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

Country Report - The Netherlands

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The Dutch NRF and regulatory practices for electricity and gas have many similarities, for this reason in this summary no distinction is made between electricity and gas.

The Dutch NRF

The Dutch NRF constitutes an incentive-based regulatory regime. The TSO (TenneT for electricity and GTS for gas) is required to carry out investment projects needed to fulfil its statutory tasks. Transmission tasks are remunerated based on *ex ante* revenue cap regulation. TenneT may however, receive a direct subsidy for the offshore electricity grid.

Although there is no clear statutory duty to innovate, one could argue that there is a general implied duty to innovate. The TSO has the obligation to develop the transmission system in an economic, efficient and reliable manner which encourages the TSO to innovate. Regarding security of supply, the TSO's system task is to ensure reliability of the grid and take measures in respect of security of supply.

The Dutch regulatory practice

In general, the Dutch NRA displays a strong emphasis on reduction of the cost per unit of output generated (TOTEX regulation). The NRA does not assess specific investments, with the exception of projects that qualify for remuneration during a regulatory period, but benchmarks total costs.

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:

- Benchmarking creates (regulatory) uncertainty for (innovative) investments;
- Despite the TOTEX regulation, there can be a CAPEX bias, discouraging OPEX solutions;
- OPEX remuneration is based on historical costs, which does not account for recent OPEX cost developments;
- Projects resulting in higher TSO CAPEX with wider societal benefits are not incentivised.

Note that there is no consensus on the existence of CAPEX bias and its impact on investment decisions. The stakeholders remark that the regulation focuses on effectiveness and efficiency and that there are no provisions in the regulation explicitly facilitating innovation. The NRF hence provides incentives for innovations resulting in cost per unit of output reductions, but not necessarily for innovations resulting in societal benefits coupled with higher costs.

Options for improvement

The following options for improvement could be considered:

- Assessment of investment framework in investment plan;
- Forward-looking modelling of costs (as an input for the revenue cap);
- Statutory requirement to consider alternatives; and
- Statutory requirement to 'ear-mark' a budget for innovative investments.

The statutory requirement to consider alternative options and a statutory 'ear-marking' requirement for innovative investments would each likely necessitate a legal change. The improvement options could potentially reduce the regulatory barriers mentioned above but would likely not result in a substantial increase in investments. Note that the options also have drawbacks, such as a potential increase in the administrative burden for TSOs and the NRA and higher network tariffs. These need to be considered when further developing and fine-tuning the options.

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 the Netherlands, drawing specifically on stakeholder interviews, and paying particular attention to the regulatory practice related to innovation and security of supply. The functioning of the legal framework and the regulatory practice are illustrated by selected specific projects in the Netherlands. Lastly, options for improvement of the regulatory practice and the regulatory framework are discussed in Section 2.3 for electricity and Section 3.3 for gas.

These options for improvement are taken from a long list of best practises that the project team has compiled based on the analysis of regulatory frameworks in all Member States. We acknowledge that we 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.:

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

2. by prospectively reducing overall cost in the future, subject however to a “learning curve” as to the cost level of the innovative solution;
3. by accelerating the process of transmission capacity expansion and thus reducing social welfare loss caused by temporarily insufficient transmission capacities; or
4. 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 the Netherlands

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

The Electricity Act 1998

The Electricity Act 1998 (the "1998 Act", which has been amended several times) is the central piece of primary legislation governing the legal framework for electricity in the Netherlands. In addition, detailed regulations are provided for in delegated legislation and in energy codes determined by the Authority for Consumers & Markets (the "ACM").[1] The energy codes for electricity (including the Grid Code for Electricity (*Netcode elektriciteit),* the Measuring Code for Electricity (*Meetcode electriciteit*) and the System Code for Electricity (*Systeemcode elektriciteit*)) put detailed and practical rules and procedures in place to ensure the security of the electricity supply. Together, these rules and regulations provide clarity on the tasks and responsibilities of all parties involved in the transmission of electricity.

Key participants in the electricity market

TenneT TSO BV ("TenneT") is the sole transmission system operator (TSO) of the national high-voltage grid in the Netherlands. TenneT has also officially been appointed as the offshore grid operator in the Netherlands. The ACM, which is responsible for the regulation of the TSO (as well as the distribution system operators ("DSOs") of the electricity networks) in the Netherlands, derives its primary duties, objectives and powers from the 1998 Act. This includes the task of supervising compliance with the EU legal framework on electricity. Finally, in addition to the ACM, the Dutch Minister of Economic Affairs ("MEA") has various duties and objectives derived from the legal framework for electricity in the Netherlands.

Incentive-based regulatory scheme

Virtually all of TenneT's activities are regulated; the revenues of TenneT are subject to *ex ante*, and to some extent: *ex post*, regulation by the ACM. The Dutch legal framework for electricity aims to create an incentive-based regulatory scheme with four distinct goals:
(1) to provide TSOs with an incentive to operate in an efficient manner. The main principle: revenue cap/price cap based on exogenous efficient cost level;
(2) to prevent system operators from charging tariffs above the (efficient) cost level. The ACM's incentive scheme aims to ensure this by setting the revenue or price cap at the level of efficient costs, and by basing the allowed returns on the returns investors can reasonably expect from comparable companies in the financial markets;
(3) to allow network operators an appropriate return on investments. In order to ensure the safety and security of the network, the TSO has to invest in its network. It needs capital to do so. The TSO should receive an appropriate return on its investment, so it can compensate its providers of capital; and
(4) to encourage optimal quality of transmission.

Limited non-regulated activities

TenneT is also involved in certain limited non-regulated activities, some of which are directly or indirectly relevant for the transmission network development: TenneT holds a 50% interest in BritNed, a merchant cable operator that manages the electricity interconnector between the Netherlands and Great Britain. Moreover, it holds a 100% interest in TenneT Green B.V., NOVEC B.V. and Relined B.V. TenneT also (indirectly) holds a 17% share in EPEX Spot SE (EPEX), the NWE (including Great Britain) electricity exchange.

Recent amendment of the Electricity Act

A proposal for revision of both the 1998 Act and the Gas Act 2000 (the "2000 Act") was prepared and submitted to Parliament. The proposal, named "Stroom", was to merge the 1998 Act and the 2000 Act, bringing the new 'Electricity and Gas Act' more in line with EU energy Regulation and to revise the tariff regulation and requirements for network operators. However,

[1] See for the most recent codes: <https://www.acm.nl/nl/onderwerpen/energie/de-energiemarkt/codes-energie/actuele-codes-energie>.

the First Chamber (*Eerste Kamer*) of the Dutch Parliament rejected the draft Act. The rejected Act also provided a legal framework for the transmission system for offshore wind energy and created a basis for compensation of damages caused by the late completion or unavailability of the offshore grid. To avoid a delay in the development of offshore wind farms, the MEA promptly submitted a new Act: 'Amendment of the Electricity Act 1998 (timely realization objectives Energy Agreement' (*Wet tot wijziging van de Elektriciteitswet 1998 (tijdig realiseren doelstellingen Energieakkoord)*). This Act came into force on 1 April 2016.[2]

On 26 April 2018, a new 'Amendment of the Electricity Act 1998 and the Gas Act *(progress energy transition)' (Wet van 9 april 2018 tot wijziging van de Electriciteitswet 1998 en van de Gaswet (voortgang energietransitie))* was adopted. Primarily focussing on energy transition, this amendment stipulates, inter alia, the following changes to the 1998 Act:

- It extends the possibility of deviating from the provisions under or pursuant to the 1998 Act by way of an experiment to all relevant aspects concerning renewable energy, energy savings, reduction of CO2 emissions, efficient use of the network, new market models, and tariff regulation;
- Updated rules on the activities the '*netwerkbedrijf*' (the group of which the TSO is part) is allowed to carry out. The core of the delineation is that activities should be limited to infrastructure activities related to the management of electricity (or gas) transmission networks;
- Additional legal flexibility regarding the requirements on redundancy;
- Replacing the current periodical quality and capacity document (*kwaliteits- en capaciteitsdocument,* or "KCD") with a periodical investment plan (*investeringsplan*). Background: the energy transition is expected to result in a sharp increase in the supply of electricity from renewable resources and an increasing supply of locally produced energy. As a result, the supply of energy will become less predictable (e.g. peaks in production in the event of a lot of wind). Questions arise concerning what investments are needed to absorb the peaks and troughs in the production of renewable energy in the grid. The expectation of the Dutch legislator is that the TSO will have to make large investments upgrading its grid in the upcoming years to accommodate these developments in the energy market. The 1998 Act in its current form requires that investments are reviewed on the basis of a periodical KCD. With the current amendment, the KCD is replaced by an investment plan. In this investment plan, all expansion investments and replacement investments have to be set out in detail. From this, it should become clear what developments the TSO foresees, how they will be dealt with, and what financial investments are necessary in light thereof. The TSO must consult stakeholders and indicate how the input from consultations has been processed in the investment plan. The plan is then submitted to the ACM for review. The core of the review is whether the TSO could reasonably have realized such a plan and whether – in case of uncertain developments – account was taken of different scenarios in a sensible way. This assessment may result in the ACM requesting one or more changes to the plan and ultimately to a binding instruction or binding ACM policy to the TSO. To the extent that the costs of such investments are deemed efficient, investments following from the investment plan, in which the consultation responses have been taken into account and any instructions from the ACM or the MEA have been followed, are deemed necessary and, on the basis of this, TSOs can charge these to the customers though the tariffs. A separate provision has been included with regard to investments in areas designated in the onshore wind energy structure vision (*structuurvisie*). TSOs are explicitly given the task of making plans for investments in those areas. TSOs are required to collaborate with the developers of wind farms and the municipalities and provinces involved.

2.1.2. Specific legal rights and duties

Role of the TSO

The Dutch national electricity high-voltage grid includes the grid of 110kV and higher and the cross-border interconnections with alternating current.[3] TenneT is currently certified as TSO for the Dutch national (extra) high voltage grid and as interconnector operator for the southern part of the NorNed Cable. In addition, TenneT TSO NL has been certified and appointed as the

[2] *Wijziging van de Elektriciteitswet 1998 (tijdig realiseren doelstellingen Energieakkoord*) ('Amendment of the Electricity Act 1998 (timely realization objectives Energy Agreement')).

[3] Section 10(1) EA. The cross-border networks with alternating current comprise two connections to the extra high-voltage grid in Belgium and three connections to the extra high-voltage grid in Germany.

sole offshore grid operator in the Netherlands. In this role TenneT has a number of exclusive, statutory tasks, including the obligation to construct, repair, and extend the national high-voltage grid.

Transmission tasks ('transporttaken')

The 1998 Act imposes a number of general transmission tasks on both DSO's and TenneT (for the national high voltage grid). *Inter alia* the following tasks are directly or indirectly relevant to transmission network development:

- To operate and maintain the existing network;[4]
- To ensure the safety and reliability of the networks and the transmission of electricity over the networks in the most efficient way;[5]
- To construct, repair, renew, or expand the networks, taking into consideration measures in the field of sustainable electricity, energy saving and demand management or decentralised electricity production, which can avoid the need for replacement or expansion of production capacity;[6]
- To maintain sufficient spare capacity for electricity transmission;[7]
- To realize links with other networks and to carry out repairs to its network;[8]
- To publish data in an appropriate manner on links between the networks, use of the networks and the allocation of transmission capacity;[9]
- To protect the grid from possible external influences;[10]
- To measure the amount of electricity coming from a production plant for renewable electricity or climate-neutral electricity or from a high-efficiency cogeneration plant.[11]

System task of TenneT ('systeemtaken')

As the national TSO, TenneT has the *additional* responsibility for the 'system task' including balancing the grid, ensuring the reliability of the grid, and taking measures in respect of security of supply:

- To make the necessary technical arrangements and to carry out system services, including the maintenance of sufficient production reserve capacity; necessary to ensure the safe and efficient transmission of electricity over all networks;[12]
- The transmission of electricity through the national high-voltage grid, either for the export of such electricity from the Netherlands to a buyer or supplier abroad, or for the import of such electricity from abroad to a buyer or supplier in the Netherlands;[13]
- To establish and maintain an appropriate level of facilities, including the maintenance of sufficient production reserve capacity, in relation to security of supply in the short and long term.[14] Among the TSO's tasks concerning the reserve for electricity transmission is to maintain reserve capacity that is large enough to guarantee operational network security and to cooperate with network operators with which it has a cross-border network.[15] If the TSO needs to make the necessary provisions in order to fulfil its task of guaranteeing long-term security of supply, it must provide the ACM with an overview of the measures to be taken and the consequences of these measures for customers and the functioning of the electricity market. The ACM sends the overview to the MEA accompanied by its advice. The measures require the approval of MEA;[16]
- Works to carry out the instructions of the MEA regarding security of supply and security, in particular with regard to the balancing supply and demand on the national market, the level of expected future demand, the additional production and network capacity

4 Section 16(1)(a) of the 1998 Act.
5 Section 16(1)(b) of the 1998 Act.
6 Section 16(1)(c) of the 1998 Act.
7 Section 16(1)(d) of the 1998 Act.
8 Section 16(1)(j) of the 1998 Act.
9 Section 16(1)(k) of the 1998 Act.
10 Section 16(1)(q) of the 1998 Act.
11 Section 16(1)(i) of the 1998 Act.
12 Section 16(2)(a) of the 1998 Act.
13 Section 16(2)(c) of the 1998 Act.
14 Section 16(2)(d) of the 1998 Act.
15 Section 16(10) of the 1998 Act.
16 Section 16(12) of the 1998 Act.

planned or under construction, the quality and condition of maintenance of the grids, and the measures in case of peak load or the default of one or more suppliers;[17]
- Provide other TSOs with the data necessary to ensure reliable and efficient operation, as well as the coherent development and interoperability of the networks;[18]
- Linking the offshore grid with the national high-voltage grid;[19]
- TenneT is entrusted with any other task attributed to it in Regulation 714/2009.

Interconnectors

TenneT is the interconnector operator for the southern part of the NorNed Cable. TenneT is also exclusively charged with the management of cross-border interconnections with alternating current on the Belgian and German border.[20] However, contrary to the general principle applying to domestic networks, it has not been given an exclusive right to build new interconnector capacity.

Undertaking of investments

The TSO is required to carry out any investment projects to deliver on its legal/regulatory duties, as described in more detail above, in the transmission and system tasks of TenneT. The TSO is also required to develop a quality and capacity document (hereafter: KCD) every two years (which will be replaced by an investment plan (*investeringsplan*)[21] as discussed above). In these KCDs, TSOs elaborate, among other things, what investments they plan to make in order to expand the network, and commit themselves to these plans.[22] The ACM will approve TenneT's KCD if it finds that TenneT is sufficiently and effectively able to realize these objectives.[23] TenneT delivers on those duties through ACM's tariff control process, the details of which are more fully described in Section 2.1.3 below.

2.1.3. Mechanism for financing of investment projects

System of setting the tariffs

TenneT can recoup the costs of its statutory tasks (which, as more fully described above in Section 2.1.2, encompass both the 'transmission task' and the 'system task' set out in Section 16(1) and (2) of the 1998 Act) in the form of electricity tariffs – including financing for regular and non-regular investments.

The tariffs which TenneT may charge are determined in several steps, taking into account the applicable tariff structures – the ACM adopts various decisions regarding TenneT, including 'method decisions', 'x-factor decisions' and yearly 'tariff decisions':

Method decision

The first step is the 'method decisions', to be taken by the ACM (after consultation with the joint network operators and market representative organisations).[24]

In the method decisions the ACM determines the economic framework for the statutory tasks of TenneT for a period of 3 to 5 years.[25] An important part of the method decision is the setting of parameters, of which the most important ones are the individual efficiency factor of TenneT ("theta", which reflects TenneT's efficiency as compared to other European TSOs[26]), the sector productivity shift ("frontier shift"), and the projected weighted average costs of capital ("WACC").

Other important elements are the value of the regulated asset base, expected investments, and the depreciation periods used for the various assets.

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17 Sections 16(2)(f) and 4a of the 1998 Act.
18 Section 16(2)(g) of the 1998 Act.
19 Section 16(2)(n) of the 1998 Act.
20 Section 10Aa of the 1998 Act.
21 From 1 January 2019 onwards.
22 Section 21(2) of the 1998 Act.
23 Section 21(8) of the 1998 Act.
24 Section 41b of the 1998 Act.
25 Sections 41-41c of the 1998 Act.
26 This approach is based on the ACM's interpretation of Section 14 of the E-Regulation.

X-factor decision

Following the method decisions, the second step is the so-called x-factor decision, in which the ACM determines the efficiency deduction that TenneT must apply to its revenues and (consequently) its tariffs for a period of 3 to 5 years.

Tariff decision

The final step, which is taken annually, starts with TenneT submitting a proposal for its tariffs to the ACM, based on the tariff structures and the formula and parameters following from the method decisions and the x-factor decision. The ACM will then set the tariffs for TenneT.

Ex ante and ex post regulation

TenneT's tariffs are subject to *ex ante* and, to some extent, *ex post* incentive regulation by the ACM whereby the system provides for a revenue cap:

- ***Ex ante* revenue cap regulation:** Under the statutory incentive regulation for transmission services, the yearly revenue cap for TenneT is calculated on the basis of approved actual grid costs in past years by applying both an individual efficiency factor, ("theta", which reflects TenneT efficiency as compared to other European transmission operators) as well as a sector productivity factor ("frontier shift") and the projected weighted average cost of capital ("WACC"). The permitted revenue is determined by the ACM based on actual costs incurred and several other variables, of which the most important are the value of the regulated asset base, the WACC, the depreciation periods used for the various assets, the expected productivity growth, and TenneT's relative efficiency score as determined by the ACM. In each method decision, the efficiency and productivity factor of TenneT is determined for the current regulatory period (currently 2017-2021). Furthermore, the method decision contains regulatory provisions regarding the compensation for capital costs and operational costs for regular expansion investments made during that regulatory period;
- ***Ex post* tariff recalculations:** In addition to *ex ante* regulation, TenneT is to some extent subject to *ex post* regulation by the ACM. The 1998 Act provides the possibility of correcting TenneT's tariffs under specific circumstances. For example, revenue surpluses and deficits resulting from differences between expected (*ex ante*) and realised (*ex post*) electricity transmission volumes by TenneT are incorporated in tariffs of subsequent year(s). The method of regulating the tariffs of TenneT is hence based on turnover regulation. TenneT therefore does not run any transmission volume risk (in the long run);
- Regulation for system service tariffs: Also applies for services incentive regulation. The difference is that budgets for the system task are determined on a yearly basis, whereas for the transport task the budget is determined for a regulatory period of 3-5 years;
- **Overview of earnings model**. The following figure provides an overview of the earnings model for TenneT:

Allowed revenue based on total cost (for which opex and capital cost are components)		
Operating costs	**Cost of capital**	
• Cost; • Examples of operating costs are grid expenses, employee expenses and grid maintenance costs; • Reimbursement of cost is measured against the cost level of an efficient TSO. ACM uses benchmarks (or similar techniques) and cost assessments to determine that level.	• Depreciation; • TenneT is compensated for the depreciation of its investments; • The basis for the reimbursement is the efficient part of the capital expenditure. The ACM uses benchmarks (or similar techniques) and cost assessments to determine that part; • Allowance for regular investments during the regulatory period. • Extra allowance for special expansion investments	• Return on asset base x weighted cost of capital; • TenneT is allowed to earn a return on the capital invested in its regulatory asset base (RAB); • The RAB represents the value of TenneT's asset base according to the ACM; • The weighted cost of capital (WACC) sets the regulated return on equity

Allowed revenue based on total cost (for which opex and capital cost are components)		
	during regulatory period, including compensation for capital costs during construction.	and cost of debt compensation[27]; • The RAB is indexed by inflation.

Yearly tariff proposal TenneT

The total revenues (excluding tariff adjustments, as stated in Section 41c of the 1998 Act) TenneT is entitled to receive in a particular year constitutes the starting point for the calculation of the tariffs. TenneT sends the ACM an annual proposal for the maximum rates that it will charge, taking into account:

- The application of the economic formula referred to in Section 41b(d) of the 1998 Act: $\mathrm{TI}_t = (1 + \frac{\mathrm{cpi-x+q}}{100})\ \mathrm{TI}_{t-1}$.[28];
- The costs incurred for investments referred to in Section 20d or 20e, third paragraph, of the 1998 Act insofar as these costs are considered 'efficient' ('*doelmatig*'). Section 20d of the 1998 Act applies to three situations: (i) the ACM includes in the tariffs the costs of an investment for which a national 'land-use plan' (*inpassingsplan*) has been established or a special 'environmental permit' (*omgevingsvergunning buitenplanse afwijking*) has been obtained[29]; (ii) the ACM includes in the tariffs the costs of investments for the setting up of wind farms that are included in a spatial vision of the government (*structuurvisie*)[30]; (iii) the ACM includes in the permitted revenues of the grid operator of the offshore grid the costs of investments to implement the development framework referred to in Section 16e(1) of the 1998 Act, which, in turn, stipulates that MEA is required to establish a framework for the development of wind energy. Section 20e of the 1998 Act provides that a TSO must announce its intention to make a special investment in the construction or expansion of the grid to which the procedure referred to in Section 3.28 of the Spatial Planning Act (on the land-use plan (*inpassingsplan*) referred to above) does not apply as soon as possible in writing to the ACM and MEA. MEA decides whether the investment proposed by TenneT is necessary, given the importance of sustainable, reliable, and efficient energy supply. Before MEA decides, the ACM issues advice. If the investment is not included in the structural vision (*structuurvisie*)[31] discussed above, MEA shall not adopt the decision before both chambers of the Dutch Parliament have been consulted;[32]
- The costs incurred for the acquisition of an existing grid for which no system operator has previously been designated, insofar as these costs are 'efficient' (*doelmatig*)[33];
- The estimated cost of capital that TenneT incurs in the year to which its yearly tariff proposal relates in respect of investments not yet put into use to which the procedure referred to in Section 3.35, first paragraph, preamble and subsection c of the Spatial Planning Act (*Wet ruimtelijke ordening*) applies (the National Coordination Scheme (*Rijkscoördinatieregeling*) and which entails the use of a so-called land-use plan (*inpassingsplan*).[34] This provision applies to large scale projects and aims to shorten and streamline the spatial planning procedure and hence to speed up the decision-

[27] ACM uses the WACC (weighted average cost of capital) for determining the compensation for investment expenditures. The WACC is a weighted average of the cost of debt and the cost of equity, based on a gearing set by ACM. The WACC enables efficient businesses to make a reasonable return on invested capital that is needed as compensation for the moneylenders. In energy regulation, the WACC is applied as a percentage.

[28] Whereby TIt represents the total income in year t; $TIt-1$ represents the total income in year t-1; cpi represents the consumer price index as determined by Statistics Netherlands; x represents the x-factor, the discount established by ACM to promote efficient business operations; q represents the quality parameters (which does not apply to TenneT).

[29] Pursuant to Section 3.28 of the Spatial Planning Act (*Wet ruimtelijke ordening*).

[30] Spatial visions of the government describe the spatial developments it expects as well as how these developments will be directed or implemented. See Section 2.3 of the Spatial Planning Act *(Wet ruimtelijke ordening*).

[31] As referred to in Section 2.3 of the Spatial Planning Act (*Wet ruimtelijke ordening*).

[32] Section 20e(3) of the 1998 Act.

[33] Section 41b(1)(g) of the 1998 Act.

[34] Section 41b(1)(h) of the 1998 Act. A land-use plan in the Netherlands in the Spatial Planning Act is a zoning plan of the government (or of the province) with which the destination of a specific area can be legally established.

making process. Section 20a of the 1998 Act provides that the procedure referred to in Section 3.35, first paragraph, preamble and subsection c of the Spatial Planning Act applies to an extension of the national high-voltage grid as far as it concerns: (a). the grids forming part of that network intended for the transmission of electricity at a voltage level of 220 kV or higher and operated as such, including the connections to those grids; (b). cross-border networks forming part of that network at a voltage level of 500 V or higher including the connections to those networks; or (c). the construction or extension of a cross-border network including the connections to such a network, and the project for electricity included on the Union list of projects of common interest referred to in Section 3, paragraph 4, Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure.[35] There is a presumption in favour of the effectiveness (*doelmatigheid*) of such investments;

- The estimated costs incurred by TenneT for investments that are or have been used in the year to which the yearly tariff proposal relates, to which the procedure, referred to in Section 3.35, first paragraph, preamble and section c, of the Spatial Planning Act applies (which, as indicated in the previous bullet point, concerns the application of the National Coordination Scheme);[36]
- The estimated costs incurred by TenneT for the performance of the system tasks[37] are applied without applying the formula referred to above[38] and will be added to the total revenues from the tariffs of TenneT;[39]
- The estimated costs that TenneT will charge another network operator for the performance of the tasks referred to in Section 16, first and second paragraph of the 1998 Act will be added to the total revenues from the tariffs of this other TSO, without the application of the formula referred to above.[40]

Permitted revenues for the offshore grid

The ACM determines the permitted revenues of TenneT annually, taking into account Article 42d of the 1998 Act, which provides that the permitted revenues must be based on:

- The application of the economic formula referred to in Section 42d(1)(a) of the 1998 Act: $\mathrm{TI}_t = (1 + \frac{\mathrm{cpi}-\mathrm{x}}{100})\ \mathrm{TI}_{t-1}$.[41];
- The costs incurred for investments as referred to in Article 20d(3) of the 1998 Act which, in turn, refers to Section 16(e)(1) of the 1998 Act, which prescribes that MEA must establish a framework for the development of wind energy at sea;
- Compensation as referred to in Article 16f of the 1998 Act. This provision prescribes that a producer is entitled to compensation for damage by the offshore TSO if: (a) this TSO delivers the part of the offshore grid necessary for the opening up of the wind farm in whole or in part later than included in the development plan (as referred to in Article 16e of the 1998 Act), and the producer cannot inject electricity; or (b) the amount of electricity that cannot be transmitted in a calendar year over the offshore grid is greater than the amount of electricity that cannot be transmitted due to the maintenance that is reasonably necessary for the offshore grid and that the producer cannot have electricity transmitted;
- The estimated cost of capital that the offshore TSO will incur in the year to which the yearly proposal relates in respect of investments not yet put into use, on which the procedure referred to in Article 3.35(1) preamble and subsection (c) of the Spatial Planning Act (discussed above) applies;

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35 Under Section 13, paragraph 1 of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure of April 17, 2013 (hereafter: the Regulation), Member States and NRAs ensure that appropriate incentives are granted when a project promoter incurs higher risks for the development, construction, operation or maintenance of certain projects of common interest (PCI). A PCI, as defined in Section 2, paragraph 4 of the Regulation, is a project necessary to implement the energy infrastructure priority corridors and areas set out in Annex I of the Regulation, and which is part of the Union list of projects of common interest referred to in Section 3 of the Regulation.

36 Section 41b(1)(I) of the 1998 Act.

37 Referred to in Section 16(2) of the 1998 Act.

38 Referred to in Section 41b(1)(d) of the 1998 Act.

39 Section 41b(3) of the 1998 Act.

40 Referred to in Section 41b(1)(d) of the 1998 Act.

41 Whereby TIt represents the total income in year t; $TIt-1$ represents the total income in year t-1; cpi represents the consumer price index as determined by Statistics Netherlands; x represents the x-factor, the discount established by ACM to promote efficient business operations; q represents the quality parameters (which does not apply to TenneT).

- The estimated costs incurred by the offshore for investments that are or have been taken into use in the year to which the proposal relates, whereupon the procedure, referred to in Article 3.35, first paragraph, preamble and under c, of the Spatial Planning Act applies.

Moreover, Section 77g of the 1998 Act allows the offshore grid operator (TenneT) to receive a subsidy that covers all or part of the costs for the construction, management and maintenance of the offshore grid.

Regulatory framework Interconnectors

- Capacity is allocated through explicit and implicit auctions organised in collaboration with the foreign TSOs;
- The 1998 Act allows MEA to grant an exemption for all or part of new interconnectors from the provisions governing third-party access, a group prohibition, and the regulatory control of tariffs or tariff methodologies. Further to Section 86(c) of the 1998 Act; MEA can only grant a temporary exemption if strict conditions are met as provided for in Section 17 of Regulation 714/2009. Importantly, two of the conditions are that, firstly, the investment must contribute to security of supply and, secondly, that it is such a high-risk investment that it would not be made otherwise. In accordance with Section 86(c) EA, the ACM advises the MEA in relation to the decision on the application for exemption;
- Section 16(2)(j) of the 1998 Act requires TenneT to collect congestion charges and payments under the compensation mechanism in accordance with Section 13 of Regulation 714/2009. Reflecting Section 16(6) of Regulation 714/2009 (formerly Art. 6(6)(a) Regulation 1228/2003), Section 31(6) of the 1998 Act prescribes that TenneT must utilise the proceeds of the auction or other market-based method of allocating capacity for the elimination of restrictions of the transmission capacity on the cross-border network or for other purposes to be determined by the ACM;
- On 22 December 2015, the ACM published an incentive decision (*Stimulansbesluit*) regarding the Cobra cable and the Doetinchem-Wesel interconnector, which have been designed as PCIs – using the proceeds of the auction discussed under the previous bullet-point.

2.1.4. Regulatory rules with respect to innovation

Specific duties of the TSO aimed at encouraging innovation

The specific duties of the TSO, including any which are applicable to innovation (or indirectly support innovation), are more fully described in Section 2.1.2 above. It is arguable that, in the absence of an explicit duty to innovate, the obligation of the TSO to develop transmission capacity for each offshore wind farm and to link the offshore grid with the national high-voltage grid could be seen as tending towards encouraging innovation.[42] The TSO will also playa role in delivering/participating in mechanisms, which support the development of innovation. These specific mechanisms, and the TSO's role in them, have been addressed in Section 2.1.3 above.

Specific duties of the NRA aimed at encouraging innovation

There are limited duties on the ACM to encourage innovation in terms of the statutory framework. However, the duty to encourage innovation is more implicit in the general duty of ACM to ensure that it secures the efficient, economic and reliable execution of activities by TenneT. As a result, many of the mechanisms, outlined above in Section 2.1.3, are aimed specifically at promoting innovation.

Although there are limited statutory duties, various regulatory incentives exist. These include the following:

- Further to Article 20e of the 1998 Act, innovative projects can be submitted to the ACM and the Ministry.[43]
- Provision for experimental derogations from specific clauses of the 1998 Act;

[42] This provision will be cancelled when the 1998 Act is changed based on the *Wet voortgang energietransitie.*

- The replacement of the current periodical quality and capacity document (*kwaliteits- en capaciteitsdocument,* or "KCD") by an investment plan (*investeringsplan*) to deal, inter alia, with the issue of a less predictable energy supply resulting from an increase in the supply of electricity from renewable resources and an increasing supply of locally produced energy;
- An explicit possibility to provide subsidies to TenneT to compensate for extra costs of the offshore grid;
- Coordinated rules on spatial planning (*Rijkscoördinatieregeling*);
- The possibility for the MEA to grant an exemption for all or part of new interconnectors from the provisions in the 1998 Act on third-party access, a group prohibition, and the regulatory control of tariffs or tariff methodologies exemption if strict conditions are met as provided for in Section 17 of Regulation 714/2009.

Moreover, there are several subsidy schemes for innovative applications of energy.[44]

Features of financing mechanisms designed to incentivise investment in innovation and result in a balance between innovation and effectiveness. As is demonstrated in Section 2.1.3 above, TenneT is regulated in such a way that the efficient costs of investments in the grid are fully socialised through the regulated connection and transmission tariffs. TenneT's ability to recoup the necessary investments through the allowed cost of capital allows it to innovate where necessary to perform its tasks listed in the 1998 Act.

TenneT has only limited possibilities to decrease uncertainties by steering or controlling the demand for grid capacity at certain locations. Due to the access and transmission obligation, TenneT is generally obliged to facilitate all requests for connection and transmission of electricity for all locations in all situations, and to strengthen the grid in case of a lack of grid capacity.

2.1.5. Regulatory rules with respect to security of supply

Specific duties of the TSO aiming at safeguarding security of supply

Duties, including those applicable to security of supply, are more fully described in Section 2.1.2 above.

Specific duties of the NRA aiming at safeguarding security of supply

In December 2016, TenneT received a committed equity contribution from the Dutch government of EUR 1.19 billion in support of their investment programme in the Netherlands, the proceeds of which are drawn down in four tranches over the 2017-20 period.

2.2. Regulatory practice

2.2.1. Overview over regulatory practice in the Netherlands

Main regulatory barriers

The interviewees were generally satisfied with the NRF in the Netherlands. Yet, they also recognise two of the regulatory barriers mentioned in the questionnaire:

- Projects which result in higher TSO expenditure, but whose benefits go to the wider society instead of the TSO, are not incentivised;
- The Netherlands has a TOTEX regulation, but CAPEX is treated more advantageously than OPEX and a shift of the ratio in favour of OPEX is not incentivised.

Additionally, they mentioned the following barriers:

- Benchmarking creates (regulatory) uncertainty for investments which do not fit into the categories (e.g. new tower designs which are more expensive than classical designs);
- In addition to the CAPEX bias in the TOTEX regulation, the OPEX remuneration is based on realized historical costs, so the remuneration is outdated by 5 years – this disincentives projects with lower CAPEX, but higher OPEX than the historical OPEX;
- The WACC (providing a return on only on CAPEX but not on OPEX) creates another bias towards CAPEX.

[44] <https://www.rvo.nl/subsidies-regelingen/subsidies-energie-innovatie-topsector-energie>.

Possible improvement of the NRF

The interviewees name the following improvements to the NRF:

- Find a way to determine the willingness to pay of the society for an (innovative) solution and include the (non-monetary) benefits into project considerations;
- Eliminate the CAPEX bias.

2.2.2. Regulatory practice related to innovation

Innovative projects

In the NRF, innovation is not specifically mentioned or defined. Nevertheless, the interviewees distinguish between two types of innovative projects:

- Innovative projects resulting in lower costs for the TSO[45];
- Innovative projects resulting in higher costs for the TSO, but also resulting in benefits to the society (i.e. environmental benefits, public acceptance etc.).

The regulation was said not to account sufficiently for the latter category. The NRF does provide incentives for projects that result in cost reduction.

Examples of these (potential) problematic projects are:

- Differently designed overhead poles (Wintrack);
- High temperature superconductive cables (a project which was abandoned in the end);
- Investments into the flexibilisation of assets.

Examples of 'innovative' projects, which are being explored or planned, encompass:

- Offshore transmission systems (for which there is a specific regulatory regime);
- An energy island in the North Sea;
- WindConnector in combination with wind parks.

These above examples are not yet implemented and are not yet in the planning phase (for this reason those projects can be classified as R&D projects). Only the Wintrack masts mentioned above are being implemented.

Adequacy of the NRF relating to its support for innovative investments

There are no provisions in the regulation explicitly facilitating innovation. The regulation should ensure that the TSO operates effective and efficient.

Therefore, to estimate the adequacy of the NRF with regard to its support for innovative investments, one can distinguish between innovations which benefit mainly the society, and investments which benefit the TSO and which are cost efficient (see differentiation above). For the first category of investments, the NRF is not seen as fully adequate, whereas for the second category, the NRF fares better, although some limitations and barriers remain (see the barriers named above, i.e. CAPEX bias etc.).

In 2009, the NRA organised a consultation on the need to make changes to the regulatory framework to more explicitly take into account of innovation.[46] As a part of this consultation, TenneT and other system operators replied that they have initiated all projects that they have deemed desirable or necessary. The NRA concluded that it is not necessary to create extra leeway in regulated rates for innovation.

2.2.3. Regulatory practice related to security of supply

The interviewees see security of supply on a system level and remarked that the energy transition poses challenges to 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.

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[45] Since the Netherlands have a TOTEX regulation, TOTEX reductions are incentivized. Yet, as we write below, a CAPEX bias has been mentioned by the stakeholders.

[46] https://www.acm.nl/nl/publicaties/publicatie/7009/Consultatie-over-innovatie.

Security of supply investments, such as extra loop lines, are less affected by regulatory shortcomings, such as by shortcomings of the benchmark. Yet regulatory shortcomings are seen related to flexibility and storage: the NRF is considered to provide an incentive for long-term solutions, but not necessarily for more flexible solutions. According to the interviewees, the TSO needs to be able to choose for flexibility solutions instead of being required to build more lines.

Moreover, the interviewees said that some thinking needs to be done related to a possible role of the TSO in new developments, which enhance security of supply, such as hydrogen and storage.

2.2.4. Illustrative specific projects

The following projects are examples of successful innovative or security of supply projects and hence illustrate how the regulatory regime works in practice. All project can be considered ´security of supply´ projects, parts of the project can also be considered innovative, an example is the application of Wintrack masts in the *Doetinchem - Wesel 380 kV* project.

- *Randstad 380 kV Noordring* – Network reinforcement to accommodate renewables and distributed generation (particularly in the horticulture industry) and increased interconnector capacity in the west of the Netherlands. The increase in capacity is also in preparation of future growth of offshore wind prroduction The project consists of new 380 kV and 150 kV lines and the construction of new 380 kV transformers.

  The project is not subject to specific incentives.

- *Zuidwest 380 kV* – 48 km of 380kV lines (and 107 Wintrack masts) to accommodate production in the South-West in the Netherlands. The current connection has insufficient capacity for expected growth of production, including new offshore and onshore wind. TenneT has the legal obligation to connect new load, which requires an increase in capacity. Without the project, the risks to security of supply are considered too high.

  No specific regulatory incentives apply to this project.

- *Network reinforcement Eemshaven* – New 110 kV-station and underground cable to existing 110/220 kV station (at Robbenplaat). According to TenneT, this project is needed to accommodate demand for transmission capacity, especially due to the growth of renewable electricity production. TenneT expects that the project will be finalized by the end of 2019.

  No specific regulatory incentives apply to this project.

- *Doetinchem - Wesel 380 kV* – Interconnector to Germany (together with Amprion, the German TSO).

  This project (a PCI) is an addition (1500MW) to the existing interconnector capacity between the Netherland and Germany. In the project 54 Wintrack masts will be used, the total length of the circuit is 57 km.

  This project does not benefit from specific incentives but the NRA has clarified how the investment will be treated in the benchmark.[47] The additional costs of the Wintrack masts compared to conventional masts will be remunerated under certain conditions.

- *Cobra interconnector 380 kV* – Interconnector to Denmark (together with Energinet.dk) This interconnector projects is also a PCI and concerns a cable of 300 kilometer (and onshore converter stations) between the Netherlands and Denmark and is expected to be completed in 2019. This is the only project for which specific incentives are applied. This project will be temporarily (10 years) exempted from benchmarking. The NRA has also clarified how the project in the future will be benchmarked. There is also a sharing mechanism for any deviations between projected and actual OPEX for the offshore part of the interconnector.[48]

[47] Source: ACM/DE/2015/406214.
[48] Source: ACM/DE/2015/406214.

2.3. Options for improvement

2.3.1. Options to improve regulatory practice

As the above shows, both the MEA and the NRA apply a relatively 'light touch approach' towards investments made by the TSO. A 'light touch approach' means that the NRA assesses efficiency *ex post* and does this on a TOTEX-basis.

(i) Assessment of investment framework in investment plan

Generally, the NRF is considered adequate in supporting security of supply investments. Currently, there are no indications that the implementation practices provide inadequate incentives to ensure security of supply. Respondents point out there may be a bias towards CAPEX-solutions. If that is considered a problem, one option for improvement that could be considered is to include an assessment of the trade-off between OPEX and CAPEX in the investment plan. This aims to ensure that investment decisions are not biased towards CAPEX-solutions leading to explicit consideration of OPEX-solutions. This could also help the NRA to achieve a better understanding on the use (and costs and benefits) of innovative solutions that are applied by the TSO.

(ii) Forward-looking modelling of costs

Currently, revenues are set based on historic costs. The revenue cap is increased when large projects are put into service, 1% of CAPEX is added to the revenue cap. Any additional increases in operational expenditures would need to be pre-financed by TenneT before they are incorporated in the revenue cap at the start of the next regulatory period. Another option to reduce the risk of any CAPEX-bias is to model the (efficient) expected operational expenditures in a forward-looking way, and to take the results into account when setting the revenue cap. This would reduce the reliance on historic costs when setting rates. Note that a forward-looking approach does have disadvantages that need to be considered, it can reduce efficiency incentives for example.

(iii) Statutory requirements to consider alternatives

Where there is an obligation or incentive to build new lines, it may sometimes be more cost-effective to explicitly allow the TSO to also consider other options, such as procuring flexibility. The conditions under which this would be deemed a desirable solution should be made explicit in legislation to provide legal certainty to network users.

(iv) Statutory 'ear-marking' requirement

While respondents do not point out any major problems with respect to innovation or the adoption of new innovative technologies, it cannot be ruled out that improvements can still be made. If it is deemed desirable to strengthen the incentives for the TSO to adopt new technologies, even when they do not directly reduce TSO costs but have wider benefits, the following legislative change could be considered. A requirement could be introduced obliging the TSO to ear-mark a budget for innovation or to apply for innovation funds (financed through regulated tariff revenues) by submitting project proposals to the regulator.

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.

2.3.2. National law mechanism(s) for implementing options

As regards option (i), this could be incorporated in lower level legislation ('Besluit_investeringsplannen_en_kwaliteitsborging'), making explicit what the contents of the investment plan should be.

We consider that option (ii) could be implemented using legal powers already available to the NRA or others under the existing NRF.

As regards option (iii) (Statutory authorisation to consider alternatives), the suggestion of incorporating a mandatory requirement in legislation for the TSO to explain what alternatives have been looked at when developing the national TYNDP plan, could be implemented by including such an obligation in the Electricity Act through the Dutch Legislative Process.

As regards option (iv) (statutory authorisation to consider alternatives), we understand that the legal mechanism for implementing this option would involve the modification of the Electricity Act through the Dutch Legislative Process.

Turning to option (v) (statutory 'ear-marking' requirement), we expect that this could be implemented by including such a requirement in the Electricity Act through the Dutch Legislative Process.

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. However, the composition of TSO spending might change (e.g. more innovative or more OPEX), leading to a better outcome. Option iv would likely result in higher costs and an increase in network tariffs.

Changes to the way OPEX are treated in the NRF during a regulatory period might have some implications for the way in which projects are executed. The impact depends on the extent to which any CAPEX-bias influences investment decisions in practice.

Option (i), (ii) and (iv) would somewhat increase the work load of the regulator. The administrative burden for the TSO would also increase, that is especially the case with option (iii), and to a more limited extent also option (ii).

Please note that we have not analysed all the effects of the suggested options for improvement in detail. These need to be considered when further developing and fine-tuning the options.

3. GAS

3.1. Legal analysis of the NRF in the Netherlands

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

The Gas Act 2000

The Gas Act 2000 (the "2000 Act", which has been amended several times) is the central piece of primary legislation governing the legal framework for gas in the Netherlands. In addition, detailed regulations are provided for in delegated legislation and in codes determined by the Authority for Consumers & Markets (the "ACM"). The Connection Code Transmission System Operator (TSO) (*Aansluitcode gas LNB*), the Transmission Code TSO (*Transportcode gas LNB*), the Feed Code Gas (*Invoedcode gas LNB*), the Grid Connection Code Gas TSO (*Netkoppelingscode gas LNB*), the Grid Code Gas TSO (*Takencode gas LNB*), and the Allocation Code Gas (*Allocatiecode gas*) put (practical) rules and procedures in place to ensure the security of the gas supply. These provide clarity on the tasks and responsibilities of all parties involved in the transmission of gas.

GTS

Gasunie Transport Services B.V. ("GTS") is the sole TSO of the national grid for gas in the Netherlands. The ACM, which is responsible for the regulation of the TSOs, derives its primary duties, objectives, and powers from the 2000 Act. The ACM has also been assigned the task of supervising compliance with the EU legal framework regarding gas. Finally, in addition to the ACM, the Dutch Minister of Economic Affairs ("MEA") also has various duties and objectives derived from the legal framework for gas in the Netherlands. MEA supervises the safety, reliability and quality of the gas transmission network and has the control of the gas supply. MEA may issue binding instructions to enforce compliance regarding these subjects.[49]

Incentive-based regulatory scheme

Virtually all of the activities of GTS are regulated. The revenues of GTS are subject to *ex ante*, and to some extent *ex post*, regulation by the ACM. The Dutch legal framework for gas aims to create an incentive-based regulatory scheme around four distinctive goals: (1) provide TSOs with an incentive to operate in an efficient manner. The main principle: revenue cap/price cap based on exogenous efficient cost level; (2) prevent system operators from charging tariffs above the (efficient) cost level; (3) allow network operators an appropriate return on investments. In order to ensure the safety and security of the network, the TSO has to invest in its network; it needs capital to do so. The TSO receives an appropriate return on its investment, so it can compensate its providers of capital; (4) encourage optimal quality of transmission.

Recent amendment of the Gas and Electricity Act

A proposal for revision of the 2000 Act and the Electricity Act 1998 ("1998 Act") was prepared and submitted to Parliament. The proposal, named "Stroom" was to merge the 1998 Act and the 2000 Act, in order to bring the new 'Electricity and Gas Act' more in line with EU energy regulation and to revise the tariff regulation and requirements for network operators. However, the First Chamber (*Eerste Kamer)* of the Dutch Parliament rejected the draft act.[50]

On 26 April 2018, a new 'Amendment of the 1998 Act and the 2000 Act (*progress energy transition*)' (*Wet van 9 april 2018 tot wijziging van de Electriciteitswet 1998 en van de Gaswet (voortgang energietransitie*)) was adopted. Primarily focussing on energy transition, this amendment stipulates, inter alia, the following changes to the 2000 Act:

- It extends the possibility of deviating from the provisions under or pursuant to the 2000 Act by way of an experiment to all relevant aspects concerning renewable energy, energy savings, reduction of CO2 emissions, efficient use of the network, new market models, and tariff regulation;
- It contains updated rules on the activities; the 'netwerkbedrijf' (the group of which the TSO is part) is allowed to carry out. The core of the delineation is that activities should

[49] Section 1c of the 2000 Act.
[50] On 22 December 2015.

be limited to infrastructure activities related to the management of gas (or electricity) transmission networks;
- Replacing the current periodical quality and capacity document (*kwaliteits- en capaciteitsdocument,* or "KCD") with a periodical investment plan (*investeringsplan*).

In March 2018, the Dutch government decided to phase out production from the Groningen natural gas field by 2030 in order to remediate the risk of further earthquakes in the region.

In June 2018 an Amendment of the 2000 Act and the Mining Act (*Mijnbouwwet*) concerning the minimisation of gas extraction from the Groningen field (*Wijziging van de Gaswet en van de Mijnbouwwet betreffende het minimaliseren van de gaswinning uit het Groningenveld*) was adopted by the Lower House.

Until now, there are no separate rules for decision-making regarding extraction from the Groningen field. NAM, the holder of the extraction license Groningenveld, outlines a number of scenarios for the extraction, including associated seismic risks, in a production plan. The MEA accepts this extraction plan, where necessary under certain conditions. In recent years, a maximum level of extraction has been attached to this consent. This means that the license holder can extract that quantity of gas, even if this is more than is necessary for the security of supply.

Under the new system, the TSO of the national gas transmission network will advise the MEA annually on the deployment of the Groningen field that is necessary for purposes of security of supply. The TSO will make this calculation on the basis of a 'degree-day formula' (*graaddagenformule*), based on the assumption that other means such as the use of nitrogen are optimally used within the possibilities of the system. This implies, among other things, that the Minister establishes a percentage that indicates how much of the nitrogen capacity must be used on average on an annual basis.

This percentage will be such that there is still some flexibility to absorb, for example, cold days, so that not all fluctuations from the Groningen field have to be absorbed, thus maintaining the quality-free gas market (*kwaliteitsloze gasmarkt*).[51] The use of gas extraction from the Groningen field will, in view of the orderliness of the resources to be deployed, be the final element for the security of supply.

The TSO makes an estimate for different temperature scenarios. The license holder is then asked, in accordance with the latest safety insights, to propose one or more operational strategies on the basis of this advice. With this request, the MEA may ask the license holder to take into account, for example, a certain degree of flat winning (*vlak winnen*), i.e. less fluctuations in the production and thus produce more evenly. In this operational strategy, the distribution of the extraction between the different clusters of the Groningen field and the other measures that the license holder will take must be described. An important component is the threat and risk analysis associated with the expected extraction. The Inspector General of Mines (*inspecteur-generaal der mijne*) will then be asked to advise the MEA about the underground aspects (such as the permit holder's estimate of the number of earthquakes and their magnitude) and the above-ground risks. In the threat and risk analysis of the license holder, the effects of gas extraction from the Groningen field for the next ten years are indicated. The MEA finally determines the operational strategy to be followed by the license holder.

For this amendment to enter into force it will still have to be adopted by the Upper House. This is expected to happen in September 2018 at the earliest.

3.1.2. Specific legal rights and duties

Role of the TSO

GTS is owner and operator of the national transmission network for gas in NL.[52] In this role, GTS has a number of statutory tasks including the obligations to construct, repair and extend the network:

[51] 'quality-free gas market' means that there is one market for gas of different qualities (low calorific or high calorific), regardless of whether the provider or customer injects or acquires high or low calorific gas.

[52] Section 2(1) of the 2000 Act.

1. Transmission tasks

The 2000 Act imposes on all gas TSOs including GTS a number of general transmission tasks. The following are directly or indirectly relevant to transmission network development:

- To operate, maintain, and develop networks at economically sound and environmentally friendly conditions in a manner that secures the safety, efficiency, and reliability of these networks;[53]
- To realize links with other gas transmission networks and to carry out the necessary repairs to its gas transmission network;[54]
- To protect the gas transmission network from possible external influences;[55]
- To determine – at the request of a producer – whether its production plant is suitable for the generation of gas from renewable energy sources, and whether the measuring device is suitable for the measurement of the gas from renewable energy sources generated with the production plant and fed into a gas transmission network.[56]

2. Balance task, quality conversion task and existing connection task of GTS

As the national TSO, GTS has the *additional* responsibility for the 'system task'. This means it is given the duty to balance the system, maintain system reliability, and to take measures in respect of security of supply:

- To make the necessary provisions concerning security of supply;[57]
- To balance the gas transmission network;[58]
- If necessary and possible to convert gas with a higher energy content to a lower energy content (and vice versa) – having regard to the difference between the quality of the gas fed into the gas transmission network and the gas extracted from the gas transmission network;[59]
- To operate and maintain connections to the national gas transmission grid that were commissioned before 1 April 2011;[60]
- To implement instructions from the MEA regarding the supply and security of supply;[61]
- To make the necessary provisions aimed at the availability of sufficient transmission capacity with a view to sufficient transmission security;[62]
- If required by MEA to carry out work to implement Regulation 994/2010;[63]
- To have one or more integrated systems in geographical areas as referred to in Article 12(3) of Regulation 715/2009 in which two or more Member States cooperate for the allocation of capacity and for monitoring the security of the grid;[64]
- To provide sufficient cross-border capacity to create an integrated European infrastructure that meets the economically reasonable and technically feasible demand for capacity, taking into account gas supply and security of supply;[65]
- To fulfil the duties arising from Regulation 715/2009.[66]

3. Gas Building and Small Fields Policy

GTS has also been charged with tasks that reflect its position in the ´Gas Building´ and the ´Small Fields Policy´:

- To ensure the careful and rational use of gas in the long term for the collection and transmission of gas from the gas deposits in areas within the Netherlands and on the continental shelf;[67]

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53 Section 10(1) of the 2000 Act.
54 Section 10(3)(a) of the 2000 Act.
55 Section 10(9) of the 2000 Act.
56 Section 10(5)(c) of the 2000 Act.
57 Section 10a(a) of the 2000 Act.
58 Section 10a(b) of the 2000 Act.
59 Section 10(a)(c)(1) and (2) of the 2000 Act.
60 Section 10a(d) of the 2000 Act.
61 Sections 10a(f) and 52a of the 2000 Act.
62 Section 10a(g) of the 2000 Act.
63 Section 10a(h) of the 2000 Act.
64 Section 10a(j) of the 2000 Act.
65 Section 10a(k) of the 2000 Act.
66 Section 10a(l) of the 2000 Act.
67 Section 54a(1) of the 2000 Act.

- If investments in the gas transmission network have to be made, GTS will inform MEA of this.[68] MEA decides whether the investment is necessary (*noodzakelijk*) or not. The obligation for GTS to transmit gas from the small fields will only cease if MEA decides that the investment proposed by GTS is not necessary;[69]
- The ACM includes the costs of an investment in respect of which the necessity has been establish in the tariffs;[70]
- GTS estimates the requirement for the next twenty years on a yearly basis and submits to MEA, in order to be able to offer the required entry and transmission capacity;[71]
- If necessary, GTS is allowed to attach additional conditions to entry capacity for small fields, in order to perform its tasks as efficiently as possible.[72]

4. Interconnection points, Prisma

Entry and exit capacity at cross-border interconnection points is auctioned via the European capacity platform Prisma.

Undertaking of investments

The TSO is required to carry out any investment projects to deliver on its legal/regulatory duties as more fully described above (1. Transmission tasks – 4. Interconnection points, Prisma). The TSO is also required to develop a quality and capacity document (hereafter: KCD) every two years (which will be replaced by an investment plan, as discussed above). In these KCDs, TSOs elaborate, among other things, what investments they plan to make in order to improve or expand the network, and commit themselves to these plans.[73] GTS delivers on those duties through ACM's tariff control process, the details of which are more fully described below.

3.1.3. Mechanism for financing of investment projects

System of setting the tariffs

GTS can recoup the costs of its statutory tasks (which, as more fully described above under 2(i), encompass both the 'transmission task' and the 'balancing task, quality conversion task and existing connection task' set out in Sections 10 and 10a of the 2000 Act) in the form of its gas tariffs – which includes financing for regular and non-regular investments. Section 12a of the 2000 Act, sets out that the ACM does not set a separate tariff for the balancing task and the quality conversion task. Remuneration for the costs of carrying out these tasks is provided for via the tariffs for the transmission task. When calculating and setting the tariff for the transmission task, the ACM calculates a separate tariff component for the balancing task as well as the quality conversion task. This enables the ACM to allocate the costs as directly as possible to the various tasks and to provide as much insight into the determination of the tariffs as possible.

This system mirrors all elements of the network ratification regime in the electricity market, which has been set out in the "Legal Response Template – Electricity". The tariffs GTS may charge are determined in several steps, taking into account the applicable tariff structures – the ACM adopts various decisions regarding GTS, including 'method decisions', 'x-factor decisions' and yearly 'tariff decisions':

Method decision

The first step is the 'method decision', to be taken by the ACM (after consultation with the joint network operators and market representative organisations):[74]

- In the method decision, the ACM determines the economic framework for the statutory tasks of GTS for a period of 3 to 5 years.[75] An important part of the method decision is the setting of parameters, of which the most important ones are the individual efficiency

[68] Section 54a(2) of the 2000 Act.
[69] Section 54a(3) of the 2000 Act.
[70] Section 54a(4) of the 2000 Act.
[71] Section 54a(5) of the 2000 Act.
[72] Section 54b(1) of the 2000 Act.
[73] Section 8(2) of the 2000 Act.
[74] Section 82(2) of the 2000 Act.
[75] Section 82(2) of the 2000 Act.

factor of GTS[76], the sector productivity shift ("frontier shift"), and the projected weighted average costs of capital ("WACC");
- Other important elements are the value of the regulated asset base, expected investments, and the depreciation periods used for the various assets.

Efficiency deduction, X-factor decision

After the method decisions, the second step is the so-called x-factor decision, in which the ACM determines the efficiency deduction that GTS must apply to its revenues and (consequently) its tariffs for a period of 3 to 5 years.[77]

Tariff decision

The final step, which is taken annually, starts with GTS submitting a proposal for its tariffs to the ACM, based on the tariff structures and the formula and parameters following from the method decision and the x-factor decision. The ACM will then set the tariffs for GTS.[78] The total revenue (excluding corrections) of GTS in a given year forms the starting point for the calculation of the tariffs. The total income (excluding the income due to tariff adjustments) that GTS may earn per task in a calendar year is determined on the basis of the following formula:

$$TI_t^i = TI_{t-1}^i\,(1 + CPI_t - x^i).$$[79]

Yearly tariff proposal GTS

The total revenues, excluding tariff adjustments pursuant to Sections 81c(2)-(5) and 82(8) of the 2000 Act GTS is entitled to receive in a particular year, constitute the starting point for the calculation of the tariffs. GTS sends the ACM an annual proposal for the maximum rates that it will charge for carrying out the tasks referred to in Sections 10 and 10a of the 2000 Act (insofar as these costs are effective (*doelmatig*)), taking into account:
- The tariff structures established on the basis of Section 12f or 12g of the 2000 Act, allowing for the adoption of network codes. Further to these provisions, the ACM determines the tariff structures and the conditions with due regard to: the proposal of the joint grid operators; the importance of reliable, sustainable, efficient and environmentally sound functioning of gas supply; the importance of the development of trade on the gas market; the importance of promoting the effective handling of network users; the importance of good quality of service provided by network operators; the importance of balancing the national gas transmission network in an objective, transparent and non-discriminatory manner and in a way that reflects the costs; Regulation 715/2009; and Directive 2009/73/EC;
- The costs incurred for designated, new, large energy projects (also referred to as 'non-regular investments') (*niet-reguliere investeringen*) as referred to in Section 39e, 39f(3) or 54a(3) of the 2000 Act insofar as these costs are efficient ('*doelmatig*').[80] Section 39e of the 2000 Act forms part of Paragraph 5.1b. of the 2000 Act on the impact of the construction of new infrastructure in the tariffs. It provides that the ACM must include in the tariffs the costs of an investment for which a national 'land-use plan' (*inpassingsplan*) has been established further to Section 3.28 of the Spatial Planning Act (*Wet ruimtelijke ordening*). Section 39(f)(3) of the 2000 Act provides that a TSO must announce its intention to make a special investment in the construction or expansion of the grid to which the procedure referred to in Section 3.28 of the Spatial Planning Act (on the land-use plan (*inpassingsplan*) referred to above) does not apply as soon as possible in writing to the ACM and MEA. MEA decides whether the investment proposed by GTS is necessary, given the importance of sustainable, reliable and efficient energy

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76 For GTS, static efficiency was determined for the first time in the current regulatory period.

77 Section 82(4) of the 2000 Act.

78 Section 82(5) of the 2000 Act.

79 TI_t^i = Total revenue excluding revenue from tariff adjustments in year t for task i in price level t. For the calculation of income in the first year of the regulatory period, TI_{t-1}^imust be replaced with the initial income set by the ACM. CPI_t = The consumer price index for the year t, being the relative change in the consumer price index (all households). This is calculated from the quotient of this price index, published in the fourth month prior to year t, and of this price index, published in the sixteenth month prior to year t, as determined each month by the Central Bureau of Statistics (in accordance with article 81 first paragraph of the 2000 Act). x^i = The discount to promote efficient operations (x-factor) for the relevant regulatory period for task i.

80 The Wet voortgang energietransitie cancels the option referred to in section 39f(3) of the 2000 Act.

supply. Before MEA decides, the ACM issues advice. If the investment is not included in a structural vision (*structuurvisie*),[81] MEA shall not adopt the decision before both chambers of the Dutch Parliament have been consulted. Furthermore, Section 54a(3) of the 2000 Act, MEA decides whether an investment by GTS is necessary in view of the importance of the systematic management of the occurrence of gas, to ensure a prudent and rational use of gas deposits in areas within the Netherlands and on the continental shelf in the long term interest.

Cross-border, allocation transmission capacity

The system of tariff regulation outlined above does not apply to GTS' tasks referred to in Section 10(1) of the 2000 Act in so far as this relates to (i) gas transmission that crosses the national border; and (ii) the allocation of transmission capacity takes place by means of an auction or another market-based method.[82] The purpose of this article is to allow for oversubscription and buy-back as well as an auction premium on top of the regulated tariffs. It does not, however, mean that the ACM does not set the reserve prices in the auction,

New infrastructure

The 2000 Act provides for powers of the MEA to grant an exemption for all or part of new infrastructure and cross-border infrastructure from the provisions governing, inter alia, the regulatory control of tariffs or tariff methodologies. According to Chapter 2.4a (Sections 18h-18i) of the 2000 Act the MEA can only grant an exemption if strict conditions are met, which are reflected in Article 36(1) of Directive 2009/73/EC.

3.1.4. Regulatory rules with respect to innovation

Specific duties of the TSO aimed at encouraging innovation

Duties, including any which are relevant to innovation, are more fully described in Section 3.1.2 above. There are no explicit duties about innovation. The TSO will also have a role in delivering/participating in mechanisms, which support the development of innovation.

Specific duties of the NRA aimed at encouraging innovation

There are limited duties on ACM to encourage innovation in terms of the statutory framework. However, the duty to encourage innovation is more implicit in the general duty of ACM to ensure that it secures the efficient, economic and reliable execution of activities by GTS.

Features of financing mechanisms designed to incentivise investment in innovation and result in a balance between innovation and effectiveness

As is demonstrated above GTS is regulated in such a way that the efficient costs of investments in the gas grid are fully socialised through the regulated connection and transmission tariffs.

3.1.5. Regulatory rules with respect to security of supply

Specific duties of the TSO aiming at safeguarding security of Supply

Duties, including those applicable to security of supply, are more fully described in Section 3.1.2 above. The TSO also has a role in delivering/participating in mechanisms, which support security of supply objectives.

Specific duties of the NRA aiming at safeguarding security of supply

See section above, with regard to the legal powers and duties available to GTS in terms of security of supply. ACM exercises these duties largely through the mechanisms more widely described in the section on financing mechanism above.

[81] As referred to in Section 2.3 of the Spatial Planning Act (*Wet ruimtelijke ordening*).
[82] Section 82(11) of the 2000 Act.

3.1.6. Institutional or procedural constraints on the performance of the TSO's role

GTS' net income sensitivity

GTS' business, financial condition and net income is sensitive to and may be materially affected by regulatory decisions which are based on estimated data (such as inflation), historical data, assumptions, research, efficiency and productivity goals which may be too stringent, fail to acknowledge costs which GTS cannot avoid incurring and, consequently, deviate from actual values or costs made. In addition, changes in the value of the parameters or in the regulatory methodology used will impact the revenue levels of GTS and therefore will impact its cash flows, results of operations and financial position.

Spatial planning

Planning processes and various legislation associated with the obtaining of appropriate planning consents can clearly act as a legal constraint on the development of the transmission network in any particular project. Any project promotor will need to develop such projects conform the requirements of the legal framework as a whole, and this will include planning processes.

WACC

GTS' level of permitted revenues includes a component based on the WACC set by the ACM. This regulatory WACC is based on historical data, which precede the regulatory period for which the WACC is determined. The WACC is determined by the extent to which GTS is financed by means of debt and shareholders' equity (gearing), the cost of debt and shareholders' equity, respectively, the corporate income tax rate applicable and inflation.

Ex post efficiency assessment by the ACM of investments made by GTS

Part or all of the investments made by GTS (directly or indirectly) may be deemed inefficient and consequently not permitted to be included in the revenue cap. This will affect the revenue levels of GTS and therefore will affect its cash flows, results of operations and financial position.

Cutting Groningen gas production, security of supply

The current legislative proposal on Groningen will actually put security of supply as a secondary consideration to safety of the people in the region. The new legislation imposes new duties on GTS to reduce demand and maintain security of supply and allows cost to be passed on in tariffs subject to ACM approval.

3.2. Regulatory practice

3.2.1. Overview over regulatory practice in the Netherlands

Main regulatory barriers

The interviewees were generally satisfied with the NRF in the Netherlands, especially regarding its support of security of Supply projects. Yet, they also recognize two of the regulatory barriers mentioned in the questionnaire:

- The stakeholders acknowledged that he recognizes the barriers named by us. In addition, the Dutch regulation is focussed on the TOTEX. If a project reduces TOTEX, it is supported by the regulation, otherwise they probably will not do the project, as they are punished by the benchmark;
- Regarding the share of CAPEX/OPEX: although, in theory, the shares should not matter, the stakeholders acknowledged that there might be qualitative effects. A bias towards CAPEX solutions might have an additional disadvantage, as OPEX solutions are more flexible and can be aborted easier in case they do not deliver the efficiency/cost reductions expected, while CAPEX solutions last for 30 years.

Possible improvement of the NRF

From the interviews, the following improvements to the NRF could be derived:

- Reduction of uncertainty stemming from benchmarking by:
  - Accounting for the innovativeness of a technological solution in a benchmark to give an incentive to innovate. Note that one can argue if 'innovativeness' is a goal in itself and should be stimulated;

  - Do not apply benchmarking to SoS projects, which are necessary to maintain a higher SoS standard than abroad. Note that at least some aspects of SoS, such as an increase in grid capacity, are considered an output in the benchmark which means they are rewarded.
- Innovations are considered important for the energy transition, e.g. related to the integration of gas with different qualities, such as biogas, green gas, hydrogen in the current system.

3.2.2. Regulatory practice related to innovation

Innovative projects

In general, the interviewee notes that GTS does not do much in the area of innovation, mainly because investments currently are limited and there are little incentives to do so. Nevertheless, the interviewees mentioned that innovative technologies are applied when pipelines are constructed or replaced and that innovations related to IT systems are deployed. Examples of projects are:

- Projects to explore how bio-methane and hydrogen can be integrated in the network;
- Use of drones for inspections;
- The balancing system has been completely renewed with some innovative features, e.g. forecasting of net load;
- Another new innovative area is data mining and data science applications.

In addition to the typological innovative infrastructure investments on our list, the interviewees note that activities that are aimed at improving the functioning of the market can also be considered innovative (e.g. market integration BBL ((Balgzand Bacton Line), changes to the balancing regime).

Adequacy of the NRF relating to its support for innovative investments

Innovative projects, which do not bring about cost reductions or efficiency gains, are not undertaken. As mentioned above, GTS does not do much in the area of innovative infrastructure – innovation has to be aimed at cost reduction and efficiency gains. The projects named above are aimed at cost reduction. There are no regulatory incentives for innovation, which do not bring about efficiency gains and cost reductions. However, there are several subsidy schemes for innovative applications of gas.[83]

Since 2016/17, benchmarking has been deployed additionally, the result being that no costs made which are not mirrored by concrete output are compensated. The benchmark is an additional incentive to become efficient, but also to become more risk-averse. The TSO hence acts risk-averse and carefully.

Furthermore, the innovativeness of a technological solution is not valued in a benchmark. Yet, this could be solved within the benchmarking framework. If innovativeness of solutions was accounted for, the costs for R&D and extra quality of the output could be valued. This would give an incentive to innovate.

On the other hand, the regulation works well for innovations in the area of services. Most of the TSO's innovations have been made in this area actually, e.g. the development of a new balancing regime. Innovations in services they can offer to the client are supported by the regulation as they bring about efficiency and cost reductions.

The interviewees also mention that a 'MFA budget (*marktfaciliterende activiteiten*)' used to exist, i.e. a budget aimed at improving the market. Yet, this budget has been abolished, the reason that it was abolished was that it was not used which makes it unlikely that projects are not started that would have been started with the budget.

Furthermore, some interviewees would like to do the innovations they consider important for the energy transition. Yet, the development of the energy transition is left to other market players and the TSO is confined to the tasks foreseen in the regulation. This constrains the possibilities of TSOs for innovation – innovation can only be done within the tasks given to the TSOs.

[83] <https://www.rvo.nl/subsidies-regelingen/subsidies-energie-innovatie-topsector-energie>.

The types of innovative projects the TSO wants to undertake relate to, for instance, the way of integrating gas with different qualities, such as biogas, green gas, hydrogen in the current system.

3.2.3. Regulatory practice related to security of supply

Security of supply projects

The regulation regarding security of supply is clearer because security of supply is a requirement in the Netherlands. Therefore, the provision of security of supply is well regulated.

Ongoing projects encompass all projects relating to Groningen and the related changes, and all investments of GTS to guarantee security of supply.

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

In general, the regulatory framework is adequate to support security of supply projects.

Benchmarking is still playing a role here, as it creates uncertainty about whether all costs will be reimbursed for the Dutch TSO. The reason is that other countries the Netherlands is compared to have different norms: security of supply is very important in the Netherlands, resulting in very strict security of supply norms, whereas the norms in other countries might be less strict. If the Dutch gas TSO does high quality investments more often than other TSOs, there is a risk that those investments are not rewarded the benchmarking system. If the high quality norms are given by law, there are possibilities to do these investments outside of the scope of benchmarking. Otherwise, benchmarking could work as a disincentive for investments above the minimum quality requirements.

3.2.4. Illustrative specific projects

The following projects are examples of successful innovative or security of supply projects and hence illustrate how the regulatory regime works in practice.

Projects related to reduction of gas production in Groningen field (security of supply project)

As a result of the decrease of production from the Groningen field the TSO will have to adapt the network, the TSO expects that this will require investments in order to ensure the security of supply. Recently, the NRA has clarified how investments will be treated in the regulatory framework and in the international benchmark in particular.[84] According to ACM 'Quality conversion' activities (from H-gas to L-gas) will not be part of the benchmark. For all other activities, the NRA will consider if the investments are comparable to those made by international peers.

Green gas booster (innovative project)

In 2018, GTS has started to build a Green-gas booster near the site of a waste treatment facility in Wijster. Green gas is preferably injected locally. During the summer period, the local demand for gas is low, whilst the production of green gas remains constant. A 'Green-gas Booster' makes it possible to inject all year around by making it possible to inject green gas in the high-pressure transmission network.

GTS obtained permission for this project from the Minister of Economic Affairs and Climate. This permission was granted despite a negative advice by the regulator. The regulator gave this negative advice, as it was not convinced that the Green gas booster falls within the scope of the legal tasks of the TSO. Moreover, not all possible alternatives were sufficiently considered according to the regulator.

Additional import at Oude StatenZijl (security of supply project)

This project is included in the 'KCD Investment Plan 2017'. In order to transmit additional Russian gas supplied by Nord Stream 2 to the Netherlands, network are necessary. There is as yet no clear indication of a range of potential capacity needs at the Dutch border. Up to an

[84] ACM/UIT/493631.

additional capacity of at least 12 GW, the associated investments in the GTS system would be limited to the debottlenecking of the Oude Statenzijl area.

Jason (Scada system) (innovative project)

The TSO has invested in a new IT-system (Scada, Supervisory Control and Data Acquisition) for the gas transmission network. According to the TSO, this system is innovative.

This investment did not require approval as the TSO is responsible for the operation of the network and its remuneration is based on the TOTEX-approach.

Expansion of the entry capacity from GATE LNG Terminal (security of supply project)

This project is included in the 'KCD Investment Plan 2017'. The TSO has the statutory task to develop the network in the Netherlands. An expansion of the only LNG terminal in the Netherlands requires corresponding expansion measures in the network. The currently contracted entry capacity by customers of Gate does not exceed the required capacity of the network, but an expansion of the terminal requires corresponding expansion measures in the GTS network.

3.3. Options for improvement

3.3.1. Options to improve regulatory practice

As the above shows, both the Ministry of Economic Affairs and the NRA apply a relatively 'light touch approach' towards investments made by the TSO. A 'light touch approach' means that the NRA assesses efficiency *ex post* and does this on a TOTEX-basis.

(i) Assessment of investment framework in investment plan

Generally, the NRF is considered adequate in supporting security of supply investments. Currently, there are no indications that the implementation practices provide inadequate incentives to ensure security of supply. Respondents point out there may be a bias towards TOTEX-solutions. If this is considered a problem , one option for improvement that could be considered is to include an assessment of the trade-off between OPEX and CAPEX in the investment plan. This aims to ensure that investment decisions are not biased towards CAPEX-solutions leading to explicit consideration of OPEX-solutions. This could also help the NRA to achieve a better understanding on the use (and costs and benefits) of innovative solutions that are applied by the TSO.

(ii) Forward-looking modelling of costs

Currently, revenues are set based on historic costs. The revenue cap is increased when large projects are put into service, 1% of CAPEX is added to the revenue cap. Any additional increases in operational expenditures would need to be pre-financed by TenneT before they are incorporated in the revenue cap at the start of the next regulatory period. Another option to reduce the risk of any CAPEX-bias is to model the (efficient) expected operational expenditures in a forward-looking way, and to take the results into account when setting the revenue cap. This would reduce the reliance on historic costs when setting rates. Note that a forward-looking approach does have disadvantages that need to be considered, it can reduce efficiency incentives for example.

(iii) Statutory requirement to consider alternatives

Where there is an obligation or incentive to build new lines, it may sometimes be more cost-effective to explicitly allow the TSO to also consider other options, such as procuring flexibility. The conditions under which this would be deemed a desirable solution should be made explicit in legislation to provide legal certainty to network users.

(iv) Statutory 'ear-marking' requirement

While respondents do not point out any major problems with respect to innovation or the adoption of new innovative technologies, it cannot be ruled out that improvements can still be made. If it is deemed desirable to strengthen the incentives for the TSO to adopt new technologies, even when they do not directly reduce TSO costs but have wider benefits, the following legislative change could be considered. A requirement could be introduced obliging the TSO to ear-mark a budget for innovation or to apply for innovation funds (financed through regulated tariff revenues) by submitting project proposals to the regulator.

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.

3.3.2. National law mechanism(s) for implementing options

As regards option (i), this could be incorporated in lower level legislation ('Besluit_investeringsplannen_en_kwaliteitsborging'), making explicit what the contents of the investment plan should be.

We consider that option (ii) could be implemented using legal powers already available to the NRA or others under the existing NRF.

As regards option (iii) (Statutory authorisation to consider alternatives), the suggestion of incorporating a mandatory requirement in legislation for the TSO to explain what alternatives have been looked at when developing the national TYNDP plan, could be implemented by including such an obligation in the Gas Act through the Dutch Legislative Process.

As regards option (iv) (statutory authorisation to consider alternatives), we understand that the legal mechanism for implementing this option would involve the modification of the Gas Act through the Dutch Legislative Process.

Turning to option (v) (statutory 'ear-marking' requirement), we expect that this could be implemented by including such a requirement in the Gas Act through the Dutch Legislative Process.

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.

Changes to the way OPEX are treated in the NRF during a regulatory period might have some implications for the way in which projects are executed. The impact depends on the extent to which any CAPEX-bias influences investment decisions in practice.

Option (i), (ii) and (iv) would somewhat increase the work load of the regulator. The administrative burden for the TSO would also increase, that is especially the case with option (iii), and to a more limited extent also option (ii).

Please note that we have not analysed all the effects of the suggested options for improvement in detail. These need to be considered when further developing and fine-tuning the options.

ANNEX I: TYPOLOGICAL INVESTMENTS – ELECTRICITY

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

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

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

ANNEX II: TYPOLOGICAL INVESTMENTS – GAS

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

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

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

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

ANNEX III: POTENTIAL REGULATORY BARRIERS FOR PROJECTS

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

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

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