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

Country Report - Portugal

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The NRF in Portugal

The national regulatory authority of both the electricity and natural gas industries (as well as for the liquefied petroleum gas, petroleum-derived products and biofuels sectors, as of 2018) is *Entidade Reguladora dos Serviços Energéticos*, a public entity with administrative and financial independence and regulation, supervision and sanctioning powers.

Alongside ERSE, the Directorate General for Energy and Geology is the competent entity for granting licences and other administrative authorisations concerning energy-related activities.

The incumbent TSO is *REN – Rede Eléctrica Nacional, S.A.*, for electricity, and *REN – Gasodutos, S.A.*, for natural gas, both subsidiaries of *Redes Energéticas Nacionais, SGPS, S.A.*, who are the holders of exclusive public service concessions for the electricity and gas transmission networks.

Transmission activity is subject to ERSE's regulation, which determines the tariffs applicable to the provision of such services by the TSO, i.e., the tariff paid for the use of the transmission network by the generators and the distribution system operator, which corresponds to REN's allowed revenues in its capacity of TSO. These revenues are intended to cover REN's costs with its TSO activity, including the investments made to develop the transmission network.

ERSE established the methodology and criteria used to evaluate investments in electricity and gas infrastructure projects and the higher risks incurred by them. According to the mentioned methodology, if the TSO's investments are included in the Transmission Network Development and Investment Plan, as approved by the Government, the corresponding costs shall be considered by ERSE when determining the network access tariffs.

The regulatory framework with regards to the establishment of administrative tariffs is based on the following incentives: i) price cap methodology with the establishment of efficiency targets for cost reduction of the OPEX, ii) efficiency targets applied to investment costs value at reference costs in the electricity sector, and iii) the 'Incentive for Economic Streamlining of TSO Investments' in the electricity sector[1].

ERSE has specific duties aimed at encouraging energy efficiency, in particular with regards to energy consumption, but there are no duties aimed at encouraging innovation.

The entity responsible for ensuring grid reliability is the TSO. The TSO must also collaborate with the DGEG on the elaboration of the annual monitoring report on safety of supply.

The regulatory practice in Portugal

As no Development and Investment Plan has been approved, projects to develop the transmission network are being approved by the member of the Government responsible for energy affairs on a case by case basis.

The usual procedure is that the TSO submits an investment plan, the NRA provides an opinion after a public consultation, and then the government will approve the plan. In Portugal, the regulator does not have a binding opinion it is always a recommendation. The investment plan has to be approved by the government and currently it also has to go through parliament.

There is a great deal of pressure to keep costs down thus the regulator has to be cautious. Any investment that is not absolutely required will not be approved.

These projects are generally approved and added to the Regulatory Asset Base (RAB). The regulator does have some leeway on whether to add all these projects to the RAB.

[1] The main goal of the incentive is the optimization between the gross assets in exploitation and the net assets remunerated by the tariffs of use of the transportation network through: i) maximization of the subsidies and the contributions to investment and ii) management of the life cycle of all assets.

The main focus in the recent past has been on urgent projects and security of supply projects. This resulted in limited funding for innovative projects. If innovative projects ensure lower costs in the future then these projects are also eligible for funding. The recently introduced incentive "for Economic Streamlining of TSO Investments" allows the TSO to benefit from innovation even if does not result in lower costs or a higher RAB.

A potential barrier for innovative investments is that in Portugal a regulatory period of three years is applied. This may give the TSO a limited time frame to benefit from innovations that result in cost reductions.

There are a limited number of investment projects aimed at increasing the security of supply. The TSO have been able to do the minimum necessary and there are no indications that the security of supply is insufficient. However, there are differences of opinion about the question if the TSO has been able to invest sufficiently in electronics and instrumentation.

Options for improvement

The stakeholders have criticized the lack of long-term perspective on innovative investment.

Investments in Portugal are approved on a case-by-case basis, as there is no approved investment plan. The following options for improvement are suggested:
(i) Statutory reference to innovation; and
(ii) Consultation on (and approval of) investment plans.

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 0 for electricity and Section 3.2 for gas examine the regulatory practice in Portugal, 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 Portugal. 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 Portugal

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

Under Portuguese law, the transmission activity entails the use of an extra-high voltage (voltage between phases with an effective value higher than 110 kV) and high voltage (voltage between phases with an effective value between 45 kV and 110 kV or less) network.

In Portugal, the most recent government policy for the energy sector (including electricity) is set out under the National Plan of Action for Energy Efficiency 2013–2016 (PNAEE 2016) and the National Plan of Action for Renewable Energies 2013–2020 (PNAER 2020), both approved by Council Resolution no. 20/2013 of 10 April.

The National Electricity System is governed mainly by Decree-Law no. 29/2006, of February 15[(2)], which establishes the general framework for the organisation and functioning of the National Electricity System, and Decree-Law no. 172/2006, of August 23[(3)], which regulates the legal regime applicable for pursuing the activities of generation, transmission, distribution and supply of electricity and for the organisation of electricity markets.

Under the Portuguese electricity market framework, activities relating to generation, supply and management of organised markets are liberalised and only require previous compliance with a licensing or authorisation/registration process. Transmission, distribution and supply of last resort are regulated activities provided through the award of licences or concessions.

Electricity transmission is carried out through the national transmission network; rights to construct and operate the national transmission network are exercised under an exclusive public service concession granted by the Portuguese government for a 50-year period (currently until 2057). The incumbent TSO is *REN – Rede Eléctrica Nacional, S.A.* ("REN"), a subsidiary of *Redes Energéticas Nacionais, SGPS, S.A*.

Portuguese law establishes a certification procedure for the transmission system operator (in order to ensure compliance with unbundling obligations), which is carried out by the Portuguese Regulatory Authority for Energy Services ("ERSE"). On 9 September 2014, ERSE issued a decision certifying that REN complies with the relevant legal requirements to be considered a transmission system operator compliant with unbundling obligations, subject to the conditions set out therein.

All entities participating in the National Electricity System (including the TSO) must comply with public service obligations, such as safety, regularity and quality of supply and grid access to all clients.

Pursuant to article 24 of Decree-Law no. 29/2006, the TSO must:

1. Operate and maintain the National Transmission Network in safety, reliability and quality conditions;
2. Manage the grid's electricity's flows;
3. Provide system services to the grid's users;
4. Guarantee the National Transmission Network long term capacity, contributing to the safety of supply;
5. Plan, develop and manage the National Transmission Network as to allow third party access and the efficient management of facilities and technical means available;
6. Comply with its obligations with CEER and ENTSO-E;
7. Not discriminate between users or categories of users;
8. Provide information to the National Transmission Network's users deemed necessary to access the grid;

(2) Amended, in particular, by Decree-Laws no. 215-A/2012, of October 8, 178/2015, of August 27 de Agosto and by Law no. 42/2016, of December 28.

(3) Amended, in particular, by Decree-Law no. 215-B/2012, of October 8, Law no. 7-A/2016, of March 30, Decree-Law no. 38/2017, of March 31, Decree-Law no. 152-B/2017, of December 11 and Law no. 114/2017, of December 29.

9. Provide the operator of another network, to which it is connected to, and to all participants within the National Electricity System the necessary information to develop the relevant grids and allow its safe and efficient functioning;
10. Preserve the confidentiality of commercially sensitive information obtained within the TSO's activity and prevent the disclosure of information regarding its activity that may deemed as commercially advantageous, except when required to do so by the Directorate-General for Energy and Geology ("DGEG") and the NRA, ERSE, and the European Commission;
11. Anticipate the level of reserves necessary to guarantee safety of supply in the short and medium terms;
12. Anticipate the use of generation equipment and, in particular, the use of hydroelectric reserves;
13. Receive from the market operators and all agents directly interested all the information necessary to the system's technical management;
14. Publish all information deemed necessary to promote competition and the market's efficient functioning.

The national regulatory authority of both the electricity and natural gas industries is the aforementioned ERSE, a public entity with administrative and financial independence. ERSE's bylaws were enacted by Decree-Law no. 97/2002 of 12 April, as amended by Decree-Law no. 212/2012 of 25 September, by Decree-Law no. 57-A/2018, of 13 July and by Decree-Law no. 69/2018 of 27 August.

ERSE is in charge of regulation, supervision and sanctioning in the aforementioned sectors, from generation to supply. Recently, Law no. 9/2013, which came into force on 28 January 2013, established the Energy Sector Sanctioning Regime, which substantially reinforced ERSE's sanctioning competence and powers. Later, Decree-Law no. 84/2013 of 25 June revised ERSE's bylaws, completing the implementation of Directives 2009/72/EC and 2009/73/EC. Decree-Law no. 57-A/2018, of 13 July and Decree-Law no. 69/2018 of 27 August recently extended ERSE's powers to the liquefied petroleum gas, petroleum-derived products and biofuels sectors.

The TSO's activity is also governed by regulation approved by the NRA, such as:
a. Networks Operation Regulation, approved by Regulation no. 557/2017, of December 19, as amended by Regulation no. 621/2017, of December 18;
b. Networks Access and Interconnections Regulation, approved by Regulation no. 560/2014, of December 22, as amended by Regulation 620/2017, of December 18;
c. Tariffs Regulation, approved by Regulation no. 619/2017, of December 18;
d. Commercial Relations Regulation, approved by Regulation no. 561/2014, of December 22, as amended by Regulation no. 632/2017, of December 21;
e. Service Quality Regulation, approved by Regulation no. 629/2017, of December 20.

Alongside ERSE, the DGEG, a state-administered entity with financial independence, has the task of implementing and developing the state's policies regarding energy matters and the exploitation of geological resources.

As such, and in most cases, the DGEG is the competent entity for granting licences and other administrative authorisations concerning energy-related activities, such as generation or operation licences.

The DGEG is also responsible for the approval of the Transmission Network Regulation (the Regulation currently in force was approved by Appendix I of Ministerial Order no. 596/2010, of July 30).

The Portuguese Competition Authority enforces rules concerning anti-trust provisions contained in the Treaty on the Functioning of the European Union and in Council Regulation (EC) no. 139/2004 of 20 January 2004. The Portuguese Competition Authority is empowered to fully apply those rules in respect of the economic principle of market economy and free competition, in view of an efficient functioning of the markets, an effective distribution of resources and the interests of consumers.

2.1.2. Specific legal rights and duties

Role of the TSO

The scope of the TSO's concession agreement includes the planning, construction, operation and maintenance of all infrastructure, which forms part of the National Transmission Network, as well as the interconnections to networks to which it is connected to, and all installations necessary for its operation (Appendix III of Decree-Law no. 172/2006).

Pursuant to article 36/3 of Decree-Law no. 172/2006, the TSO must prepare the Transmission Network Development and Investment Plan every odd year. This Plan must contain, at least:
a. information on infrastructure to be constructed or modernised in the following 10-year period, including indication of the investment decided by the TSO (and, among these, those projects that are to be executed within the next three years), and respective execution calendar;
b. obligations arising from MIBEL and objectives set out under Regulation 714/2009 of the European Parliament and of the Council of 13 July 2009; and
c. joint measures adopted by the Agency for the Cooperation of Energy Regulators and European Network of Transmission System Operators for Electricity, notably the non-binding 10-year plan for a European-wide transmission network.

This Plan must take into account:
a. the supply safety monitoring report prepared by the Government;
b. technical characteristics of the network and electricity supply and demand; and
c. coordination with the planning of the networks, which are interconnected with the national transmission network (including neighbouring networks).

The Plan's proposal must be submitted to the DGEG. After the DGEG analyses the Plan, it may suggest amendments to the TSO and shall submit the Plan to the NRA, for a 30-day public consultation.

Upon the public consultation, the NRA shall issue an opinion, if necessary determining amendments to the Plan. The TSO must then adapt the Plan accordingly and submit it once again to the DGEG. The Plan is then submitted to the member of the Government responsible for energy affairs, who shall decide to approve or to reject the Plan based on the opinions of the NRA, the results of the public consultation and the discussion of the Plan by the Parliament.

The Plan can only be rejected if the TSO did not include the DGEG and the NRA's amendments or if it does not contain the investments necessary to fulfil the objectives of national energy policy.

Since the enactment of Decree-Law no. 215-A/2012, of October 8 and Decree-Law no. 215-B/2012, of October 8, which have amended Decree-Law no. 29/2006 and Decree-Law no. 172/2006, respectively, establishing the procedure for the elaboration and approval of the Plan, no Plan has ever been approved or rejected by the Government.

Please note that Portuguese law does not establish a consequence for the non-approval and the non-rejection of the Transmission Network Development and Investment Plan.

Undertaking of investments

The TSO undertakes investments authorized by the grantor of the concession agreement. The projects undertaken by the TSO are the ones identified in the relevant Plan, as duly authorized by the Portuguese Government according to the procedure described above.

Role of NRA

See the subsection about the role of the TSO above.

Institutional or procedural constraints on the performance of these roles

The procedure of the approval of the Transmission Network Development and Investment Plan was, until recently, based on the technical assessment conducted by the DGEG and ERSE. The Government can only reject the Plan when it does not contain the amendments determined by those entities or when the investment projects are not adequate to comply with the energy policy targets.

In the context of the financial crisis in Portugal, there is an ongoing discussion on the price of electricity, which, regardless of the supplier, includes regulated tariffs, in particular the tariff for the use of the transmission network (integrated into the grid access tariffs) which ultimately grants the TSO its allowed revenues, as determined by ERSE.

As such, the approval of investment on the transmission network and its impact on grid access tariffs became an issue of political interest and all parties involved, including the Government, have become more critical and rigorous.

Additionally, Law no. 42/2016, of December 28, which approved the State Budget for 2017, has determined, by means of an amendment to article 30 of Decree-Law no. 29/2006, that the Transmission Network Development and Investment Plan must also be analysed and discussed by the Portuguese Parliament.

The intervention of all these entities allow greater scrutiny of the investment projects to develop the transmission network, and while it may not constrain the performance of the TSO, the NRA, the DGEG and the Government's roles, it does make for a more difficult procedure.

2.1.3. Mechanism for financing of investment projects

Transmission activity is subject to ERSE's regulation, which determines the tariffs applicable to the provision of such services by the TSO, i.e., the tariff paid for the use of the transmission network by the generators and the distribution system operator, which corresponds to REN's allowed revenues in its capacity of TSO. These revenues are intended to cover REN's costs with its TSO activity, including the investments made to develop the transmission network.

The determination of such tariffs must comply with certain legal principles that, in particular, aim at guaranteeing transparent and efficiency-driven pricing, as well as the protection of electricity consumers and equality of treatment and must also guarantee that the TSO has an incentive to increase its activity and the network's efficiency and promote market integration. The methodology for the calculation of the mentioned tariffs is approved by ERSE's Tariff Regulation of the electricity sector.

Pursuant to article 13/6 of Regulation (EU) no. 347/2013 of the European Parliament and of the Council, of 17 April 2013, on guidelines for trans-European energy infrastructure, ERSE published on September 2015 its methodology and the criteria used to evaluate investments in electricity and gas infrastructure projects and the higher risks incurred by them.

According to the mentioned methodology, if the TSO's investments are included in the Transmission Network Development and Investment Plan, as approved by the Government, the corresponding costs must be considered by ERSE when determining the network access tariffs. These costs are divided into investment costs (CAPEX) and operation costs (OPEX).

With regards to the OPEX, efficiency targets are established in order to achieve cost reduction. Prior to the end of each regulatory period (3 years), the performance of the company is evaluated so as to determine if those targets were met or not, if the methodology is efficient and if the incurred costs match the costs that are recovered through the regulated tariffs. According to the results of such analysis, the following regulatory parameters may be adjusted: i) the OPEX base level to be recovered during the next regulatory period, ii) the efficiency targets applicable to these costs, and iii) the external variables that justify the cost evolution.

With regards to the CAPEX, a rate of return is applied over the regulated assets, i.e. the assets for which remuneration and amortization are considered when determining the tariffs. The rate of return is established for each regulatory period considering the activity's risk, as well as financing costs.

The return rate corresponds to the weighted average cost of capital, which considers the borrowed capital's cost (cost of financing) and the cost of equity (calculated through the Capital Asset Pricing Model) and is indexed to the evolution of the country's financial conditions.

In order to eliminate the main investment risks, ERSE implements other regulatory measures:

1. Risk of non-compliance with deadlines:
   The financial costs associated with the investments are included in the investment costs incorporated into the regulated assets, which costs shall be recovered through the tariffs. As such, any financial cost that is increased due to non-compliance with deadlines are included

in the access tariffs and thus recovered. As a way to mitigate such risk, investment costs are only recovered after the projects enter into operation;
2. Risk of stranded assets:
   Upon entry into operation, these are included in the regulated assets and considered for the CAPEX calculation until they are totally amortized;
3. Risk of dismissing the planned investments:
   The expected costs associated with investments that will likely enter into operation on a given period shall be included in the regulated assets for the purposes of the establishment of network access tariffs for the subsequent years. However, the foreseen costs are adjusted, taken into consideration the costs really occurred (see point 4);
4. Risk of mismatch between real CAPEX and expected CAPEX:
   The network access tariffs include the expected investment costs. The difference between these and the real costs is included in the tariffs two years later, including costs or financial gains associated with any deviation[4].

The regulatory framework is based on incentives: i) price cap methodology with the establishment of efficiency targets for cost reduction of the OPEX, ii) efficiency targets applied to investment costs value at reference costs, iii) incentive for economic streamlining of TSO investments in the electricity sector[5], and iv) incentive to increase assets availability.

Relevant product categories

The projects undertaken by the TSO financed through regulated tariffs are the ones identified in each Plan, provided the Plan is approved by the Government.

The 2017 Plan for the 2018-2027 was under discussion until March 29, 2018 and identifies two categories of projects:
a. Base Projects, which in the TSO's opinion must be carried out in order to guarantee the infrastructures' safety and operation, including the assets' refurbishment and modernisation works – for instance, the modernisation of panels and extra-high and high voltage equipment on several substations, the substitution of power transformers, the refurbishment of protection, automation and control systems and the remodelling of extra-high voltage lines – and the projects associated with commitments with the distribution system operator – for instance, the transformation reinforcements in Falagueira and Pedralva, the increase of safety conditions of the Ermesinde substation and the substations located in Trás-os-Montes and the investment on a new injector for Vila Nova de Famalicão; and
b. Complementary Projects, which include works deemed necessary in light of the national energy policy and of the need to promote social and environmental sustainability. The TSO submits the proposals and the final investment decision is made by the grantor of the concession, i.e., the Portuguese Government. These proposals are thus viewed as conditional, as each project's execution is subject to the formal request by the DGEG, ERSE and other external stakeholders and to the Government's authorization. As such, the TSO does not establish an execution calendar for these additional projects on the 2017 Plan, which include, for instance, the new interconnection Minho-Galiza, the Fundão-Falagueira and the Vieira do Minho-Ribeira da Pena-Feira 400 kV connections, the new Divor substation and the refurbishment of the 220 kV lines in Oporto and Lisbon.

2.1.4. Regulatory rules with respect to innovation

Specific duties of the TSO aimed at encouraging innovation

We are not aware of any legal duties aimed at encouraging innovation.

[4] For instance, if the investment is not realized the cost previously foreseen to the investment and included into the tariff already paid by the network users are given back to the them through a tariff deduction.

[5] The main goal of the incentive is the optimization between the gross assets in operation and the net assets remunerated by the tariffs of use of the transportation network through: i) maximization of the subsidies and the contributions and ii) management of the life cycle of all assets. This incentive is, in somehow, a Totex approach. The incentive also stimulates the TSO to improve functional aspects of network operation.

Specific duties of the NRA aimed at encouraging innovation

ERSE has specific duties aimed at encouraging energy efficiency, in particular with regards to energy consumption, but there is no specific duty aimed at encouraging innovation.

2.1.5. Regulatory rules with respect to security of supply

Specific duties of the TSO aiming at safeguarding security of supply

The entity responsible for ensuring grid reliability is the TSO. To achieve this goal the TSO uses its attributions as the global manager of the National Electricity System, notably through its functions of system technical management, system services procurement and market-making, energy planning and transmission network planning.

The TSO must also collaborate with the DGEG on the elaboration of the annual monitoring report on safety of supply, which shall cover the balance between demand and supply within the national market, expected level of demand and available supply, supplementary capacity (both expected and under construction), as well as quality and grids' maintenance level and the measures destined to deal with extreme demand and the generators or suppliers breakdowns. This report is published by the Government on the DGEG's website by July 31 of each year and must be sent to ERSE and the European Commission.

Specific duties of the NRA with respect to security of supply

According to article 3/2, paragraphs *h)* and *q)* of ERSE's statutes, ERSE must monitor investment in electricity generation capacity as to guarantee security of supply and promote Iberian interconnections destined to increase competition and security of supply.

Also, please refer to Section 2.1.2. with regards to the NRA's role within the approval procedure of the Transmission Network Development and Investment Plan.

2.2. Regulatory practice

2.2.1. Overview over regulatory practice in Portugal

Information about the general regulatory framework in Portugal

The usual procedure is that the TSO submits an investment plan, the NRA provides an opinion, and then the government will approve the plan. In Portugal, the regulator does not have a binding opinion it is always a recommendation. The investment plan has to be approved by the government and currently it also has to go through parliament.

There is a great deal of pressure to keep costs down thus the regulator has to be cautious. Any investment that is not absolutely required will not be approved.

Since 2012 the government has not taken any decision on the plans. Currently some projects are being approved on a case by case basis. The TSO submits it for approval to the government and the regulator provides an opinion. These projects are generally approved and added to the Regulatory Asset Base (RAB). The regulator does have some leeway on whether to add all these projects to the RAB. Any decision to not include a specific investment into the RAB is preceded by the submission to the tariff council, for a non-binding opinion, explaining the reason why the investment is not included. The 2017 plan has been submitted and it was recommended to split the investments into "base" projects and "complementary" projects, so that the urgent projects are approved quickly and that there is more time to analyse the "not so urgent" investments. The 2017 plan is not yet published.

The 'standard costs' model used in Portugal is much more detailed than the model used in Spain. If cost items are not on the list, REN is still allowed to invest in it but there are no opportunities to beat the benchmark for additional remuneration. However, the risk is null, since it still receives a return that reflect the cost of capital, without any further conditions, like beating the standard costs. Moreover, it has been announced that in the future the standard investment cost mechanism will be reviewed during the current regulatory period.

Main regulatory barriers

In the interviews, the following regulatory barriers were discussed.

The different treatment of CAPEX and OPEX can be an issue and are continuously assessing whether they should change it at the TSO level.

Projects that result in higher CAPEX, with benefits that go to the wider society would fall under the "not so urgent" projects. With such projects, there is a risk that they are not approved for budgetary reasons. If they are approved, the TSO will be remunerated and part of regulatory asset base.

This is the reason why since 2018, ERSE has implemented a new mechanism, Incentive for Economic Streamlining of TSO Investments in the electricity sector .[6] The main goal of the incentive is the optimization between the gross assets in exploitation and the net assets remunerated by the tariffs of use of the transportation network through: i) maximization of the subsidies and the contributions and ii) management of the life cycle of all assets. The incentive also stimulates the TSO to improve functional aspects of network operation[7]. This incentive introduces some of the characteristics of a TOTEX-approach. Currently, around 9% of the TSO allowed revenues are due to this incentive.

The regulatory period is relatively short at the moment (three years), according to some stakeholders, a longer regulatory period could improve the investment climate. Other stakeholders emphasize that most regulatory mechanisms are in place for more than two regulatory periods and that the regulatory framework is very stable.

The interviewees mention that there is a legislative proposal that would shift the cost of network reinforcements to producers, this could have negative effects on investments as the (higher) costs of capital of producers instead of TSO's would be applied in investment decisions.

2.2.2. Regulatory practice related to innovation

Innovative projects

Several examples of innovative projects were mentioned, most of the projects are related to optimizing asset management (e.g. predictive maintenance, revision of towers using less materials and the integration of renewables in the system (e.g. forecasting models).

Adequacy of the NRF relating to its support for innovative investments

The main focus in the recent past has been on urgent projects and security of supply projects. This resulted in limited funding for innovative projects. If innovative projects ensure lower costs in the future then these projects are also eligible for funding. The recently introduced incentive "for Economic Streamlining of TSO Investments" allows the TSO to benefit from innovation even if does not result in lower costs or a higher RAB.

REN has a multivariable incentive for innovative projects. They are incentivized to reduce costs. They have a standard framework for investment cost based on 'standard costs'. If they beat this price, they get a premium. They are also incentivized to improve the knowledge about their assets, as there is a quality of service incentive. This is considered as an indirect way of compensating for innovation in the asset management area. Moreover, REN is incentivized to improve their efficiency and to delay as much as possible the renewal of their equipment.

A potential barrier for innovative investments is that in Portugal a regulatory period of three years is applied. This gives the TSO a limited time frame to benefit from innovations that result in cost reductions. However, since 2018 the Tariff Code includes the principle that performance related to cost reduction or any other regulatory aim achieved in the former regulatory period, shall be shared by both companies and consumers, whenever the regulator defines the parameters and the allowed revenues for the next regulatory period.

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[6] Incentivo à racionalização económica dos investimentos da atividade de transporte de energia elétrica (IREI).

[7] Currently the indicators used to evaluate functional performance of the network are: i) availability of network elements (lines and transformers), ii) quality of service indicator (equivalent interruption time) and iii) availability of interconnections capacity for commercial purposes.

According to stakeholders, EU unbundling requirements impede the TSO from participating in innovative projects aimed at the integrations of renewables in the market.

2.2.3. Regulatory practice related to security of supply

Security of supply projects

There are a limited number of investment projects aimed at increasing the security of supply. In addition to the list of 'typological investments', stakeholders mention that investments in hydropower (in the hands of generators, not the TSO) and connection to the network can also be considered security of supply investments.

The TSO has been able to do the minimal but has for example not been able to invest sufficiently in electronics and instrumentation. Interviewees mentioned that the security of supply also depends on production and storage but that the TSO is not allowed to be involved in such projects.

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

Although investment plans are not approved, the TSO is able to 'do the minimal'. Stakeholders mention that the investment climate is 'not positive' due to the discussion on network costs. Project approval is requested on a project-by-project basis.

2.2.4. Illustrative specific projects

The projects described below can be considered innovative and security of supply projects, hence the projects show how the current regulatory framework works in practice. The first two projects have not been approved or executed and highlight some of the barriers explained in the previous section. The last project, Uprating works 400 kV between Falagueira and Cedillo, is an example of a project that has been approved and executed.

Interconnection Portugal-Spain (PCI 2.17 in the EC 2017 PCI list (3rd list); Project 4 – TYNDP 2016)

Description and aim

This project allows an increase of the interconnection capacity between Portugal and Spain, meeting the objectives defined for the Iberian Electricity Market (MIBEL). Larger and more volatile flows are expected between both countries due to the increase of volatile sources and the market interchanges. The project is part of the new 400 kV interconnection axis in the North between Minho and Galicia, connecting the substation of Beariz and Fontefría in Spain and the Porto region through Ponte de Lima and Vila Nova de Famalicão substations. From this axis, the section between the Oporto region and Vila Nova de Famalicão is already in service.

Approval process and financial mechanisms

The project's execution is subject to the formal request by the DGEG, ERSE and other external stakeholders and to the Government's authorization.

Submarine cable project

Description and aim

REN had identified the off-shore investment in the 2015 Plan that would allow the connection of the Windfloat project and future off-shore windfarms to the transmission network, upon the granting, by the licensing authority, of the reception point to such project. This project investment entailed the construction of a 17 km submarine cable.

Approval process and financial mechanisms

As the Plan was not approved, the Council of Ministers issued Resolution no. 81-A/2016, of December 9, determining that REN should conclude, in a timely manner, the construction of such cable and that the cost should be financed, preferably, by European structural funds.

Integration of RES in Alentejo

Description and aim

The main objective of this project consists in introducing the network reinforcements that are needed to allow the connection of new RES generation (mostly solar but also some wind) that is foreseen for the south region of Portugal, where the solar potential is considerably high. The project includes two new 400 kV OHL that will constitute a new axis between F. Alentejo-Ourique-Tavira substations. It is also included the expansion of the Ourique substation to include the 400 kV voltage level.

Approval process and financial mechanisms

This project is part of National Power Transmission Development Plan but the permitting process has not been completed yet.

Uprating works 400 kV between Falagueira and Cedillo

Description and aim

Eurico Ferreira Portugal concluded successfully the Uprating works in the Very High Voltage (VHV) Overhead Power Transmission Line, of 400 kV, between Falagueira and Cedillo, for REN - Redes Energéticas Nacionais, it aims to increase the capacity of this transmission line, allowing its exploitation at a temperature of 85°C.This OPL is one of those that allows the interconnection with the Spanish power grid. The project started May 2017 and lasted 4 months.

Approval process and financial mechanisms

This project is part of National Power Transmission Development Plan.

2.3. Options for improvement

2.3.1. Options to improve regulatory practice

The above discussion shows that the NRF is generally adequate for security of supply projects. However, those projects are approved on a case-by-case basis and there is considerable pressure to reduce network costs. There are also issues regarding the implementation of innovative projects. This is especially the case for innovations that provide most of the benefits to other stakeholders (and not the TSO) but there are some incentives to invest in project that result in cost efficiencies.

The following options for improvement focus on these aspects.

(i) Statutory reference to innovation

The stakeholders criticized that there is no long-term perspective on innovative investment. A long-term strategic perspective can only be developed if the regulatory framework contains an explicit reference to innovation. This long-term strategic perspective could shaped by governmental policies, statutory duties or could be included in the NDP.

(ii) Consultation on (and approval of) investment plans

Investments in Portugal are approved on a case-by-case basis, as there is no approved investment plan. The formal approval of a portfolio of projects in an investment plan would provide guidance to the TSO and other market participants about the development of the electricity system in Portugal. This would reduce the risk that investments for which the benefit to the TSO or other market participants outweigh the costs are not executed.

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

We consider that, with the exception of the following, the above mentioned changes could be implemented using legal powers already available to the NRA or others under the existing NRF.

As regards option (i), the suggestion of incorporating a reference to innovation in the regulatory framework could be implemented by including such a reference on Decree-Law no. 172/2006, 2006, of 23 August, as amended, via the Portuguese Legislative Process8 Impact assessment.

2.3.3. Impact assessment

The long-term strategic perspective on innovation mentioned in option (i) necessitates efforts and coordination between the TSO and the NRA regarding the design of this long-term perspective (e.g. the organisation of stakeholder consultations, determining the scope of the innovation needed, monitoring and evaluating of how the statutory duty is translated into the long-term perspective).

We have not encountered any specific examples of projects that have been cancelled due to the regulatory framework. For this reason, we do not expect that any of the suggested changes will result in considerable changes to investment levels. Yet, if the perceived risk of innovative projects is lowered and a long-term strategic perspective on innovation could be attained by an explicit statutory reference to innovation, the share of innovative projects is expected to increase.

As mentioned in option (ii) above, a structured process for the appraisal and approval of projects would inform the TSO other market participants about the development of the Portuguese electricity system. It could also result in a better assessment of all the (social) costs and benefits of projects. A potential disadvantage is that it reduces the possibilities for the government to control network tariffs.

[8] The Portuguese Legislative Process usually entails a Government initiative, as follows: the member of the Government for energy affairs (and the corresponding Cabinet) drafts a decree-law with the needed amendment. This draft is discussed by all members of the Government – firstly by all Secretaries of State and subsequently by all Ministers. When the decree-law is approved by the Ministers, it will be submitted to the analysis and promulgation of the President of the Portuguese Republic. The Parliament may also approve legislation, either by its own initiate or in the context of a proposal made by the Government.

3. GAS

3.1. Legal analysis of the NRF in Portugal

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

Under Portuguese law, transmission activity entails the use of a high pressure (higher than 20 bar) network.

The National Natural Gas System is governed mainly by Decree-Law no. 30/2006, of February 15[(9)], which establishes the general framework for the organisation and functioning of the National Natural Gas System, and Decree-Law no. 140/2006, of July 26[(10)], which regulates the legal regime applicable for pursuing the activities of transmission, underground storage, receipt, storage and regasification on LNG terminals, distribution and supply of natural gas.

Natural gas transmission is carried out through the national transmission network and rights to construct and operate the national transmission network are exercised under an exclusive public service concession granted by the Portuguese government for a maximum 40-year period. The incumbent TSO is *REN – Gasodutos, S.A.* ("**REN**") and the concession was granted by means of article 65 (revoked in 2012) of Decree-Law no. 140/2006, pursuant to the implementation of the unbundling provisions in Portugal.

Portuguese law (article 21-A of Decree-Law no. 30/2006) establishes a certification procedure for the transmission system operator (in order to ensure compliance with unbundling obligations), which is carried out by the Portuguese Regulatory Authority for Energy Services ("ERSE"). On 9 September 2014, ERSE issued a decision certifying that REN complies with the relevant legal requirements to be considered a transmission system operator compliant with unbundling obligations, subject to the conditions set out therein.

All entities participating in the National Natural Gas System (including the TSO) must comply with public service obligations, such as safety, regularity and quality of supply and grid access to all clients.

Pursuant to article 15 of Decree-Law no. 140/2006, the TSO must:

a. Operate and maintain the National Transmission Network in safety, reliability and quality conditions;
b. Guarantee the National Transmission Network long term capacity, contributing to the safety of supply;
c. Not discriminate between users or categories of users;
d. Provide information to the National Transmission Network's users deemed necessary to access the grid.

The national regulatory authority of both the electricity and natural gas industries is the aforementioned ERSE, a public entity with administrative and financial independence. ERSE's bylaws were enacted by Decree-Law no. 97/2002 of 12 April, as amended by Decree-Law no. 212/2012 of 25 September, by Decree-Law no. 57-A/2018, of 13 July and by Decree-Law no. 69/2018 of 27 August.

Decree-Law no. 57-A/2018, of 13 July and Decree-Law no. 69/2018 of 27 August recently extended ERSE's powers to the liquefied petroleum gas, petroleum-derived products and biofuels sectors.

ERSE is in charge of regulation, supervision and sanctioning in the aforementioned sectors, from generation to supply. Recently, Law no. 9/2013, which came into force on 28 January 2013, established the Energy Sector Sanctioning Regime, which substantially reinforced ERSE's sanctioning competence and powers. Later, Decree-Law no. 84/2013 of 25 June revised ERSE's bylaws, completing the implementation of Directives 2009/72/EC and 2009/73/EC.

The TSO's activity is also governed by regulation approved by the NRA, such as:

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(9) Amended, in particular, by Decree-Laws no. 230/2012, of October 26 and by Law no. 42/2016, of December 28.

(10) Amended, in particular, by Decree-Law no. 231/2012, of October 26 and by, Decree-Law no. 38/2017, of March 31.

a. Infrastructures Operation Regulation, approved by Regulation no. 417/2016, of April 29;
b. Networks, Infrastructures and Interconnections Access Regulation, approved by Regulation no. 435/2016, of May 9;
c. Tariffs Regulation, approved by Regulation no. 415/2016, of April 29;
d. Commercial Relations Regulation, approved by Regulation no. 416/2016, of April 29;
e. Service Quality Regulation, approved by Regulation no. 629/2017, of December 20.

Alongside ERSE, the DGEG, a state-administered entity with financial independence, has the task of implementing and developing the state's policies regarding energy matters and the exploitation of geological resources.

As such, and in most cases, the DGEG is the competent entity for granting licences and other administrative authorisations concerning energy-related activities.

The Portuguese Competition Authority enforces rules concerning anti-trust provisions contained in the Treaty on the Functioning of the European Union and in Council Regulation (EC) No. 139/2004 of 20 January 2004. The Portuguese Competition Authority is empowered to fully apply those rules in respect of the economic principle of market economy and free competition, in view of an efficient functioning of the markets, an effective distribution of resources and the interests of consumers.

3.1.2. Specific legal rights and duties

Role of TSO

Pursuant to Appendix I of Decree-Law no. 140/2006, the scope of the TSO's concession agreement includes, in particular, the following activities:
a. receiving, transporting and delivering high pressure natural gas;
b. operating and maintaining all transmission infrastructure, the interconnections to which the transmission network is connected and all installations necessary for its operation;
c. planning, developing, expanding and building transmission infrastructure, as well as all installations necessary for its operation;
d. planning the Transmission Network and the use of its infrastructure, through the elaboration of an indicative 10-year Development and Investment Plan;
e. controlling and maintaining the natural gas reserve stockpiling;
f. preparing medium and long term studies on the balance between demand and supply and medium and long term security of supply monitoring reports.

Pursuant to article 12 of Decree-Law no. 140/2006 and article 26 of Decree-Law no. 30/2006, the TSO must prepare the Transmission Network Development and Investment Plan every odd year. This Plan must contain information on infrastructure to be constructed or modernised in the following 10-year period, including indication of the investments decided by the TSO (and, among these, those projects that are to be executed within the next three years), and respective execution calendar. This Plan must take into account:
a. the objectives set out under Regulation 715/2009 of the European Parliament and of the Council of 13 July 2009;
b. the supply safety monitoring report prepared by the Government;
c. technical characteristics of the network; and
d. coordination with the planning of the distribution networks.

The Plan's proposal must be submitted to the DGEG by the end of the first trimester of each odd year. After the DGEG analyses the Plan, it may suggest amendments to the TSO and shall submit the Plan to the NRA, for a 30-day public consultation.

Upon the public consultation, the NRA shall issue an opinion, if necessary determining amendments to the Plan. The TSO must then adapt the Plan accordingly and submit it once again to the DGEG. The Plan is then submitted to the member of the Government responsible for energy affairs, who shall decide to approve or to reject the Plan based on the opinions of the NRA and the results of the public consultation and of the discussion of the Plan by the Parliament.

The Plan can only be rejected if the TSO did not include the DGEG and the NRA's amendments or if it does not contain the investments necessary to fulfil the objectives of national energy policy.

Since the enactment of Decree-Law no. 230/2012, of October 26 and Decree-Law no. 231/2012, of October 26, which have amended Decree-Law no. 30/2006 and Decree-Law no. 140/2006, respectively, establishing the procedure for the elaboration and approval of the Plan, no Plan has ever been approved or rejected by the Government.

Please note that Portuguese law does not establish a consequence for the non-approval and the non-rejection of the Transmission Network Development and Investment Plan.

Undertaking of investments

The TSO undertakes investments authorized by the grantor of the concession agreement. The projects undertaken by the TSO are the ones identified in the relevant Plan, as duly authorized by the Portuguese Government according to the procedure described in Section 3.1.1 above.

Role of NRA

Please refer to the answer regarding the role of the TSO above with regards to the NRA's role within the approval procedure of the Transmission Network Development and Investment Plan.

Institutional or procedural constraints on the performance of these roles

The procedure of the approval of the Transmission Network Development and Investment Plan was, until recently, based on the technical assessment conducted by the DGEG and ERSE. The Government can only reject the Plan when it does not contain the amendments determined by those entities or when the investment projects are not adequate to comply with the energy policy targets.

In the context of the financial crisis in Portugal, there is an ongoing discussion on the price of energy, which, regardless of the supplier, includes regulated tariffs, in particular the tariff for the use of the transmission network (integrated into the grid access tariffs) which ultimately grants the TSO its allowed revenues, as determined by ERSE.

As such, the approval of investment in the transmission network and its impact on grid access tariffs became an issue of political interest and all parties involved, including the Government, have become more critical and rigorous.

Additionally, Law no. 42/2016, of December 28, which approved the State Budget for 2017, has determined, by means of an amendment to article 26/4 of Decree-Law no. 30/2006, that the Transmission Network Development and Investment Plan must also be analysed and discussed by the Portuguese Parliament.

The intervention of all these entities allow greater scrutiny of the investment projects to develop the transmission network, and while it may not constrain the performance of the TSO, the NRA, the DGEG and the Government's roles, it does make for a more difficult procedure.

3.1.3. Mechanism for financing of investment projects

Transmission activity is subject to ERSE's regulation, which determines the tariffs applicable to the provision of such services by the TSO, i.e., the tariff paid for the use of the transmission network, which corresponds to part of REN's allowed revenues in its capacity of TSO. These revenues are intended to cover REN's costs with its TSO activity, including the investments made to develop the transmission network.

The determination of such tariffs must comply with certain legal principles that, in particular, aim at guaranteeing transparent and efficiency-driven pricing, as well as the protection of consumers and equality of treatment and must also guarantee that the TSO has an incentive to increase its activity and the network's efficiency and promote market integration. The methodology for the calculation of the mentioned tariffs is approved by ERSE's Tariff Regulation of the natural gas sector.

Pursuant to article 13/6 of Regulation (EU) no. 347/2013 of the European Parliament and of the Council, of 17 April 2013, on guidelines for trans-European energy infrastructure, ERSE

published on September 2015[11] its methodology and the criteria used to evaluate investments in electricity and gas infrastructure projects and the higher risks incurred by them.

According to the mentioned methodology, if the TSO's investments are included in the Transmission Network Development and Investment Plan, as approved by the Government, the corresponding costs must be considered by ERSE when determining the network access tariffs. These costs are divided into investment costs (CAPEX) and operation costs (OPEX).

With regards to the OPEX, efficiency targets are established in order to achieve cost reduction. Prior to the end of each regulatory period (3 years), the performance of the company is evaluated so as to determine if those targets were met or not, if the methodology is efficient and if the incurred costs match the costs that are recovered through the regulated tariffs. According to the results of such analysis, the following regulatory parameters may be adjusted: *i)* the OPEX base level to be recovered during the next regulatory period, *ii)* the efficiency targets applicable to these costs, and *iii)* the external variables that justify the cost evolution.

With regards to the CAPEX, a rate of return methodology (based on the guaranteed remuneration of the regulated assets) is applied over the investments, evaluated at historical costs. This methodology guarantees the recovery of investments costs, i.e. the corresponding amortizations and the remuneration of the asset liquid of amortizations and copayments.

A rate of return is applied over the regulated assets, i.e., the assets for which remuneration and amortization are considered when determining the tariffs. The rate of return is established for each regulatory period considering the activity's risk, as well as financing costs.

The return rate corresponds to the weighted average cost of capital, which considers the borrowed capital's cost (cost of financing) and the cost of equity (calculated through the Capital Asset Pricing Model) and is indexed to the evolution of the country's financial conditions.

Additionally, the rate of return is partially indexed to the evolution of the yields of the 10-year treasury bonds of the Portuguese republic, reflecting the evolution of the country's financial conditions, which allows for the liquidity risk to be mitigated and prevents the rate of return evolving beyond a maximum and a minimum value.

As with the electricity sector, the TSO's investment costs included in the Plan approved by the Government are recovered through the network access tariffs. All investments considered regulated assets are valued at accounting costs.

In order to eliminate the main investment risks, ERSE implements other regulatory measures:

1. Risk of non-compliance with deadlines:
   The financial costs associated with the investments are included in the investment costs incorporated into the regulated assets, which costs shall be recovered through the tariffs. As such, any financial cost that is increased due to non-compliance with deadlines shall be included in the access tariffs and thus recovered. As a way to mitigate such risk, investment costs are only recovered after the projects enter into operation;
2. Risk of stranded assets:
   Upon entry into operation, these are included in the regulated assets and considered for the CAPEX calculation until they are totally amortized;
3. Risk of dismissing the planned investments:
   The expected costs associated with investments that will likely enter into operation in a given period shall be included in the regulated assets for the purposes of the establishment of network access tariffs for the subsequent years However, the foreseen costs are adjusted, taken into consideration the costs really occurred (see point 4);
4. Risk of mismatch between real CAPEX and expected CAPEX:
   The network access tariffs include the expected investment costs. The difference between these and the real costs is included in the tariffs two years later, including costs or financial gains associated with any deviation.

(11) http://www.erse.pt/pt/internacional/mercadosEur/Documents/EIP_AvalicaoInvestimentosRiscosELEeGN_PT.pdf.

Relevant project categories

The projects undertaken by the TSO financed through regulated tariffs are the ones identified in each Plan, provided the Plan is approved by the Government.
The 2017 Plan for the 2018-2027 (under public consultation until February 15, 2018) identifies two categories of projects:

a. Base Projects, which in the TSO's opinion must be carried out in order to guarantee the infrastructures' safety and operation, including the assets' refurbishment and modernisation works and the projects associated with commitments with the distribution system operator; and
b. Complementary Projects, which include works deemed necessary in light of the national energy policy and of the need to promote social and environmental sustainability – for instance, the Carregado compression station and the third interconnection between Portugal and Spain The TSO submits the proposals and the final investment decision is made by the grantor of the concession, i.e., the Portuguese Government. These proposals are thus viewed as conditional, as each project's execution is subject to the formal request by the DGEG, ERSE and other external stakeholders and to the Government's authorization.

3.1.4. Regulatory rules with respect to innovation

Specific duties of the NRA aimed at encouraging innovation

ERSE has specific duties aimed at encouraging energy efficiency, in particular with regards to energy consumption, but we are not aware of any legal powers or duties aimed at encouraging innovation.

Specific duties of the TSO at encouraging innovation

There are no legal duties aimed at encouraging innovation.

3.1.5. Regulatory rules with respect to security of supply

Specific duties of the TSO aiming at safeguarding security of supply

The entity responsible for ensuring grid reliability is the TSO. To achieve this goal the TSO uses its attributions as the global manager of the National Natural Gas System, notably through its functions of system technical management. According to article 53 of Decree-Law no. 140/2006, the TSO must:

a. monitor the reserve stockpiling;
b. release safety reserves when duly authorized by the member of the Government responsible for energy affairs;
c. submit to the DGEG, by the 15th of each month, information with regards to the previous month on the amount of reserves, its location and the corresponding holders;
d. inform the DGEG and ERSE of situations where the reserves stockpiling and maintenance obligations were not complied with.

Pursuant to article 13/2, paragraph *c)* and article 48-A of Decree-Law no. 140/2006, the TSO must also collaborate with the DGEG on the creation of the annual monitoring report on safety of supply, which shall include the following information (as determined by article 47-C/2 of Decree-Law no. 140/206): *i)* level of use of storage capacity and evaluation of its sufficiency to guarantee compliance with security reserves, *ii)* the scope of the long term supply agreements entered into by companies established on national territory, its duration period and level of liquidity, and *iii)* regulatory frameworks destined to encourage new adequate investment on natural gas infrastructures. This report is published by the Government on the DGEG's website until July 31 of each year and must be sent to ERSE and the European Commission.

The TSO must also collaborate with the DGEG on the creation of the preventive plan and the emergency plan, described in question 4 below.

Specific duties of the NRA aiming at safeguarding security of supply

According to article 3/2, paragraphs *i)*, *j)* and *q)* of ERSE's statutes, ERSE must monitor investment destined to strategic reserves stockpiling, guarantee the existence of conditions to efficiently satisfy the demand for natural gas and encourage competition and security of supply.

3.2. Regulatory practice

3.2.1. Overview over regulatory practice in Portugal

Information about the general regulatory framework in Portugal

The usual procedure is that the TSO submits an investment plan, the NRA provides an opinion, and then the government will approve the plan. In Portugal, the regulator does not have a binding opinion it is always a recommendation. The investment plan has to be approved by the government and currently it also has to go through parliament.

There is a great deal of pressure to keep costs down thus the regulator has to be cautious. Any investment that is not absolutely required will not be approved.

No investment plan has been approved, neither disapproved since 2012 by the government. Due to the economic crisis, there was also limited need to expand the existing gas transport network.

Currently projects are being approved on a case by case basis. The TSO submits it for approval to the government and the regulator provides an opinion. These projects are generally approved and added to the Regulatory Asset Base (RAB). The regulator does have some leeway on whether to add all these projects to the RAB, thus adding uncertainty. Any decision to not included a specific investment into the RAB is preceded by the submission to the tariff council, for a non-bidding opinion, explaining the reason why the investment is not included. The 2017 plan has been submitted and it was recommended to split the investments into “base” projects and “complementary” projects, so that the urgent projects are approved quickly and that there is more time to analyse the “not so urgent” investments. The 2017 plan is not yet published.

Main regulatory barriers

In the interviews, the following regulatory barriers were discussed:

The different treatment of CAPEX and OPEX (building block approach) can be an issue.

Projects with Higher CAPEX but benefits to wider society would fall under the “not so urgent” projects, with such projects there is a risk that they are not approved for budgetary reasons. If approved then will be remunerated and part of regulatory asset base.

3.2.2. Regulatory practice related to innovation

Adequacy of the NRF relating to its support for innovative investments

The main focus in the recent past has been on urgent projects and security of supply projects. This resulted in limited funding for innovative projects. If innovative projects ensure lower costs in the future then these projects are also eligible for funding.

A potential barrier for innovative investments is that in Portugal a regulatory period of three years is applied. This gives the TSO a limited time frame to benefit from innovations that result in cost reductions.

According to stakeholders, EU unbundling requirements impede the TSO from participating in innovative projects aimed at the integration of renewables in the market.

3.2.3. Regulatory practice related to security of supply

There are a limited number of investment projects aimed at increasing the security of supply. The TSO has been able to do the minimal but has for example not been able to invest sufficiently in electronics and instrumentation. Interviewees mentioned that the security of supply also depends on production and storage but that the TSO is not allowed to be involved in such projects.

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

Although investment plans are not approved, the TSO is able to ‘do the minimal’. Project approval is requested on a project-by-project basis.

3.2.4. Illustrative specific projects

The projects described below can be considered innovative and security of supply projects, hence the projects show how the current regulatory framework works in practice. The first two

projects are examples of 'complementary projects' in the 2017 Plan, which are deemed necessary in light of the national energy policy and of the need to promote social and environmental sustainability.

3rd Interconnection between Portugal and Spain

Description and aim

The 3rd Interconnection between Portugal and Spain will connect Celorico da Beira to Zamora (pipeline Celorico - Vale de Frades) with a DN700 (28") pipeline with a total length of 162 km. The project is developed in two stages, which incrementally include the respective capacity enhancements in each of the countries.

This project is an example of 'complementary projects' in the 2017 Plan, which include works deemed necessary in light of the national energy policy and of the need to promote social and environmental sustainability. The TSO submits the proposals and the final investment decision is made by the grantor of the concession, i.e., the Portuguese Government. These proposals are thus viewed as conditional, as each project's execution is subject to the formal request by the DGEG, ERSE and other external stakeholders and to the Government's authorization.

Carregado compression station

Description and aim

This work has as main objective to reinforce the general reliability of the network, the Carregado Substation is a crucial node of the national energy transmission network.

The project includes the supply, assembly and testing of high voltage equipment (220KV), GIS1 technology, insulated cables and their respective control, control and protection systems, as well as the integrated safety system.[12]

This project is also an example of 'complementary projects' in the 2017 Plan.

Dynamic solution for the analysis of odorant content

Description and aim

Development of a new methodology to determine the level of Tetrahydrothiophene (THT), through the application of algorithms, which allow the THT content to be calculated at individual network points. The project is expected to result in higher efficiency and lower sulphur dioxide (SO2) emissions.[13]

Odorization gas (from Spain)

Description and aim

Implementation of a new control concept for the odorization system so as to make use of the pre-odorized NG received at the interconnection point Campo Maior.

3.3. Options for improvement

3.3.1. Options to improve regulatory practice

The above discussion shows that the NRF is generally adequate for security of supply projects. However, those projects are approved on a case-by-case basis and there is considerable pressure to reduce network costs. There are issues regarding the implementation of innovative projects. This is especially the case for innovations that provide most of the benefits to other stakeholders (and not the TSO) but there are some incentives to invest in project that result in cost efficiencies. The following options for improvement could be considered to address these issues.

(i) Statutory reference to innovation

The stakeholders criticized that there is no long-term perspective on innovative investment. A long-term strategic perspective can only be developed if the regulatory framework contains an

[12] Source: https://w5.siemens.com/portugal/web_nwa/pt/portalinternet/negocios/em/noticias-eventos/pages/ren-e-siemens-colocam-em-servico-a-subestacao-de-transformacao-do-carregado.aspx.

[13] Source: https://www.ren.pt/en-GB/sustentabilidade_old/a_idi_na_ren/.

explicit reference to innovation. This long-term strategic perspective could shaped by governmental policies, statutory duties or could be included in the TYNDP.

(ii) Consultation on investment plans

Investments in Portugal are approved on a case-by-case basis, as there is no approved investment plan. The formal approval of a portfolio of projects in an investment plan would provide guidance to the TSO and other market participants about the development of the gas system in Portugal. This would reduce the risk that investments for which the benefit to the TSO or other market participants are not done.

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

We consider that, with the exception of the following, the above mentioned changes could be implemented using legal powers already available to the NRA or others under the existing NRF.

As regards option (i), the suggestion of incorporating a reference to innovation in the regulatory framework could be implemented by including such a reference on Decree-Law no. 140/2006, 2006, of 26 July, as amended, via the Portuguese Legislative Process[14].

3.3.3. Impact assessment

The long-term strategic perspective on innovation mentioned in option (i) necessitates efforts and coordination between the TSO and the NRA regarding the design of this long-term perspective (e.g. the organisation of stakeholder consultations, determining the scope of the innovation needed, monitoring and evaluating of how the statutory duty is translated into the long-term perspective).

We have not encountered any specific examples of projects that have been cancelled due to the regulatory framework. For this reason, we do not expect that any of the suggested changes will result in considerable changes to investment levels. Yet, if the perceived risk of innovative projects is lowered and a long-term strategic perspective on innovation could be attained by an explicit statutory reference to innovation, the share of innovative projects is expected to increase.

As mentioned in option (ii) above, a structured process for the appraisal and approval of projects would inform the TSO and other market participants about the development of the Portuguese gas system. It could also result in a better assessment of all the (social) costs and benefits of projects. A potential disadvantage is that it reduces the possibilities for the government to control network tariffs.

[14] The Portuguese Legislative Process usually entails a Government initiative, as follows: the member of the Government for energy affairs (and the corresponding Cabinet) drafts a decree-law with the needed amendment. This draft is discussed by all members of the Government – firstly by all Secretaries of State and subsequently by all Ministers. When the decree-law is approved by the Ministers, it will be submitted to the analysis and promulgation of the President of the Portuguese Republic. The Parliament may also approve legislation, either by its own initiate or in the context of a proposal made by the Government.

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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