



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

Country Report - Denmark



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

Country Report - Denmark

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## EXECUTIVE SUMMARY

### Assessment of the NRF and the regulatory practice of the electricity and gas sector in Denmark

#### The Danish electricity NRF

Energinet is the sole transmission system operator (TSO) in the national high-voltage grid (defined as 132kV or above) of Denmark. Energinet is solely owned by the Ministry of Energy, Utilities and Climate (the "Minister"), who decides on matters pertaining to Energinet, including electing the board of directors and approving extensions to the transmission network. The Danish Utility Regulator ("DUR") is the independent authority monitoring compliance with the regulations of the Electricity Supply Act. Finally, the Danish Energy Agency ("DEA") is the authority granting approvals and licences, and also monitoring compliance with licence terms.

Almost all of Energinet activities are regulated. The principle of "break-even", reflecting the point of balance making neither a profit nor a loss through tariffs and fees approved by DUR, governs the mechanism to invest in projects. However, the regulation of Energinet is currently under revision. As of May 2018, it was announced by the Danish Ministry of Energy, Utilities and Climate that the current break-even principle will be abandoned and replaced by a revenue cap regulation accompanied by efficiency goals.<sup>1</sup>

Extensions and investments in the transmission network are governed by the Electricity Supply Act as well as the Act on Energinet. As a rule, extensions of new transmission network are subject to approval by the Minister.

The costs of Energinet's statutory tasks are recouped in the form of electricity tariffs. The methods applied in calculating transmission charges and fees reflect the current "break-even" policy (break-even is the point of balance making neither a profit nor a loss). The DUR verifies and approves the methods employed to calculate the tariffs; making an ex-post adjustment of the fees for the following year in case of any discrepancy between the annual revenue and expenses.

Investments are considered a major driver for the development of the transmission tariff for electricity and drive development in the Regulatory Asset Base (and thus finance costs and returns) and depreciation. These are initially often financed through Danmarks Nationalbank.<sup>2</sup>

#### The Danish regulatory practice in the electricity sector

The NRF works well in general and stakeholders expressed their satisfaction with the system. Yet, a couple of potential barriers were mentioned by the stakeholders:

- Integration of coordination scheme in the NRA to harmonise innovative solutions encompassing both DSO and TSO level;
- The Ownership of energy assets making up an innovation solution may become an issue in the justification of project related costs;
- Local authority permitting rules are considered too strict to allow the installation of new transmission lines in the grid;
- Innovative solutions originated by coupling more activities may lead to some issues in the justification of some costs not directly related to the TSO's core business.

With respect to security of supply, the NRF is generally considered appropriate, with shortcomings related to flexibility and storage.

#### Options for improvement

The following options for improvement are considered:

- Include regional socio-economic benefits – and not only national benefits - in the regulation governing the TSO obligations;
- Incentivise third parties to provide these solutions;

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<sup>1</sup> <https://efkm.dk/aktuelt/nyheder/2018/maj/ny-aftale-om-fremtidssikret-energinet/>.

<sup>2</sup> Cf. section 14(2) of the Act on Energinet.

- Provide specific incentives for OPEX based solutions or include OPEX-related innovative options in network development plan as options to substitute for CAPEX investments; and
- Include innovative infrastructure projects in the TYNDP.

## **Assessment of the NRF and the regulatory practice of the Danish gas sector**

### **The Danish gas NRF**

Energinet is the sole transmission system operator (TSO) in the natural gas grid of Denmark. Energinet is solely owned by the Ministry of Energy, Utilities and Climate (the "Minister"), who decides on matters pertaining to Energinet, including electing the board of directors and approving extensions to the transmission network. The Danish Utility Regulator ("DUR") is the independent authority monitoring compliance with the regulations of the Natural Gas Supply Act. Finally, the Danish Energy Agency ("DEA") is the authority granting approvals and licences, and also monitoring compliance with licence terms.

Almost all of Energinet activities are regulated. The principle of "break-even", reflecting the point of balance making neither a profit nor a loss through tariffs and fees approved by DUR, governs the mechanism to invest in projects. However, the regulation of Energinet is currently under revision. As of May 2018, it was announced by the Danish Ministry of Energy, Utilities and Climate that the current break-even principle will be abandoned and replaced by a revenue cap regulation accompanied by efficiency goals.<sup>3</sup>

Extensions and investments in the transmission network are governed by the Natural Gas Supply Act as well as the Act on Energinet. As a rule, extensions of new transmission network are subject to approval by the Minister.

The costs of Energinet's statutory tasks are recouped in the form of gas tariffs. The methods applied in calculating transmission charges and fees reflect the "break-even" policy (break-even is the point of balance making neither a profit nor a loss). The DUR verifies and approves the methods employed to calculate the tariffs; ex-post adjustment of the fees for the following year in case of any discrepancy between the annual revenue and expenses.

Investments are considered a major driver for the development of the transmission tariff for gas and drive development in the Regulatory Asset Base (and thus finance costs and returns) and depreciation. These are initially often financed through Danmarks Nationalbank.<sup>4</sup>

Despite there being limited duties on the relevant authorities, including the DEA and the DUR, in the statutory framework to encourage innovation, the duty to innovate is likely implicit in the more general duties on the relevant authorities to ensure that they secure the efficient and economic execution of activities by licensees.

Regarding security of supply, the TSO's system task is to taking measures in respect of security of supply. The DUR's mechanisms for ensuring appropriate investment in the transmission network is also based on the rules set out in the Natural Gas Supply Act.

In addition to the approval of tariffs and fees, DUR also monitors the TSO's 10-year network development plans, and assesses the compatibility of the plans with the European Network Development Plans.

### **The Danish regulatory practice in the gas sector**

The NRF works well in general and stakeholders expressed their satisfaction with the system. The interviewees have mentioned the following general barriers in innovation:

- One barrier could be the price of CO<sub>2</sub> that is deemed too low by the TSO to support investment towards CO<sub>2</sub> reduction. In general, the NRF should support the TSO to act optimally;
- The NRA points out the risk of project failure or abandonment inherently characterizing innovative investments in the face of uncertainty. Being them associated with "green field" projects able to introduce new concepts or technology in the transmission system,

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<sup>3</sup> <https://efkm.dk/aktuelt/nyheder/2018/maj/ny-aftale-om-fremtidssikret-energinet/>.

<sup>4</sup> Cf. section 14(2) of the Act on Energinet.



the associated CAPEX and OPEX might lead to unexpected higher costs than what estimated in the feasibility study phase. This aspect might compromise and undermine the sustainability of innovative infrastructure projects.

With respect to security of supply, the NRF is generally considered appropriate, with shortcomings related to flexibility and storage.

### **Options for improvement**

The following options for improvement are considered:

- Include regional socio-economic benefits – and not only national benefits - in the regulation governing the TSO obligations;
- Incentivise third parties to provide these solutions;
- Provide specific incentives for OPEX based solutions or include OPEX-related innovative options in network development plan as options to substitute for CAPEX investments; and
- Include innovative infrastructure projects in the TYNDP.



## 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, 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 analysis. It is divided into two main sections, Section 2 which relates to electricity, and Section 3 which relates to gas. Each of these sections examines the legal framework (Section 2.1 for electricity and Section 3.1 for gas), including specific rights and duties of relevant parties, such as TSOs and NRAs (hereafter also referred to as stakeholders), mechanisms for the financing of investment projects and the regulatory rules regarding innovation and security of supply in particular. Having studied the legal regulatory framework, Section 2.2 for electricity and Section 3.2 for gas examine the regulatory practice in Denmark, 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 Denmark. Lastly, options for improvement of the regulatory practice and the regulatory framework are discussed in Section 2.3 for electricity and Section 3.3.3 for gas.

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

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

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

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

- i. by immediately reducing overall cost as compared to a conventional solution;
- ii. by prospectively reducing overall cost in the future, subject however to a “learning curve” as to the cost level of the innovative solution;

- iii. by accelerating the process of transmission capacity expansion and thus reducing social welfare loss caused by temporarily insufficient transmission capacities; or
- iv. by providing improvements with respect to other criteria that are often difficult to monetarise, like environmental or public acceptance aspects.

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

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

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

## 2. ELECTRICITY

### 2.1. Legal analysis of the NRF in Denmark

#### 2.1.1. Overview of the regulatory framework of Denmark – legal rules

##### The Electricity Supply Act

The Electricity Supply Act<sup>5</sup> is the primary legislation in relation to electricity. It lays down the overall framework for distribution network operators and for transmission system operations. The Electricity Supply Act is supplemented by the Act on Promotion of Renewable Energy.<sup>6</sup> The legal framework, implemented by the Electricity Supply Act, is derived from EU regulation, notably from the Gas and Electricity Directives supplemented by three regulations (the Third Energy Package).

The main objective of the Electricity Supply Act is to ensure that the planning and execution of national power production is carried out in consideration of security of supply, macroeconomics, environment, and consumer protection, including providing consumers with access to cheap electricity and supporting competition in electricity markets. Through the European Network for Transmission System Operators for Electricity (ENTSO-E), the Transmission System Operators (TSO) in Europe must work together to ensure the optimal management of EU networks given the cross-border nature of Europe's energy market.

The regulatory duties set out in the Electricity Supply Act are split between the Ministry of Energy, Utilities and Climate (the Minister) and the Danish Utility Regulator<sup>7</sup> (the DUR). The latter, being the independent authority, monitors compliance with the regulations of the Electricity Supply Act relating to pricing, consumer protection and certain other regulations, such as the unbundling obligations.

##### Energinet

Energinet is explicitly exempted from the licensing requirement, and there are therefore no licensed TSOs. Instead, Energinet – being a state-owned enterprise – is the national TSO pursuant to and governed by the Act on Energinet. Other than the licensing requirements for TSOs and distribution network operators, there are only few licensing requirements applicable to the Danish electricity industry; generators with a capacity in excess of 25 MW require a licence, and a number of separate permits are required for offshore wind turbines, but there are no licensing requirements in respect of e.g. electricity supply or trading. The Minister has extensive influence in relation to Energinet. For instance, the Minister “may decide any matters pertaining to Energinet” (excluding decisions in contradiction of written law or decisions, which would entail that, the Minister de facto assumes management of Energinet). The decisions are effected through the board of directors of Energinet. All members of Energinet's board of directors, except for employee representatives, are elected by the Minister.

##### Cost-based regulatory scheme

The principle of “break-even” reflecting the point of balance making neither a profit nor a loss (i.e. cost-based framework) governs Energinet's economic regulatory framework. The tariffs charged by the TSO operations, accordingly, must only include “necessary costs” and “necessary returns on invested capital”.<sup>8</sup> Such “necessary costs” include e.g. purchases of energy, maintenance costs, depreciations, interests, payroll expenses, etc., and “necessary returns on invested capital” exclusively include such costs as are necessary to allow Energinet to service its debts and to ensure that the real value of Energinet's assets are maintained.<sup>9</sup>

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<sup>5</sup> Consolidated Act No 1009 27 June 2018.

<sup>6</sup> Consolidated Act No 1009 27 June 2018.

<sup>7</sup> DUR was established by Act No 690 of 8 June 2018 with effect from 1 July 2018 to replace the Danish Energy Regulatory Authority. The tasks of DUR do, however, not differ significantly from those of the Danish Energy Regulatory Authority.

<sup>8</sup> Cf. section 71 of the Electricity Supply Act.

<sup>9</sup> Cf. sections 2-4 of Executive Order No. 816 of 27 June 2016.

However, the regulation of Energinet is currently under revision. As of May 2018, it was announced by the Danish Ministry of Energy, Utilities and Climate that the current break-even principle will be abandoned and replaced by a revenue cap regulation accompanied by efficiency goals.<sup>10</sup>

### **2.1.2. Specific legal rights and duties**

#### **Energinet**

Energinet owns and operates the transmission network in Denmark and is required to carry out its activities, which include, among others, the development of the transmission network in compliance with the Electricity Supply Act and the Act on Energinet. In order for Energinet to develop and maintain an efficient, co-ordinated and economical transmission system and to facilitate competition in supply of electricity, a set of general statutory duties are set out.<sup>11</sup> For instance, Energinet is under a duty to assess whether extension of the transmission network is needed.<sup>12</sup>

#### **Transmission tasks**

Energinet must complete plans for the future need for transmission capacity in the electricity supply system and transmission connections to other networks as well as ensuring the expansions of transmission networks in accordance with the plans. Extensions and investments in the transmission network are governed by the Electricity Supply Act as well as the Act on Energinet.<sup>13</sup>

As a rule, extensions of new transmission network are subject to approval by the Minister. Specific to the development of the transmission network, various conditions on the TSO apply.

These include the following:

- **Need for development:** The TSO shall maintain security of supply in Denmark and prepare plans for the future need for transmission capacity.<sup>14</sup> As a rule, extension and establishment of new transmission networks and significant changes in existing networks may only be initiated if there is a sufficient need for such expansion in terms of increased security of supply, emergency considerations, the creation of well-functioning competitive markets or the integration of renewable energy. If a project has “regional impact” across national borders, this must be included in the assessment of need for extension. The permit can only be granted if the applicant can establish the need for expansion;
- **Special conditions:** The permit may be subject to compliance with conditions regarding the establishment and operation of the project of the network, including security for abandonment of installations;<sup>15</sup>
- **Submission of development plan:** Extensions, including significant changes to existing transmission network and establishment of new transmission network, must be illustrated beforehand in a plan, which outlines the future need for transmission capacity. The plan must be submitted to the Minister before the extension. This enables the Minister to assess and decide whether the planned project requires approval.<sup>16</sup> Such extension may first commence six weeks after the submission of the plan if the Minister decides that the project does not require approval. If the Minister decides that the project does require approval, such extension may only commence after approval is received;
- **Approval and conditions:** The Minister may lay down conditions for approving extensions or significant changes to the transmission network. Such conditions must be in accordance with applicable legislation, notably the Electricity Supply Act and the Act on Energinet.

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<sup>10</sup> <https://efkm.dk/aktuelt/nyheder/2018/maj/ny-aftale-om-fremtidssikret-energinet/>.

<sup>11</sup> Cf. section 27 of the Electricity Supply Act.

<sup>12</sup> Cf. section 28 of the Electricity Supply Act.

<sup>13</sup> Cf. section 28(2) of the Electricity Supply Act and section 4 of the Act on Energinet.

<sup>14</sup> Cf. section 28(2) of the Electricity Supply Act.

<sup>15</sup> Cf. section 4(4) of the Act on Energinet.

<sup>16</sup> Cf. section 4(3) of the Act on Energinet.

### ***Security of supply specific duties***

The TSO shall ensure the quality of electricity supplied from the transmission grid and maintain security of supply in Denmark. The TSO must therefore cooperate with transmission companies in other countries for the efficient exchange of electricity as well as to ensure that there are sufficient quantities of electricity in the total electricity supply system, so that the physical balance of the grid can be maintained.<sup>17</sup>

Rules imposing specific duties aimed at safeguarding security of supply are laid down in Executive Order No 891 of 17 August 2011 on Systems Operator and Use of the Electricity Transmission Network and Executive Order No 1296 of 10 December 2014 on measures to maintain security of supply. For instance, Energinet has a duty to develop criteria for maintaining a reasonable degree of operational reliability in the transmission network, for adequate transmission reserve capacity and for the degree of predictability in which reliability of operations should be maintained.<sup>18</sup>

In the electricity industry, requirement for legal unbundling in relation to the parts of the value chain of monopolistic character derived from the EU Electricity Directives aimed at safeguarding security of supply, have been implemented in the Electricity Supply Act.<sup>19</sup> These requirements, which are measures designed to implement the requirements of the Third Energy Package<sup>20</sup>, are also supplemented by demands for managerial unbundling, notably to prevent conflicts of interest.<sup>21</sup>

### ***Duties aiming at encouraging innovation***

Laid down in the Electricity Supply Act, certain statutory duties aim at encouraging innovation. Energinet must ensure that research and development activities required for a future environmentally friendly and energy efficient transmission and distribution of electricity are carried out.<sup>22</sup> Energinet shall, furthermore, carry out tasks related to environmentally friendly electricity generation in accordance with Chapter 9 of the Act on the Promotion of Renewable Energy.

Specific duties aimed at encouraging innovation on Energinet are also fleshed out in Executive Order No 891 of 17 August 2011. For instance, Energinet shall ensure that electricity generation from decentralized power-heat production plants and power generation plants that produce renewable energy or use waste as fuel, in the event of network constraints, has priority access to the collective power supply network.<sup>23</sup>

### ***Undertaking of investments***

In general, the TSO is required to carry out any investment projects to deliver on their legal/regulatory duties as described above in the "Transmission tasks" section.

Models for tariffs and fees for using the extended transmission network are subject to approval by the Danish Utility Regulator (DUR) pursuant to the Electricity Supply Act. Such models are, however, not part of the statutory conditions regarding the investment itself; cf. above.

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<sup>17</sup> Cf. section 28 of the Electricity Supply Act.

<sup>18</sup> Cf. Section 9 of Executive Order No 891 of 17 August 2011 on Systems Operator and Use of the Electricity Transmission Network.

<sup>19</sup> Cf. section 19 of the Electricity Supply Act.

<sup>20</sup> Implemented by Act No 466 of 18 May 2011.

<sup>21</sup> Hence, executives and managers of a distribution undertaking must not directly or indirectly participate in the operation or management of an associated undertaking selling or producing electricity, or participate in such undertaking that owns such an undertaking. Said obligations equally apply to Energinet as TSO and its subsidiaries.

<sup>22</sup> Cf. section 28(2)(1) of the Electricity Supply Act.

<sup>23</sup> Cf. section 5(3) of Executive Order No 891 of 17 August 2011.

### **2.1.3. Mechanism for financing of investment projects**

#### **Tariffs**

Energinet's primary mechanism to ensure the financing of investments in the transmission network is ultimately through its tariffs and fees.<sup>24</sup> These are subject to approval by the DUR.<sup>25</sup> Hence, Energinet must report methods for calculating tariffs to the DUR. Specific rules on the methods for calculating tariffs are fleshed out in Executive Order No 1085 of 20 September 2010.<sup>26</sup>

#### **The "break-even" policy**

The methods applied in calculating transmission charges and fees reflect the "break-even" policy (Break-even is the point of balance making neither a profit nor a loss) subject to approval by the DEA.<sup>27</sup> Hence, any discrepancy between the annual revenue and expenses results in an adjustment of the fees and charges for the following year. The "break-even" policy sets out limits on what Energinet may charge for development and operation of the transmission network. However, the regulation of Energinet is currently under revision. As of May 2018, it was announced by the Danish Ministry of Energy, Utilities and Climate that the current break-even principle will be abandoned and replaced by a revenue cap regulation accompanied by efficiency goals.<sup>28</sup>

The methods applied by Energinet in calculating transmission tariffs and fees adhere to the same rules and regulations that apply to all EU TSO's.<sup>29</sup> As a rule, no specific statutory price controlled period applies; however, the DUR may condition the method to a specific time period and/or to be reviewed after a certain period of time in order to secure compliance with applicable regulation. Thus, the approved methods as such reflect the development of the tariffs and fees over time. The DUR consistently monitors the tariffs and fees.<sup>30</sup>

#### **Method decision**

Investments are initially often financed through Danmarks Nationalbank<sup>31</sup> and they are considered a major driver for the development of the transmission tariff for electricity. Investments drive development in the Regulatory Asset Base (and thus finance costs and returns) and depreciation. Thus, the use of such incentive regulation may increase the incentive to invest as such investments can increase the revenue base. However, the tariffs are still subject to approval by the DUR, with approval being based largely on socioeconomic principles. Hence, the approval will ensure that investments are effectively implemented and that investments are offset against alternatives. At the same time, the DUR must ensure that the corporate economic incentives reflect as much as possible the socioeconomic value. To calculate the socioeconomic value of a given investment, Energinet applies the Danish Ministry of Finance's general guidance notes (used by all public authorities in Denmark) in conjunction with Energinet's own annually-updated analysis assumptions.<sup>32</sup> The assessment of an investment case also entails an assessment of a "best alternative" to the given investments.

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<sup>24</sup> Cf. section 73 of the Electricity Supply Act.

<sup>25</sup> Cf. sections 73 a and 76 of the Electricity Supply Act.

<sup>26</sup> Also, specific reporting obligations are laid down in sections 5 and 6 of Executive Order No 823 of 27 June 2014 on Reporting in the Field of Electricity.

<sup>27</sup> See Executive Order No 816 of 27 June 2016 on the Economic Regulation on Energinet and Executive Order No 1085 of 20 September 2010 on Distribution Companies', Transmission Companies' and Energinet's Calculation of Tariffs and Fees.

<sup>28</sup> <https://efkm.dk/aktuelt/nyheder/2018/maj/ny-aftale-om-fremtidssikret-energinet/>.

<sup>29</sup> The methods must be based on reasonable, transparent, objective and non-discriminatory principles and the DUR may lay down conditions to ensure compliance with these principles and applicable regulation.

<sup>30</sup> Also, certain reporting obligations apply to Energinet in order to ensure the DUR insight in the calculation of the tariffs and fees based on the method, cf. section 5 of Executive Order No 823 of 27 June 2014 on Reporting in the Field of Electricity and section 11 of Executive Order No 816 of 27 June 2016 on the Economic Regulation on Energinet.

<sup>31</sup> Cf. section 14(2) of the Act on Energinet.

<sup>32</sup> Available in English at <https://en.energinet.dk/Analysis-and-Research/Analysis-assumptions/Analysis-assumptions-2017>.



#### **2.1.4. Regulatory rules with respect to innovation**

##### **Specific duties of the TSO aimed at encouraging innovation**

There are limited duties on the relevant authorities, including the DEA and the DUR, to encourage innovation in terms of the statutory framework, however the duty to encourage innovation is likely implicit in the more general duties on the relevant authorities to ensure that it secures the efficient and economic execution of activities by licensees. Political initiatives in favour of innovation will generally be carried out by or implemented by the DEA (at the request of the Minister) if the responsibilities are not placed with Energinet.

#### **2.1.5. Regulatory rules with respect to security of supply**

##### **Specific duties of the TSO aiming at safeguarding security of supply**

In general, the Minister is responsible for ensuring that Energinet and its wholly owned subsidiaries comply with the relevant electricity legislation, notably provision aimed at safeguarding security of supply. Hence, the Minister monitors the statutory obligations on the TSO. The supervision pursuant to the Electricity Supply Act has been delegated to the DEA and the DUR.

Also, the DEA's mechanisms for ensuring appropriate investment in the transmission network are based on the rules set out in the Electricity Supply Act and Act on Energinet. Accordingly, the DEA may (and usually will) include terms in power generation licences (i.e. licences for capacities in excess of 25 MW) stating that the DEA may require the generator to maintain a minimum level of production capacity in order to safeguard security of supply.<sup>33</sup> Further, and in light of the objectives of the Electricity Supply Act, the DEA may "under special circumstances" include specific terms under a licence, if the terms are a result of the specific licensee's circumstances. Also, Energinet and the DEA each year discuss the plans completed by Energinet to provide the basis for assessing current and future market conditions, security of supply, system operations, and for research and development activities that are necessary for future environmentally friendly and energy efficient transmission and distribution of electricity.<sup>34</sup>

The DUR's mechanisms for ensuring appropriate investment in the transmission network are also based on the rules set out in the Electricity Supply Act.

## **2.2. Regulatory practice**

### **2.2.1. Overview over regulatory practice in Denmark**

#### **Main regulatory barriers**

The interviewees deem that the NRF is, in general terms, adequate to support current innovation and security of supply in the Denmark. Limitations on how the current framework will be able to accommodate future innovative projects have been drawn attention to the need of a more flexible framework able to allow investments embracing solutions at DSO and TSO level.

The interviewees did not recognize any of the regulatory barriers mentioned in the questionnaire (see Annex III) as a regulatory barrier. However, on-going studies are led to individualise whether the current cost-plus economic regulation might hinder the TSO from investing in future innovative projects. The implementation on an (incentive-based) revenue-cap economic regulation is accordingly under scrutiny to potentially amend the current cost-based regime.

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<sup>33</sup> The generator must be provided with notice of at least one year prior to the requirement taking effect. The generator cannot shut down the generating asset without the prior approval of the DEA. In respect of TSOs licensees, the DEA may likewise include licence terms stating that the TSO must maintain a minimum level of transmission capacity. The provision is without practical effect as there are no TSO licensees in Denmark.

<sup>34</sup> Cf. sections 12 and 13 of Executive Order No 891 of 17 August 2011.

### **2.2.2. Regulatory practice related to innovation**

#### **Innovative projects**

Despite the framework being, in general, adequate to accommodate innovative investments, they mentioned the following barriers:

- Integration of coordination scheme in the NRA to harmonise innovative solutions encompassing both DSO and TSO level;
- Ownership of energy assets making up an innovation solution may become an issue in the justification of project related costs;
- Local authority permitting rules are considered too strict to allow the installation of new transmission lines in the grid;
- Innovative solutions originated by coupling more activities may lead to some issues in the justification of some costs not directly related to the TSO's core business.

#### **Possible improvement of the NRF**

The interviewees name the following improvements to the NRF:

- The framework should consider some synergy between TSO and DSO to facilitate investments at TSO level, which may cover market solutions at DSO level; such a problem was manifested in the smart metering roll-out project in Denmark.

There are examples of 'innovative' projects, which are being conducted or planned, that thus shows that current regulation and practice does not prevent innovative projects. The list of projects includes:

- "Kriegers Flak Offshore Wind Farm", a PCI project. the innovative aspect is the combination of interconnections and wind energy production;
- Smart metering roll-out project in Denmark that will be completed in two years;
- "Old-fashioned" solutions that change the way the TSO operates the system; for instance, "Synchronous condensers" which ensure the stability of energy delivery.

#### **Adequacy of the NRF relating to its support for innovative investments**

The interviewees deem the current NRF adequate to support innovation.

### **2.2.3. Regulatory practice related to security of supply**

#### **Security of supply projects**

Most projects undertaken has an element of security of supply.

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

Generally, the NRF is considered adequate in supporting security of supply investments.

### **2.2.4. Illustrative specific projects**

The following projects all illustrate how the regulatory regime works in practice, when it comes to projects enhancing the security of supply.

#### **Viking Link Project**

##### **Description and aim**

Viking Link is a proposal to build a high voltage direct current (DC) electricity interconnector, 770km long, between Bicker Fen in Lincolnshire, Great Britain and the substation Revsing in southern Jutland, Denmark.

The interconnector would enable more effective use of renewable energy, access to sustainable electricity generation and improved security of electricity supplies. Thus, it will benefit the UK consumer as well as the socio economy of both countries. The Viking Link is a PCI project, and promoted by Energinet and National Grid. As such, it enhances security of supply and hence illustrates how the regulatory practice works in practice.

## **Kriegers Flak Offshore Wind Farm**

### ***Description and aim***

Kriegers Flak Offshore Wind Farm is a combined wind farm connection and interconnector to Germany.

Energinet has been assigned the task of connection Denmark's largest offshore Wind Farm at Kriegers Flak in the Baltic Sea to the Danish power grid and the Danish sockets. The facility will transport the power from the offshore wind farm and into the high-voltage grid onshore.

Kriegers Flak plays an important role in Denmark's objective to become independent of fossil fuels. Kriegers Flak will be erected a few kilometers from the German offshore wind farm Baltic 2 in the Baltic Sea. Energinet and German 50Hertz Transmission will use this opportunity to connect the two wind farms; creating the world's first offshore power grid which combines wind energy with the possibility of exchanging power between the two countries. The combined grid solution is granted financial support from the EU.

The facility comprises:

- Two offshore transformer platforms;
- Two submarine cables, led onshore at Rødvig on Stevns;
- Land cable from Rødvig to Bjæverskov substation;
- Land cable from Bjæverskov to Ishøj substation;
- Land cable between Ishøj substation and Hovegård substation;
- Expansion of the existing substation in Bjæverskov;
- Rebuild of existing substations in Ishøj, Bjæverskov and Hovegård.

As such, this is an example of a novel approach to enhancing security of supply (and market integration), and shows how the regulatory setup works in practice.

## **2.3. Options for improvement**

### ***2.3.1. Options to improve regulatory practice***

The regulation on security of supply is adequate, and there are no shortcomings or regulatory barriers for security of supply.

We do not see any barriers from regulation with regards to incentives for investments in innovative projects. On the contrary, the regulation supports innovative projects, and there are statutory duties in the Electrical Supply Act and in the Act of Energinet on research and development activities, which may be related as encouragement for innovation. The cost-plus regulation in Denmark further supports risky and innovative investments, as the interviewees confirmed. Finally, the lack of penalties for late delivery is deemed as a "good practise" enabling a further level of improvement in the Danish NRA. The following options for solution to identified issues are proposed:

#### **(i) Include regional socio-economic benefits – and not only national benefits - in the regulation governing the TSO obligations**

Before making investments, the Danish TSO is obliged by law to put weight on socio-economic (and environmental) benefits to society, rather than merely on financial benefit for the TSO. Nevertheless, the socio-economic benefits in question are identified on a national level leaving out any cross-border benefits. This option may potentially be an improvement, when investments in Denmark would create gains for neighbouring countries. If this option was progressed, it would create incentives to invest in projects that benefit the wider society on a cross-border, regional basis, which is currently not considered.

#### **(ii) Provide specific incentives for OPEX based solutions or include OPEX-related innovative options in network development plan as options to substitute for CAPEX investments**

and

#### **(iii) Include innovative infrastructure projects in the TYNDP**

Large infrastructure projects are financed through the Danish State, so-called re-lending through the central bank of Denmark, Danmark Nationalbank. The interest rate is low, as the Danish state guarantees the loan. Hence, CAPEX intensive projects become (relatively) cheap to finance. This causes two problems: (i) The attractiveness of CAPEX intensive projects compared to OPEX intensive projects is increased; and (ii) since financing is relatively cheap, investments may increase leading to a potential increase in tariff level. It is thus not the regulation of the Danish TSO, the regulated revenue or the tariffing principles that cause the bias towards the CAPEX intensive projects; it is the financing of the projects. This may impact the level of investments in innovative OPEX heavy solutions, and can potentially lead to over-investment in CAPEX-intensive projects and result in high tariffs.

### **2.3.2. National law mechanism(s) for implementing options**

As far as option (i) ("Include regional socio-economic benefits – and not only national benefits - in the regulation governing the TSO obligations") is concerned, we expect that this could be implemented by clarifying how cross-border benefits pursuant to the Act on Energinet should be given weight in assessing the benefits to society. Reference is made to section 4(2) of the Act on Energinet. A clarification could be introduced, by following the formal procedure for passing amendments of acts under the Danish Constitution, providing an explicit statutory basis of how cross-border benefits should be determined. According to the Danish Constitution, a bill must be read three times in the Parliament (*Folketinget*) before it can be passed. The time that it will take to pass the bill is difficult to estimate. However, the Parliament has introduced a minimum 30-day period for reading bills. Another option would be for the Minister to condition approval of investments pursuant to sections 4(3) and 4(4) of the Act on Energinet, making it explicit how cross-border benefits should be met. Such conditions are set by the discretion of the Minister in compliance with applicable legislation, including the Act on Energinet. The latter option would not require an amendment to the existing legislation.

As regards options (ii) ("Provide specific incentives for OPEX based solutions") and (iii) ("Include innovative infrastructure projects in the TYNDP"), it is our understanding that the legal mechanism implementing these options would involve the amendment of Executive Order No 816 of 27 June 2016 on the Economic Regulation on Energinet, and possibly also the Electricity Supply Act. The Minister may, with legal basis in the existing Electricity Supply Act, issue a new Executive Order incentivising OPEX based solutions. However, more OPEX based radical solutions may require that the legal basis in the Electricity Supply Act is amended. Reference is made to the answer to option (i) above for the process of statutory amendments.

Some respondents have highlighted potential hurdles created by EU unbundling regime. Whether or not such hurdles are actually caused by the unbundling regime or not requires a careful analysis that falls outside the scope of this project. In the final report we point out that for some areas, a clarification of the boundaries of the activities that TSOs are allowed to undertake would be helpful. In other cases, the recently adopted Clean Energy Package (including e.g. the market test) provides a procedure to overcome such hurdles.

### **2.3.3. Impact assessment**

We have not encountered any specific examples of projects that have been cancelled due to the regulatory framework. It is also not clear to what extent potentially welfare enhancing projects have not been initiated due to inadequate incentives. For this reason, we do not expect that any of the suggested changes will result in considerable changes to investment levels.

### 3. GAS

#### 3.1. Legal analysis of the NRF in Denmark

##### 3.1.1. Overview of the regulatory framework of Denmark – legal rules

###### Natural Gas Supply Act

The Natural Gas Supply Act<sup>35</sup> forms the backbone of the Danish legislation regarding natural gas and lays down the legal framework for transmission of gas in Denmark. The legal framework broadly mirrors that of the framework for electricity. The Natural Gas Supply Act is supplemented by the Oil Pipeline Act<sup>36</sup> that applies to oil pipelines and related separation activities.<sup>37</sup>

The legal framework is derived from EU regulation, notably from the Gas and Electricity Directives supplemented by three regulations (the Third Energy Package).<sup>38</sup> Said regulation is mainly implemented by the Natural Gas Supply Act.

Also, due to the cross-border nature of Europe's energy market, the Transmission System Operators (TSO) in Europe must work together to ensure the optimal management of EU networks. Regarding natural gas, this is done through the European Network for Transmission System Operators for Gas (ENTSOG).

###### Energinet

Energinet is explicitly exempted from the licensing requirement, and there are therefore no licensed TSOs. Energinet is a state-owned enterprise, which owns, operates and develops the Danish transmission network for gas. Energinet is a member of ENTSOG and derives its primary duties, objectives and powers regarding transmission of natural gas from the Natural Gas Supply Act supplemented by the Act on Energinet.<sup>39</sup> Many of the primary duties, objectives and powers pursuant to the Natural Gas Supply Act mirror that of the framework for electricity set out in the Electricity Supply Act.<sup>40</sup> Accordingly, it is required to carry out its activities compliance with the Natural Gas Supply Act and the Act on Energinet.

Pursuant to the Natural Gas Supply Act, Energinet is responsible for the general security of supply in Denmark and must ensure market players access to the transmission system on objective, fair and transparent terms. Also, Energinet issues rules on gas transmission and coordinates the general planning of emergency supply for the natural gas sector. Also, Energinet carries out operational tasks related to the security of natural gas supply following the regulation of the European Parliament and of the Council on measures to safeguard security of natural gas supply.<sup>41</sup>

The Minister for Energy, Utilities and Climate (the Minister) has the overall responsibility regarding the Danish gas legislation. Part of the Minister's authority has been delegated to the Danish Energy Agency (the DEA).<sup>42</sup> Pursuant to the Act on Energinet, the Minister has the authority to approve the development and expansion of new transmission infrastructure.<sup>43</sup>

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<sup>35</sup> Consolidated Act No 1157 of 6 September 2016.

<sup>36</sup> Consolidated Act No 277 of 25 March 2014.

<sup>37</sup> Also, the Act on the Danish Continental Shelf (Consolidated Act No 1101 of 18 November 2005) applies to installations placed on the Danish continental shelf under certain circumstances (notably regarding environmental matters etc.).

<sup>38</sup> Electricity Directive (2009/72/EC) and Natural Gas Directive (2009/73/EC), Regulation (EC) No 714/2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003, Regulation on Conditions for Access to the Natural Gas Transmission Networks (715/2009/EC) and Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators.

<sup>39</sup> Consolidated Act No 147 of 20 February 2018.

<sup>40</sup> Consolidated Act No 114 of 9 February 2018.

<sup>41</sup> Cf. Executive Order No 962 of 27 September 2012.

<sup>42</sup> Cf. Executive Order No 1512 of 15 December 2017.

<sup>43</sup> Cf. Section 4 of the Act on Energinet.

The DEA is responsible for the entire chain of tasks linked to energy production and supply, transmission and consumption, including energy efficiency and savings. The DEA prepares, in cooperation with the Minister, the majority of the bills and other political proposals. Hence, the DEA issues licences for transmission, distribution and storage activities. Also, the DEA carries out analyses and forecasts of development in the energy sector. Even though the DEA has a central role in the regulation and continuing development of the legal framework, there is scope for direct intervention by the Minister. The Danish Utility Regulator<sup>44</sup> (the DUR) is the independent authority monitoring compliance with the regulations of the Natural Gas Supply Act relating to pricing, consumer protection and certain other regulations. The key tasks of the DUR are stipulated in the Act on DUR, the Electricity Supply Act, the Natural Gas Supply Act and the Heat Supply Act.<sup>45</sup> The DUR's main purpose is to ensure an efficient and transparent energy market in Denmark. Transmission, storage and distribution undertakings and supply-committed undertakings are under the supervision of the DUR.

In general, the abovementioned powers and duties on gas regulation also extend to pipelines connecting production facilities to land and onshore terminals.

### ***Cost-based regulatory scheme***

The principle of "break-even" reflecting the point of balance making neither a profit nor a loss (i.e. cost-based framework) governs Energinet's economic regulatory framework. The tariffs charged by the TSO operations, accordingly, must only include "necessary costs" and "necessary returns on invested capital". Such "necessary costs" include e.g. purchases of energy, maintenance costs, depreciations, interests, payroll expenses, etc., and "necessary returns on invested capital" exclusively include such costs as are necessary to allow Energinet to service its debts and to ensure that the real value of Energinet's assets are maintained.<sup>46</sup>

However, the regulation of Energinet is currently under revision. As of May 2018, it was announced by the Danish Ministry of Energy, Utilities and Climate that the current break-even principle will be abandoned and replaced by a revenue cap regulation accompanied by efficiency goals.<sup>47</sup>

### ***3.1.2. Specific legal rights and duties***

#### **Energinet**

Energinet handles oil pipelines and related separation activities (upstream activities) in compliance with the Oil Pipeline Act. The Natural Gas Act provides that TSOs are licensed by the DEA.<sup>48</sup> However, the only TSO currently operating in Denmark (for both electricity and gas), Energinet, is explicitly exempted from the licensing requirement, and there are therefore no licensed TSOs.<sup>49</sup>

#### ***Transmission tasks***

Energinet owns and operates the transmission network in Denmark and is required to carry out its activities, including the development of the transmissions network, in compliance with the Natural Gas Supply Act and the Act on Energinet.

There are general statutory duties on Energinet to develop and maintain an efficient, co-ordinated and economical transmission system and to facilitate competition in supply of gas.<sup>50</sup> For instance, Energinet is under a duty to assess whether extension of the transmission network is needed.<sup>51</sup>

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<sup>44</sup> DUR was established by Act No 690 of 8 June 2018 with effect from 1 July 2018 to replace the Danish Energy Regulatory Authority. The tasks of DUR do, however, not differ significantly from those of the Danish Energy Regulatory Authority.

<sup>45</sup> Consolidated Act No 523 of 22 May 2017.

<sup>46</sup> Cf. sections 2-4 of Executive Order No. 816 of 27 June 2016.

<sup>47</sup> <https://efkm.dk/aktuelt/nyheder/2018/maj/ny-aftale-om-fremtidssikret-energinet/>.

<sup>48</sup> Cf. section 10(1) of the Natural Gas Supply Act.

<sup>49</sup> Cf. section 10(1) of the Natural Gas Supply Act.

<sup>50</sup> Cf. section 12 of the Natural Gas Supply Act.

<sup>51</sup> Cf. section 12(1) (5) of the Natural Gas Supply Act and Executive Order No. 1034 of 4 November 2011.

Also, more specific rules are laid down in Executive Order No. 1034 of 4 November 2011 on the use of the natural gas supply grid and plans for the future need for gas transmission capacity. For instance, the TSO must implement a coherent, holistic planning that can provide the basis for assessing current and future market conditions and security of supply, as well as assessing the need for establishing new transmission networks as well as changing and eliminating existing transmission networks.<sup>52</sup> The planning must be completed with a time horizon of at least 10 years and can contain alternative development processes.<sup>53</sup> Energinet and the DEA discuss each year the more detailed content of said plans.<sup>54</sup> Energinet is also required to develop business plans regarding fees and tariffs to the DUR.<sup>55</sup>

Extensions and investments in the transmission network are governed by the Natural Gas Supply Act as well as the Act on Energinet.<sup>56</sup> As a rule, extensions of new transmission networks are subject to approval by the Minister.

There are various conditions on the TSO specific to development of the transmission network. That includes the following:

- Need for development: The TSO shall maintain security of supply in Denmark and prepare plans for the future need for transmission capacity.<sup>57</sup> As a rule, extension and establishment of new transmission networks and significant changes in existing networks may only be initiated if there is a sufficient need for such expansion in terms of increased security of supply, emergency considerations, the creation of well-functioning competition markets or the integration of renewable energy. If a project has “regional impact” across national borders, this must be included in the assessment of need for extension. The permit can only be granted if the applicant can establish the need for expansion;
- Special conditions: The permit may be subject to compliance with conditions regarding the establishment and operation of the project of the network, including security for abandonment of installations;<sup>58</sup>
- Submission of development plan: Extensions, including significant changes to existing transmission network and establishment of new transmission network, must be illustrated beforehand in a plan, which outlines the future need for transmission capacity. The plan must be submitted to the Minister before extension. That enables the Minister to assess whether the planned project requires approval.<sup>59</sup> Such extension may first commence six weeks after the submission of the plan if the Minister decides that the project does not require approval. If the Minister decides that the project does require approval, such extension may only commence after approval is received;
- Approval and conditions: The Minister may lay down conditions for approving extensions or significant changes to the transmission network. Such conditions must comply with applicable legislation, notably the Natural Gas Supply Act and the Act on Energinet.

Models for tariffs and fees for using the extended transmission network are subject to approval by the DUR pursuant to the Natural Gas Supply Act. Such models are, however, not part of the statutory conditions regarding the investment itself; cf. the description above.

### ***Security of supply specific duties***

The TSO shall ensure the quality of natural gas supplied from the transmission grid and maintain security of supply in Denmark. Also, the TSO must cooperate with transmission companies in other countries for the efficient exchange of natural gas as well as to ensure that there are sufficient quantities of natural gas in the total natural gas supply system, so that the physical balance of the grid can be maintained.<sup>60</sup>

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<sup>52</sup> Cf. section 7 of Executive Order No. 1034 of 4 November 2011.

<sup>53</sup> Cf. section 7 of Executive Order No. 1034 of 4 November 2011.

<sup>54</sup> Cf. section 8 of Executive Order No. 1034 of 4 November 2011.

<sup>55</sup> Cf. section 36 of the Natural Gas Supply Act.

<sup>56</sup> Cf. section 13 of the Natural Gas Supply Act and section 4 of the Act on Energinet.

<sup>57</sup> Cf. section 12(1)(5) of the Natural Gas Supply Act.

<sup>58</sup> Cf. section 4(4) of the Act on Energinet.

<sup>59</sup> Cf. section 4(3) of the Act on Energinet.

<sup>60</sup> Cf. section 12 of the Natural Gas Supply Act.

Specific rules fleshing out specific duties aimed at safeguarding security of supply are laid down in Regulation (EU) No 994/2010 concerning measures to safeguard security of gas supply and Council Directive 2004/67/EC, Executive Order No 962 of 27 September 2012 and Executive Order No. 1034 of 4 November 2011 on the use of the natural gas supply grid and plans for the future need for gas transmission capacity. For instance, Energinet has a duty to monitor the natural gas supply safety and to prepare and submit a security report to the DEA each year.<sup>61</sup> Also, Energinet must prepare for emergency situations.<sup>62</sup>

In the natural gas industry, there is a requirement for legal unbundling in relation to the parts of activities of monopolistic character derived from the EU Gas Directives aimed at safeguarding security of supply. These requirements have been implemented in the Natural Gas Supply Act.<sup>63</sup> Also, these requirements are supplemented by demands for managerial unbundling, notably to prevent conflicts of interest.<sup>64</sup> Said conditions are measures designed to implement requirements of the Third Energy Package.<sup>65</sup> The requirement for legal unbundling only applies to some extent to Energinet.

Further, the TSO will also have other roles in delivering/participating in mechanisms, which support security of supply objectives.

Duties, including those applicable to security of supply, are further described above.

#### ***Duties aiming at encouraging innovation***

Duties, including those applicable to innovation, may to some extent be reflected in conditions set out in the specific permissions pursuant to the Natural Gas Supply Act or pursuant to the Act on Energinet. Reference is made to the description above.

The Minister may decide that the TSO in cooperation with distribution companies must initiate research and development with a view to efficient energy use, environmental improvements and safety in natural gas use.<sup>66</sup> Also, specific duties are allocated on Energinet regarding the development of biogas.<sup>67</sup>

The TSO will also have role in delivering/participating in mechanisms, which support the development of innovation.

### ***3.1.3. Mechanism for financing of investment projects***

#### **Tariffs**

Energinet's primary mechanism to ensure the financing of investments in the transmission network is ultimately through tariffs and fees.<sup>68</sup> As tariffs and fees are subject to approval by the DUR.<sup>69</sup> Energinet must report methods for calculating tariffs to the DUR.<sup>70</sup> Also, certain reporting obligations apply to Energinet in order to ensure the DUR insight in the calculation of the tariffs and fees based on the method.<sup>71</sup>

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<sup>61</sup> Cf. section 4 of Executive Order No 962 of 27 September 2012.

<sup>62</sup> Cf. Section of Executive Order No 1025 of 21 August 2007.

<sup>63</sup> Cf. section 10 b and section 10 c of the Natural Gas Supply Act.

<sup>64</sup> Thus, executives and managers of a distribution undertaking must not directly or indirectly participate in the operation or management of an associated undertaking selling or producing natural gas, or participate in such undertaking that owns such an undertaking. Said obligations equally apply to Energinet as TSO and its subsidiaries.

<sup>65</sup> Implemented by Act No 466 of 18 May 2011.

<sup>66</sup> Cf. section 11(3) of the Natural Gas Supply Act.

<sup>67</sup> Cf. sections 35a-35c of the Natural Gas Supply Act. Hence, at the request of an owner of a biogas upgrading plant, Energinet must under certain circumstances connect the upgrading plant to the natural gas supply grid.

<sup>68</sup> Cf. section 37 d of the Natural Gas Supply Act.

<sup>69</sup> Cf. section 40 of the Natural Gas Supply Act.

<sup>70</sup> Cf. section 2 of Executive Order No 822 of 27 June 2014.

<sup>71</sup> Cf. see Executive Order No 816 of 27 June 2016 on the Economic Regulation on Energinet.

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### **The “break-even” policy**

The methods applied in calculating transmission charges and fees reflect the “break-even” policy (Break-even is the point of balance making neither a profit nor a loss) subject to approval by the DEA.<sup>72</sup> Hence, any discrepancy between the annual revenue and expenses results in an adjustment of the fees and charges for the following year. The “break-even” policy sets out limits on what Energinet may charge for development and operation of the transmission network. However, the regulation of Energinet is currently under revision. As of May 2018, it was announced by the Danish Ministry of Energy, Utilities and Climate that the current break-even principle will be abandoned and replaced by a revenue cap regulation accompanied by efficiency goals.<sup>73</sup>

The methods applied by Energinet in calculating transmission tariffs and fees adhere to the same rules and regulations that apply to all EU TSO's.<sup>74</sup> As a rule, no specific statutory price controlled period applies; however, the DUR may condition the method to a specific time period and/or to be reviewed after a certain period of time in order to secure compliance with applicable regulation. Thus, the approved methods as such reflect the development of the tariffs and fees over time. The DUR consistently monitors the tariffs and fees.<sup>75</sup>

### **Method decision**

Investments are initially often financed through Danmarks Nationalbank<sup>76</sup> and they are considered a major driver for the development of the transmission tariff for gas. Investments drive development in the Regulatory Asset Base (and thus finance costs and returns) and depreciation. Thus, the use of such incentive regulation may increase the incentive to invest as such investments can increase the revenue base. However, the tariffs are still subject to approval by the DUR, with approval being based largely on socioeconomic principles. Hence, the approval will ensure that investments are effectively implemented and that investments are offset against alternatives. At the same time, the DUR must ensure that the corporate economic incentives reflect as much as possible the socioeconomic value. To calculate the socioeconomic value of a given investment, Energinet applies the Danish Ministry of Finance's general guidance notes (used by all public authorities in Denmark) in conjunction with Energinet's own annually-updated analysis assumptions.<sup>77</sup> The assessment of an investment case also entails an assessment of a “best alternative” to the given investments.

### **3.1.4. Regulatory rules with respect to innovation**

#### **Specific duties of the TSO aimed at encouraging innovation**

There are limited duties on the relevant authorities, including the DEA and the DUR, to encourage innovation in terms of the statutory framework, however the duty to encourage innovation is likely implicit in the more general duties on the relevant authorities to ensure that it secures the efficient and economic execution of activities by licensees. Political initiatives in favour of innovation will generally be carried out by or implemented by the DEA (at the request of the Minister) if the responsibilities are not placed with Energinet.

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<sup>72</sup> See Executive Order No 816 of 27 June 2016 on the Economic Regulation on Energinet and Executive Order No 1085 of 20 September 2010 on Distribution Companies', Transmission Companies' and Energinet's Calculation of Tariffs and Fees.

<sup>73</sup> <https://efkm.dk/aktuelt/nyheder/2018/maj/ny-aftale-om-fremtidssikret-energinet/>.

<sup>74</sup> The methods must be based on reasonable, transparent, objective and non-discriminatory principles and the DUR may lay down conditions to ensure compliance with these principles and applicable regulation.

<sup>75</sup> Also, certain reporting obligations apply to Energinet in order to ensure the DUR insight in the calculation of the tariffs and fees based on the method, cf. section 5 of Executive Order No 823 of 27 June 2014 on Reporting in the Field of Electricity and section 11 of Executive Order No 816 of 27 June 2016 on the Economic Regulation on Energinet.

<sup>76</sup> Cf. section 14(2) of the Act on Energinet.

<sup>77</sup> Available in English at <https://en.energinet.dk/Analysis-and-Research/Analysis-assumptions/Analysis-assumptions-2017>.

### **3.1.5. Regulatory rules with respect to security of supply**

#### **Specific duties of the TSO aiming at safeguarding security of supply**

Various duties aimed at safeguarding security of supply rests with the relevant authorities, including the DEA and the DUR. Regarding duties imposed on the TSO, reference is made to the above.

In general, the Minister is responsible for ensuring that Energinet and its wholly owned subsidiaries comply with the relevant gas legislation, notably provisions aimed at safeguarding security of supply. Hence, the Minister monitors the statutory obligations on the TSO. The supervision pursuant to the Natural Gas Supply Act has been delegated to the DEA and the DUR. More specifically, the Minister may impose changes in security of supply on the TSO regarding the duties laid down in the Natural Gas Supply Act.<sup>78</sup>

Also, the DEA's mechanisms for ensuring appropriate investment in the transmission network are mainly based on the rules set out in the Natural Gas Supply Act and Act on Energinet. Accordingly, the Minister may decide that the TSO must initiate research and development with a view to efficient energy use, environmental improvements and safety in natural gas use.<sup>79</sup> The TSO must each year discuss with the DEA the more detailed content of plans regarding the current and future market conditions and security of supply and the need for establishing new transmission networks.<sup>80</sup> The TSO is required to complete such plans within a time horizon of 10 years.<sup>81</sup> The DEA may require that the plans contain or illuminate additional elements.

The DUR's mechanisms for ensuring appropriate investment in the transmission network is also based on the rules set out in the Natural Gas Supply Act. Apart from approval of tariffs and fees, the DUR also monitors the TSO's 10-year network development plans,<sup>82</sup> and assess the compatibility of the plans with the European Network Development Plans.<sup>83</sup> The assessment of the DUR may include recommendations for changes to the TSO's.

## **3.2. Regulatory practice**

### **3.2.1. Overview over regulatory practice in Denmark**

#### **Main regulatory barriers**

The interviewees deem that the NRF is, in general terms, adequate to support current innovation and security of supply in the Denmark. Limitations on how the current framework will be able to accommodate future innovative projects have been drawn attention to the need of a more flexible framework able to allow investments embracing solutions at DSO and TSO level.

The interviewees did not recognize any of the regulatory barriers mentioned in the questionnaire (see Annex III) as a regulatory barrier. However, ongoing studies are led to individualise whether the current cost-plus economic regulation might hinder the TSO from investing in future innovative projects. The implementation on an (incentive-based) revenue-cap economic regulation is accordingly under scrutiny to potentially amend the current cost-based regime.

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<sup>78</sup> Cf. section 12(3) of the Natural Gas Supply Act.

<sup>79</sup> Cf. section 11(3) of the Natural Gas Supply Act.

<sup>80</sup> Cf. section 8 of Executive Order No. 1034 of 4 November 2011 on the use of the natural gas supply grid and plans for the future need for gas transmission capacity.

<sup>81</sup> Cf. sections 7 and 11 of Executive Order No. 1034 of 4 November 2011.

<sup>82</sup> Cf. section 11 of Executive Order No. 1034 of 4 November 2011.

<sup>83</sup> Cf. article 8(3) b of Regulation (EC) No 1775/2005 of the European Parliament and of the Council of 28 September 2005 on conditions for access to the natural gas transmission networks.

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### **3.2.2. Regulatory practice related to innovation**

#### **Innovative projects**

The interviewees have mentioned the following general barriers in innovation:

- One barrier could be the price of CO<sub>2</sub> that is deemed too low by the TSO to support investment towards CO<sub>2</sub> reduction. In general, the NRF should support the TSO to act optimally;
- The NRA points out the risk of project failure or abandonment inherently characterizing innovative investments in the face of uncertainty. Being them associated with “green field” projects able to introduce new concepts or technology in the transmission system, the associated CAPEX and OPEX might lead to unexpected higher costs than what estimated in the feasibility study phase. This aspect might compromise and undermine the sustainability of innovative infrastructure projects.

#### **Possible improvement of the NRF**

The interviewees name the following improvements to the NRF:

- The framework should consider some synergy between TSO and DSO to facilitate investments at TSO level, which may cover market solutions at DSO level; such a problem was manifested in the smart metering roll-out project in Denmark.

There are examples of ‘innovative’ projects, which are being conducted or planned, that thus shows that current regulation and practice does not prevent innovative projects. The list of projects includes:

- Bionatural gas/Renewable gas sector bringing the production from decentralized locations to the high pressure grid;
- H<sub>2</sub>/natural gas projects;
- expansion of gas quality band to cope with Re gasses and business related projects as certification of bionatural gas;
- CNG filling stations;
- CNG production from Bio Gas.

#### **Adequacy of the NRF relating to its support for innovative investments**

The interviewees deem the current NRF adequate to support current innovation projects but need to accommodate of future innovative solutions.

### **3.2.3. Regulatory practice related to security of supply**

#### **Security of supply projects**

The overhaul of the Tyra platform in the North Sea, with no deliveries of gas from the North Sea as a result, is an N-1 incident. Hence, the security of supply situation has been carefully analysed and approved by Energinet, largely due to the doubling of capacity and reverse-flow enhancement of the Danish-German interconnector in 2013.

Most projects undertaken has an element of security of supply. An example of a project undertaken that successfully enhances security of supply and hence illustrates how the regulatory practice works in practice are the Baltic Pipe Project (a PCI project) as it i) introduces a new supplier (Norway), and ii) allows access to the LNG terminal in Świnoujście, Poland.

The Danish natural gas transmission grid is connected with (southern) Sweden. This is the only entry point to the Swedish natural gas transmission grid and Sweden is exempt from the N-1 criteria<sup>84</sup>. Hence, all security of supply enhancing projects is de-facto also increasing the security of supply of Sweden. Similarly, Sweden is exempt from the solidarity principle<sup>85</sup>.

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

Generally, the NRF is considered adequate in supporting security of supply investments.

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<sup>84</sup> EU Regulation No 994/2010, article 6(10).

<sup>85</sup> EU Regulation 2017/1938, article 5(9).

#### **3.2.4. Illustrative specific projects**

The following projects all illustrate how the regulatory regime works in practice, when it comes to projects enhancing the security of supply.

##### **Baltic Pipe Project**

The Baltic Pipe Project is a strategic gas infrastructure project with the goal of creating a new gas supply corridor in the European market. The Baltic Pipe Project will allow transport of gas from Norway to the Danish and Polish markets, as well as to end-users in neighbouring countries. At the same time, the Baltic Pipe Project will enable the supply of gas from Poland to the Danish and Swedish markets. Hence, the project allows Denmark and Sweden access to the LNG market via the Polish LNG terminal in Świnoujście.

The project is being developed in collaboration between the Danish gas and electricity transmission system operator Energinet and the Polish gas transmission system operator GAZ-SYSTEM.

The Baltic Pipe Project illustrates how the regulatory practice works in practice when it comes to projects that enhances security of supply.

### **3.3. Options for improvement**

#### **3.3.1. Options to improve regulatory practice**

The regulation on security of supply is adequate, and there are no shortcomings or regulatory barriers for security of supply.

We do not see any barriers from regulation with regards to incentives for investments in innovative projects. On the contrary, the regulation supports innovative projects, and there are statutory duties in the Natural Gas Supply Act and in the Act of Energinet on research and development activities, which may be related as encouragement for innovation. The cost-plus regulation in Denmark further supports risky and innovative investments, as the interviewees confirmed. Finally, the lack of penalties for late delivery is deemed as a “good practise” enabling a further level of improvement in the Danish NRA. The following options for solution to identified issues are proposed:

##### **(i) Include regional socio-economic benefits – and not only national benefits - in the regulation governing the TSO obligations**

Before making investments, the Danish TSO is obliged by law to put weight on socio-economic (and environmental) benefits to society, rather than merely on financial benefit for the TSO. Nevertheless, the socio-economic benefits in question are identified on a national level leaving out any cross-border benefits. This option may potentially be an improvement, when investments in Denmark would create gains for neighbouring countries. If this option was progressed, it would create incentives to invest in projects that benefit the wider society on a cross-border, regional basis, which is currently not considered.

##### **(ii) Provide specific incentives for OPEX based solutions or include OPEX-related innovative options in network development plan as options to substitute for CAPEX investments**

and

##### **(iii) Include innovative infrastructure projects in the TYNDP**

Large infrastructure projects are financed through the Danish State, so-called re-lending through the central bank of Denmark, Danmark Nationalbank. The interest rate is low, as the Danish state guarantees the loan. Hence, CAPEX intensive projects become (relatively) cheap to finance. This causes two problems: (i) The attractiveness of CAPEX intensive projects compared to OPEX intensive projects is increased; and (ii) since financing is relatively cheap, investments may increase leading to a potential increase in tariff level. It is thus not the regulation of the Danish TSO, the regulated revenue or the tariffing principles that cause the bias towards the CAPEX intensive projects; it is the financing of the projects. This may impact the level of investments in innovative OPEX heavy solutions, and can potentially lead to over-investment in CAPEX-intensive projects and result in high tariffs.

### **3.3.2. National law mechanism(s) for implementing options**

As far as option (i) ("Include regional socio-economic benefits – and not only national benefits – in the regulation governing the TSO obligations") is concerned, we expect that this could be implemented by clarifying how cross-border benefits pursuant to the Act on Energinet should be given weight in assessing the benefits to society. Reference is made to section 4(2) of the Act on Energinet. A clarification could be introduced, by following the formal procedure for passing amendments of acts under the Danish Constitution, providing an explicit statutory basis of how cross-border benefits should be determined. According to the Danish Constitution, a bill must be read three times in the Parliament (*Folketinget*) before it can be passed. The time that it will take to pass the bill is difficult to estimate. However, the Parliament has introduced a minimum 30-day period for reading bills. Another option would be for the Minister to condition approval of investments pursuant to sections 4(3) and 4(4) of the Act on Energinet, making it explicit how cross-border benefits should be met. Such conditions are set by the discretion of the Minister in compliance with applicable legislation, including the Act on Energinet. The latter option would not require an amendment to the existing legislation.

As regards options (ii) ("Provide specific incentives for OPEX based solutions") and (iii) ("Include innovative infrastructure projects in the TYNDP"), it is our understanding that the legal mechanism implementing these options would involve the amendment of Executive Order No 816 of 27 June 2016 on the Economic Regulation on Energinet, and possibly also the Natural Gas Supply Act. Reference is made to section 37 d of the Natural Gas Supply Act. The Minister may, with legal basis in the existing Natural Gas Supply Act, issue a new Executive Order incentivising OPEX based solutions. However, more radical OPEX based solutions may require that the legal basis in the Natural Gas Supply Act is amended. Reference is made to the answer to option (i) above for the process of statutory amendments.

Some respondents have highlighted potential hurdles created by EU unbundling regime. Whether or not such hurdles are actually caused by the unbundling regime or not requires a careful analysis that falls outside the scope of this project. In the final report we point out that for some areas, a clarification of the boundaries of the activities that TSOs are allowed to undertake would be helpful. In other cases, the recently adopted Clean Energy Package (including e.g. the market test) provides a procedure to overcome such hurdles.

### **3.3.3. Impact assessment**

We have not encountered any specific examples of projects that have been cancelled due to the regulatory framework. It is also not clear to what extent potentially welfare enhancing projects have not been initiated due to inadequate incentives. For this reason we do not expect that any of the suggested changes will result in considerable changes to investment levels.



## 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  | <ul style="list-style-type: none"> <li>• New HVDC lines (→allow to control the power flow; less expansive for long distance transport; undergrounding less complex);</li> <li>• Replacement of HVAC by HVDC lines (→less complex and less expensive; more compact design);</li> <li>• Underground cables or GIL (→ more expensive than OHL but can help improving public acceptance and accelerate the authorisation process);</li> <li>• Design of overhead line poles (→can help improving public acceptance and accelerate the authorisation process);</li> <li>• 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).</li> </ul> |
| 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.  | <ul style="list-style-type: none"> <li>• Phase-shifting transformers;</li> <li>• Semiconductor-based FACTS elements (including HVDC converters).</li> </ul>   |
| Investment into components contributing to ancillary services provision (reactive power / voltage control, short-circuit power, momentary power reserves and black-start capability) | <ul style="list-style-type: none"> <li>• Purely phase-shifting generators (→offer operational flexibility and can serve to improve cost efficiency);</li> <li>• FACTS elements (→ see above).</li> </ul>  |
| New or extended power system control and automation technology with the aim to lower the risk of disturbances threatening security of supply   | <ul style="list-style-type: none"> <li>• Improvements in observability and controllability based on conventional sensor and actor devices;</li> <li>• Wide-area measurement systems (aiming at synchronously measuring power phasor angles at the grid nodes to improve observability);</li> <li>• Real-time dynamic security assessment tools (aiming at observing stability phenomena beyond static voltage/current measurements).</li> </ul>   |

| 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 | <ul style="list-style-type: none"><li>• Generation-side flexibilities (especially renewables);</li><li>• Demand-side flexibilities (DSM/DR);</li><li>• Storage components; and</li><li>• Technologies coupling the electricity sector with other sectors (gas, heat, traffic).</li></ul> |



## 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.   | <ul style="list-style-type: none"><li>• (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);</li><li>• Increase withdrawal and injection capacity in storages by incentivising investments supporting flexibility (support of gas market liquidity and security of supply level);</li><li>• Allowance of higher pressure in selected pipeline/routes (increase of flexibility of the supply side).</li></ul> |
| Incentivise and facilitate upgrade of biogas to the transmission system.  | <ul style="list-style-type: none"><li>• Investments in upgrade of biogas to transmission system (support of gas market liquidity and security of supply).</li></ul>   |
| Digitalisation of operations, through e.g. drone inspections and artificial intelligence (AI), resulting in a safer and cost-efficient operation. | <ul style="list-style-type: none"><li>• 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).</li></ul>   |
| In order to support security of supply and add liquidity to the gas market, there is a need to build interconnectors in Europe.                   | <ul style="list-style-type: none"><li>• 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);</li><li>• Enhancement of available gas supply in situation of supply crisis;</li><li>• possibility of arbitrage a price convergence between markets to support the development of the internal market.</li></ul>  |



### 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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