")

The Energy Authority ("EA") administers a licenced regime for the electricity market, which is created by the Monitoring Act. Therefore, the EA grants licences and monitors compliance with the terms of the licences and engages in economic regulation through the regulation of reasonable return[4]. One of the EA's tasks is to adopt a regulatory methodology.[5] Based on the regulatory methodology, a "Rate of return" financing mechanism is operated. A description of the mechanism is described in the following Section.

A "Rate-of-return" financing scheme

The EA conducts an ex-post assessment of network operators'[6] regulated profits in accordance with a previously published regulatory methodology and determines whether regulated profits have been reasonable from the EA's perspective. Prices will then have to be adjusted accordingly during the subsequent regulatory period.

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2 The entire list of tasks allocated to of the EA are listed in the Act on the Energy Authority (870/2013, as amended).
3 Section 14, EMA.
4 Section 10, the Monitoring Act.
5 Section 10, Monitoring Act.
6 Including also networks with a lower voltage than 110 kV, which in practise means distribution networks.

The EA adopts the regulatory methodology for calculating reasonable return for a period of eight years. Currently, the regulatory methodology in place covers the regulatory periods 2016-2019 and 2020-2023.[7] The EA calculates reasonable return for each year of the regulatory period based on information submitted by network operators. Reasonable return is calculated by applying the regulated asset value of the network to regulatory WACC and comparing to adjusted profit. At the end of the regulatory periods, the EA confirms reasonable return for each network operator and on the basis of this, the possible surplus / deficit in relation to reasonable return. Based on whether a network operator has incurred a surplus / deficit, the EA orders the network operator to lower its prices or allows it to increase its prices with an amount that corresponds to the surplus / deficit, over the following regulatory period. For purposes of calculating a network operator's realised adjusted profit, there are a number of incentives in place, which the network operator can benefit from. The incentives decrease the adjusted profit to be taken into account when comparing it to reasonable return. Among these incentives are the investment incentive and the innovation incentive.

Limited non-regulated activities

None.

2.1.2. Specific legal rights and duties

Role of the TSO

The general role, including applicable legal rights and duties, allocated to the TSO, as relevant for the development of the transmission network.

Transmission tasks

Fingrid, as the Finnish TSO, is responsible for operation, maintenance, renewal and development of the transmission network. Fingrid holds a licence granted by the EA, and in addition, it has specific duties set out in the EMA applicable to the responsible TSO as well as general duties set applicable to all network operators pursuant to the EMA.

Pursuant to the EMA, all network operators have a general obligation to develop their networks[8]. The development obligation requires e.g. that network operators maintain, use and develop the network in a way that ensures electricity supply of sufficient quality to network users. Further, the EMA sets out additional requirements applicable to the responsible TSO in relation to transmission network development[9].

The Ten-Year Development Plan

The TSO is required to adopt a ten-year development plan, which is required to be updated every two years. The development plan must be used as a basis for drafting the EU TYNDP.

The development plan has no other legal effects on the TSO, the users of the transmission network or the EA. The TSO must publish the plan and before its adoption arrange a stakeholder hearing where network users, the EA and other relevant stakeholders are invited to submit comments.

As part of the ten-year development plan, the TSO is called for adopting an investment plan, which includes investments in interconnectors, in order to meet its development obligation[10]. Although the plan does not in itself require approval from the EA, the construction of new transmission lines and cross-border interconnectors require approval from the EA and the Ministry of Economic Affairs and Employment, respectively[11].

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7 https://www.energiavirasto.fi/en/web/energy-authority/regulation-methods-2016-2023. The EA has published an English-language version of the regulatory methodology on its website. However, the published version applies specifically to DSOs and not the TSO. Although the main principles are the same, all incentives in the DSO methodology are not applicable to the TSO, such as the security of supply incentive.

8 Section 19, EMA.

9 Section 41, EMA.

10 Section 41, EMA.

11 Section 14, EMA.

2.1.3. Mechanism for financing of investment projects

The regulatory methodology for calculating reasonable return contains an investment incentive, which is aimed at encouraging maintenance and improvement of the network. However, there are no requirements to meet performance standards. The investment incentive is calculated as the difference between regulatory depreciation and accounting depreciation. Regulatory depreciation is calculated as the annual straight-line depreciation of an asset's regulated value over its selected regulatory lifetime. As such, the investment incentive is not considered as an "incentive" per se, but rather as recovery of accelerated depreciation. The true incentive is the possibility to retain the benefit of outperforming regulatory unit prices[12]. The role of the EA in the financing mechanism has been outlined in Section 2.1.1.

2.1.4. Regulatory rules with respect to innovation

Specific duties of the TSO aimed at encouraging innovation

The EMA and the Monitoring Act do not contain any specific duties on the TSO aimed at encouraging innovation. Notwithstanding that, the regulatory methodology for calculating reasonable return contains an innovation incentive. Pursuant to the regulatory methodology, the EA aims at encouraging research and development by allowing for the deduction of up to 1% of R&D costs when calculating realised adjusted profits. Costs included in the innovation incentive must be related to defined R&D projects that create new knowledge, technology, products or methods of operation in network operations, or to the planning work of such projects. The results of projects for which costs have been accepted in the innovation incentive must be public so they can be used by the sector as a whole, with the exception of confidential customer information or results protected by industrial property rights.

Specific duties of the NRA aimed at encouraging innovation

The Monitoring Act does not assign the EA with duties or powers that are specifically aimed at encouraging innovation. Indirectly, however, the EA does encourage innovation through its regulatory methodology and the innovation incentive, as described in the Section above.

Further, in September 2018, the Ministry of Economic Affairs and Employment, which is responsible for energy policy, set up a working group tasked with investigating the possibilities of smarts grids in the electricity market. The working group contains members from e.g. both the EA and the TSO. In particular, the task of the working group is to investigate and make proposals on how smart grids can empower electricity consumers to actively participate in the market and promote security of supply. The group will present its final report by the end of September 2018. In its intermediate report[13] of October 2017, the working group proposed a market-based approach to demand-side management. Currently, the EA is also investigating whether it should include a demand-side response incentive in its regulatory methodology.

2.1.5. Regulatory rules with respect to security of supply

Specific duties of the TSO aiming at safeguarding security of supply

Pursuant to the general development obligation, all network operators must plan and construct their networks in a way that enables the functioning of their networks in expected and unexpected exceptional circumstances.[14] Further, the TSO has a significant role in creating and administering reserve markets through the frequency reserve system.

The frequency reserve system has been operating since 2007 and is intended for situations where market-based supply is insufficient to cover demand. This is achieved by establishing a reserve of generators and parties capable of adjusting consumption, which quickly can respond to adjustment requests by the TSO in order to balance the system.

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12 For a description of this incentive in English, please see the link to a translated version of the EA's regulatory methodology below. Please note that the linked regulatory methodology as a whole applies to DSO and not to the TSO. However, in principle the investment incentive essentially functions the same way. Link to the regulatory methodology: https://www.energiavirasto.fi/en/web/energy-authority/regulation-methods-2016-2023.

13 In Finnish only: Matkalla kohti joustavaa ja asiakaskeskeistä sähköjärjestelmää – Älyverkkotyöryhmän väliraportti (http://julkaisut.valtioneuvosto.fi/handle/10024/80792).

14 Section 19, EMA.

The participants are financially compensated for their adjustment. The system was set up pursuant to the Act on Frequency Reserve to Balance Electricity Supply and Demand (117/2011, as amended, the "Reserve Act"). The participants are selected by way of a public tender process, organised by the TSO in the form of auctions, and the selected participants subsequently enter into a four-year agreement with the TSO[15]. The selection decision is made by the EA.

The Reserve Act determines the selection criteria for the generation and consumption capabilities that wish to participate. The selection criteria relate to the ability to adjust certain volumes of generation or consumption within a certain time. In a situation where supply and demand do not meet, the TSO will decide on when to order the resources part of the reserve to adjust in a manner that will balance the system[16]. The reserve is financed by collecting fees from users of the transmission network based on electricity consumption[17]. The fees are collected and retained by the TSO, and pursuant to the Reserve Act, the fees must cover the TSO's costs of administering the system as well as reasonable return[18].

Specific duties of the NRA aimed at aiming at safeguarding security of supply

As described in the Section above, the EA is responsible for selecting the participants of a public tender for a four-year contract to provide reserve of generators to adjust consumption in unexpected critical situations.

The Reserve Act provides for tasks to be carried out by the EA in relation to the frequency reserve. The primary task is to determine the size of the frequency reserve, which will then be procured from the market[19]. In addition, the EA determines e.g. the technical requirements for the participants in the reserve as well as the rules for how compensation of participants is determined[20].

Additionally, pursuant to Monitoring Act, the EA is required to monitor and publish a bi-annual report on security of supply in the electricity system[21].

2.2. Regulatory practice

2.2.1. Overview over regulatory practice in Finland

Main regulatory barriers

The NRF is, in general terms, adequate to support current innovation and security of supply in Finland. As to the project financing mechanism, a possible barrier is individualised in the fact that CAPEX intensive projects are preferred over OPEX-based solutions whose associated variation of costs over time in the face of uncertainty may affect the predictability of the TSO's revenue level.

As it pertains bolstering innovative technology, investments in smart grid related solutions may reduce investments in grid development infrastructure (e.g. transmission lines); accordingly, a reduction of the Regulates Asset Base (RAB) of the TSO is realised and a slight increase in tariffs may be produced.

2.2.2. Regulatory practice related to innovation

Innovative projects

As mentioned previously, focus was drawn to the fact that a revenue-cap/Rate-Of-Return based financing mechanism might lead to choosing capital intensive projects to the detriment of OPEX-based alternatives.

15 Section 4, Reserve Act.
16 Section 10, Reserve Act.
17 Section 12, Reserve Act.
18 Section 12, Reserve Act.
19 Section 4, Reserve Act.
20 Section 11, Reserve Act.
21 Section 8, Monitoring Act.

The current NRF is adequate in accommodating current types of innovative investments, despite doubts are posed to its applicability to innovative solutions of the future in which synergies between different member states' TSO may become pivotal in the development of smart-grid based solutions.

Moreover, life-time span of solutions mentioned in the NRA may become totally out of scale once compared to the time span of future solutions.

Finally, investing on very innovative solutions bears an inherent risk of implementing be-spoke solutions that may well be adequate nowadays but result in being non-compatible with the needs of the future grid. Accordingly, the TSO might bear the brunt of unusable, yet innovative, investments.

Adequacy of the NRF relating to its support for innovative investments

The NRF, despite it being able to shore up/embrace current solutions, may have to be revised to become more flexible and versatile to the benefit of foreseeable future investment needs in the electricity grid. For instance, these might include data management systems, data exchange platform for the development of spot markets, energy storage in different forms (Power-to-gas and electrochemical storage).

Possible improvement of the NRF

One suggestion for improvement was identified in the possibility of letting the TSO expand its options of investments, for instance, towards battery storage facilities; currently, although the TSO provides battery storage services, the ownership of battery storage facility is not allowed based to unbundling restrictions.

2.2.3. Regulatory practice related to security of supply

Security of supply projects

An example of a security of supply driven project, that shows how the regulatory regime works in practice, is the third 400 Kv AC interconnection project adding 30% capacity between the cross-board connection between the northern part of Finland and Sweden (PCI).

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

The current NRF is adequate to support security of supply projects.

Possible improvement of the NRF

No need for improvement came up during interviewing.

2.2.4. Illustrative specific projects

The following four projects are examples of innovation and security of supply projects and thus they illustrate how the regulatory framework works in practice.

The illustrative projects the TSO has embarked on are:

1. "Battery" related investments including battery devises ("Battery plans" investigated but not fully carried out);
2. Grid Overhead line tower enabling better lend utilization for the farmers (innovative infrastructure investment);
3. A third 400 Kv AC interconnection project adding 30% capacity between the cross-board connection between the northern part of Finland and Sweden(PCI); and
4. Investments to increase transmission capacity without building new physical transmission lines through the inclusion of control-type of devises (FACTS - Flexible Alternating Current Transmission System) in the grid.

Description and aim

The aims of the above-mentioned solutions are respectively to:

1. ameliorate the balancing of demand and supply (i.e. system adequacy) to offset electricity demand in critical situations;
2. improve lend utilization for the farmers (innovative infrastructure investment);
3. improve security of supply;

4. increase transmission capacity without building new physical transmission lines through the inclusion of control-type of devises (FACTS - Flexible Alternating Current Transmission System) in the grid to better utilise the existing transmission capacity (cost-effective on-going solutions have been since 10 years); this is an example where innovative solutions using “classic” electrotechnical technology applied in an innovative way are employed.

Approval process

The approval process each project went through did not offer any hindrance; conversely, the collaboration between the Energy Agency and the TSO streamlined the process and application of the NRF.

Possible improvement to the (approval) process for such projects)

No specific improvements have been addressed for each mentioned project.

2.3. Options for improvement

2.3.1. Options to improve regulatory practice

(i) Favouring OPEX based solutions

As described in Section 2.1.1, the financing mechanism is based on a regulatory methodology in which, instead of directly controlling prices, the EA performs an ex-post tariffs adjustment at the end of a four-year regulatory period on the basis of a calculation of reasonable yearly returns on the basis of the information provided by the network operator. Being the return estimated by applying the regulated asset value of the network to regulatory WACC, OPEX-based projects would provide a reduction of the Regulated asset base and a consequent reduction of the level of regulated return. Hence, such a financing mechanism may present the inherent drawback of favouring CAPEX intensive projects to OPEX based solutions (e.g. IT-solutions or smart metring technology).

A possibility, which might help favouring OPEX based investments, despite it being a partial-solution, would be to include TOTEX in calculating reasonable returns. Moreover, providing specific incentives for OPEX based investments may find its application for these kinds of investment, such as the inclusion of control-type of devises, which optimize the capacity of the existing transmission line without requiring investing in CAPEX new transmission line. By so doing, this solution is able to create efficacy gains for the electricity system.

2.3.2. National law mechanism(s) for implementing options

It is our understanding that the above mentioned changes could be implemented through an amendment to the regulatory methodology by the EA.

2.3.3. Impact assessment

By implementing the above-mentioned solution, the approval process of projects may result in being slightly more detailed and therefore delaying the approval time.

As to incentives to promote OPEX based projects, the risk of preferring CAPEX intensive solutions providing comparable solutions as their OPEX based counterparts could still be valid. Accordingly, a through process of project selection may add some burden on project approval when the TSO presents its investment plan to the EA and stockholders.

3. GAS

3.1. Legal analysis of the NRF in Finland

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

Finland applies Article 49 on isolated markets of Directive 2009/73/EC, and therefore the natural gas market is not yet wholly deregulated. However, legislative amendments are set to open up markets to competition.

Currently, the Finnish natural gas transmission network is physically isolated from the rest of the EU, and the only source of imports is through Russia[22]. In the beginning of 2018, new legislation entered into force (the Natural Gas Market Act (587/2017), which provides for opening up of the natural gas market to competition in 2020. This opening of the markets to competition is facilitated by the construction of Baltic Connector, an interconnecting line between Finland and Estonia, as well as through the construction of interconnection capacity between Lithuania and Poland, which is intended to connect the Finnish and Baltic networks to the rest of the EU. Already from the beginning of 2018, the Natural Gas Market Act introduced amendments such as steps towards deregulation of wholesale and retail sales of natural gas, and to a wide extent abolished pricing regulation. However, not until the beginning of 2020 will the wholesale market wholly open up to competition and the current wholesale monopolist and transmission network owner, state-owned Gasum Oy, will have its operations unbundled by way of ownership unbundling, and an independent TSO will begin operating.[23]

The Finnish natural gas network is quite limited in its coverage. The network is mainly concentrated to the south of the country. In 2016, only 6% of all consumed energy in Finland originated from natural gas and in recent years, the level of natural gas consumption has gone down.[24] In recent years, Gasum's investments have been aimed at developing bio gas plants as well as LNG terminals[25].

The primary pillars of legislations governing the Legal Framework for natural gas in Finland, as relevant for transmission network development, are the Natural Gas Market Act (587/2017) ("GMA") along with the Act on the Monitoring of the Electricity and Gas Markets (2013/590, as amended) ("Monitoring Act").

The duties and powers related to the natural gas market of EA are set out mainly in the Monitoring Act and to a more limited extent in the GMA.

The Monitoring Act sets out a licensing regime for the natural gas market, which is administered by the EA. Activities that require licensing, include transmission and distribution. The construction of cross-border interconnectors require a permit from the Ministry of Economic Affairs and Employment[26]. The EA grants licences, monitors compliance with the terms of the licences and engages in economic regulation through the regulation of reasonable return, as well as develops various initiatives, programmes and interventions to secure the achievement of its statutory objectives. The Government's role, through the Ministry of Economic Affairs and Employment is mainly limited to developing the natural gas market through legislative initiatives. The Government may also issue decrees in accordance with rules set out in the GMA and the Monitoring Act.

The regulatory responsibility within the natural gas sector is divided between three government agencies:

1 The Energy Authority ("EA") is the regulator for the natural gas market;
2 State-owned Gasum Oy is the owner and operator of the transmission network; and
3 The Government's role, through the Ministry of Economic Affairs and Employment is mainly limited to developing the natural gas market through legislative initiatives.

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22 In addition, there are LNG terminals under construction. However, most of these are not connected to the transmission network. There is also to a minor extent production of biogas as well.
23 Act on the Unbundling of the Natural Gas Market Transmission System Operator (588/2017).
24 http://pxhopea2.stat.fi/sahkoiset_julkaisut/energia2017/html/suom0000.htm.
25 See e.g. Gasum Financial Review 2017.
26 Section 10, Monitoring Act.

The Government's role, through the Ministry of Economic Affairs and Employment is mainly limited to developing the natural gas market through legislative initiatives.

Gasum

Gasum Oy is a state-owned company, owner and operator of the Finnish gas transmission network.

Pursuant to the GMA, the TSO has a general obligation to develop its network[27]. Specific duties are reported in Section 3.1.2.

The Energy Authority ("EA")

The Energy Authority ("EA") administers a licenced regime for the natural gas market, which is created by the Monitoring Act. Therefore, the EA grants licences and monitors compliance with the terms of the licences and engages in economic regulation through the regulation of reasonable return[28]. One of the EA's tasks is to adopt a regulatory methodology[29] whereby a "Rate of return" financing mechanism is operated. A description of the mechanism is described in the following Section.

A "Rate-of-return" financing scheme

The EA conducts an ex-post assessment of network operators[30]' regulated profits in accordance with a previously published regulatory methodology and determines whether regulated profits have been reasonable from the EA's perspective. Prices will then have to be adjusted accordingly during the subsequent regulatory period.

The EA adopts the regulatory methodology for calculating reasonable return for a period of eight years. Currently, the regulatory methodology in place covers the regulatory periods 2016-2019 and 2020-2023.[31] The EA calculates reasonable return for each year of the regulatory period based on information submitted by network operators. Reasonable return is calculated by applying the regulated asset value of the network to regulatory WACC and comparing to adjusted profit. At the end of the regulatory periods, the EA confirms reasonable return for each network operator and on the basis of this, the possible surplus / deficit in relation to reasonable return. Based on whether a network operator has incurred a surplus / deficit, the EA orders the network operator to lower its prices or allows it to increase its prices with an amount that corresponds to the surplus / deficit, over the following regulatory period. For purposes of calculating a network operator's realised adjusted profit, there are a number of incentives in place, which the network operator can benefit from. The incentives decrease the adjusted profit to be taken into account when comparing it to reasonable return. Among these incentives are the investment incentive and the innovation incentive.

Limited non-regulated activities

None.

3.1.2. Specific legal rights and duties

Role of the TSO

The general role, including applicable legal rights and duties, allocated to the TSO, as relevant for the development of the transmission network.

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27 Section 4, GMA.
28 Section 10, the Monitoring Act.
29 Section 10, Monitoring Act.
30 Including also networks with a lower voltage than 110 kV, which in practise means distribution networks.
31 https://www.energiavirasto.fi/en/web/energy-authority/regulation-methods-2016-2023. The EA has published an English-language version of the regulatory methodology on its website. However, the published version applies specifically to DSOs and not the TSO. Although the main principles are the same, all incentives in the DSO methodology are not applicable to the TSO, such as the security of supply incentive.

Transmission tasks

Gasum, as the Finnish TSO, is responsible for operation, maintenance, renewal and development of the transmission network. Pursuant to the GMA, the TSO has a general obligation to develop its network.[32] Pursuant to the GMA, the TSO must maintain, use and develop the network in a way that ensures gas supply of sufficient quality to network users. In addition, the GMA requires the TSO to construct sufficient transmission capacity to connect with the European network, if such transmission capacity is needed from an economic perspective in order to meet reasonable and technically feasible demand, and in order to ensure security of supply.[33]

3.1.3. Mechanism for financing of investment projects

The regulatory methodology for calculating reasonable return contains an investment incentive, which is aimed at encouraging maintenance and improvement of the network. However, there are no requirements on meeting performance standards. The investment incentive is calculated as the difference between regulatory depreciation and accounting depreciation. Regulatory depreciation is calculated as the annual straight-line depreciation of an asset's regulated value over its selected regulatory lifetime. As such, the investment incentive is not considered as an "incentive" per se, but rather as recovery of accelerated depreciation. The true incentive is the possibility to retain the benefit of outperforming regulatory unit prices[34]. The role of the EA in the financing mechanism has been outlined in Section 2.1.1.

3.1.4. Regulatory rules with respect to innovation

Specific duties of the TSO aimed at encouraging innovation

The GMA and the Monitoring Act do not contain any specific duties on the TSO aimed at encouraging innovation. However, the regulatory methodology for calculating reasonable return contains an innovation incentive. Pursuant to the regulatory methodology, the EA aims at encouraging research and development by allowing for the deduction of up to 1 % of R&D costs when calculating realised adjusted profits.

Costs included in the innovation incentive must be related to defined R&D projects that create new knowledge, technology, products or methods of operation in network operations, or to the planning work of such projects.

The results of projects for which costs have been accepted in the innovation incentive must be public so they can be used by the sector as a whole, with the exception of confidential customer information or results protected by industrial property rights.

Specific duties of the NRA aimed at encouraging innovation

The EA does not have any powers or duties specifically aimed at encouraging innovation. However, through the regulatory methodology for calculating reasonable return, the EA provides networks operators with an innovation incentive.

3.1.5. Regulatory rules with respect to security of supply

Specific duties of the TSO aiming at safeguarding security of supply

In addition to being under a general obligation to develop the network, in relation to security of supply, as described in Section 3.1.2, there are no additional duties or rights of the TSO in this respect.

Specific duties of the NRA aimed at aiming at safeguarding security of supply

Pursuant to the Monitoring Act, the EA is tasked with monitoring the development of supply and demand in natural gas, the quality of the network and their level of their maintenance as well as

[32] Section 4, GMA.
[33] Section 14, GMA.
[34] For a description of this incentive in English, please see the link to a translated version of the EA's regulatory methodology below. Please note that the linked regulatory methodology as a whole applies to DSO and not to the TSO. However, in principle the investment incentive essentially functions the same way. Link to the regulatory methodology: https://www.energiavirasto.fi/en/web/energy-authority/regulation-methods-2016-2023.

actions to meet peaks in demand and disruption in supply. To this end, the EA shall draft a bi-annual report on the security of supply that it must submit to the Ministry of Economic Affairs and Employment as well as the European Commission.[35]

3.2. Regulatory practice

3.2.1. Overview over regulatory practice in Finland

Main regulatory barriers

The NRF is, in general terms, adequate to support current innovation and security of supply in Finland. As to the project financing mechanism, a possible barrier is individualised in the fact that CAPEX intensive projects are preferred over OPEX-based solutions whose associated variation of costs over time in the face of uncertainty may affect the predictability of the TSO's revenue level.

As it pertains bolstering innovative technology, investments in smart grid related solutions may reduce investments in grid development infrastructure (e.g. transmission lines); a reduction of the Regulates Asset Base (RAB) of the TSO is hence realised and produces a slight increase in tariffs.

3.2.2. Regulatory practice related to innovation

Innovative projects

The focus was drawn to the fact that the financing mechanism might lead to choosing capital intensive projects to the detriment of OPEX-based alternatives.

Adequacy of the NRF relating to its support for innovative investments

The interviewees did not evaluate how adequate the current NRF is as to innovation during the interviews.

Possible improvement of the NRF

One suggestion for improvement was identified in the possibility of letting the TSO expand its options of investments, for instance, towards innovative gas-to-power infrastructure solutions.

3.2.3. Regulatory practice related to security of supply

Security of supply projects

The Baltic Connector project, connecting the natural gas grid of Finland and Estonia, is an example of a security of supply enhancing project. As such, it shows how the current regulatory regime can support security of supply enhancing projects.

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

The current NRF is deemed adequate to bolster security of supply of supply related projects.

Possible improvement of the NRF

The Finnish NRA is working on slightly modifying the financing methodology featuring a bias towards CAPEX to switch focus on TOTEX in the future.

3.2.4. Illustrative specific projects

In recent years, the natural gas grid has undergone little expansion. The most significant development project, which is regarded as innovative, and security of supply related is the Baltic Connector.

Balticconnector

The Balticconnector aims at interconnecting the Finnish and Estonian natural gas transmission networks with the view to improving the energy security of the Baltic-Finnish region.

[35] Section 8, Monitoring Act.

This infrastructure has a twofold function. From one hand, it ensures a more coherent and diverse natural gas transmission network in the Baltic Sea region; on the other, it will guarantee the security of natural gas supply for the north-eastern Member States of the EU.

Description and aim

The Baltic Connector pipeline project is a PCI project, which connects the Finnish and Estonian gas grids. Through diversification of gas sources, it contributes to the improvements of regional security of supply and enables the connection between the Finnish and Baltic gas markets.

As such, the Baltic Connector will end Finland's reliance on their single supply source from the east, and connect to the Baltic states that offer both gas storage at Inčukalns, Latvia at a LNG terminal in Klaipeda, Lithuania.

Financial mechanisms

In 2016, the project was recognised as PCI project and granted funding of EURO 187.5 million.

3.3. Options for improvement

3.3.1. Options to improve regulatory practice

(i) Favouring OPEX based solutions

The financing mechanism is based on a regulatory methodology in which, instead of directly controlling prices, the EA performs an ex-post tariffs adjustment at the end of a four-year regulatory period on the basis of a calculation of reasonable yearly returns on the basis of the information provided by the network operator. Being the return estimated by applying the regulated asset value of the network to regulatory WACC, OPEX-based projects would provide a reduction of the Regulated asset base and a consequent reduction of the level of regulated return. Hence, such a financing mechanism may present the inherent drawback of favouring CAPEX intensive projects to OPEX based solutions (e.g. IT-solutions or smart metring technology).

A possibility, which might help favouring OPEX based investments, despite it being a partial-solution, would be to include TOTEX in calculating reasonable returns. Moreover, providing specific incentives for OPEX based investments may find its application for these kinds of investment, optimize the system capacity of the grid without requiring investing in CAPEX-intensive gas pipeline development.

3.3.2. National law mechanism(s) for implementing options

It is our understanding that the above mentioned changes could be implemented through an amendment to the regulatory methodology by the EA.

3.3.3. Impact assessment

By implementing the above-mentioned solution, the approval process of projects may result in being slightly more detailed and therefore impact on approval time.

As to incentives to promote OPEX based projects, the risk of preferring CAPEX intensive solutions providing comparable solutions as their OPEX based counterparts could still be valid. Accordingly, a through process of project selection may add some burden on project approval when the TSO presents its investment plan to the EA and stockholders.

ANNEX I: TYPOLOGICAL INVESTMENTS – ELECTRICITY

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

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

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

ANNEX II: TYPOLOGICAL INVESTMENTS – GAS

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

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

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

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

ANNEX III: POTENTIAL REGULATORY BARRIERS FOR PROJECTS

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

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

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MJ-03-19-369-EN-N

Publications Office

doi: 10.2833/81042