



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

Country Report - Croatia



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

Country Report - Croatia

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

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## **EXECUTIVE SUMMARY**

### **Assessment of the NRF and the regulatory practice of the electricity sector in Croatia**

#### **The electricity NRF in Croatia**

The general regulatory principle can be described as cost-based Cost+ system. Thus, it is generally incentivising investments and eliminating the risk of not covering the costs of infrastructure projects if they are deemed eligible and economically efficient by the NRA.

#### **The regulatory practice in the electricity sector in Croatia**

We have not received any feedback to our questionnaires and requests from the electricity sector. Therefore, a description and analysis of the regulatory practice cannot be given.

#### **Options for improvement**

Due to the lack of response, we could not identify any improvement options.

### **Assessment of the NRF and the regulatory practice of gas sector in Croatia**

#### **The gas NRF in Croatia**

The general regulatory principle can be described as a hybrid approach where CAPEX is calculated using a cost-plus mechanism and OPEX is calculated using an incentive-based method. An audit of allowed revenues and reconciliation eliminates the risk of under-recovery of the costs of an approved asset. Both the TSO and the NRA have no specific statutory duties to encourage innovation. But the TSO has an obligation to be efficient which may imply innovation if the result of the innovation is lower costs. Further, the TSO issues a development plan for next 10 calendar years, on an annual basis. The current plan includes the construction of new capacity but no upgrade of existing assets. The NRA reviews and approves the network development plan, ensures the alignment with the EU wide development plan and monitors implementation of the plan.

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

It could be argued that the main legal deficiency is the lack of a specific duty for the TSO to be innovative, as the current calculation of the tariff does not achieve the desired results. Yet, interviewees do not report any severe issues but also, they remark that there are not many innovative projects being implemented presently. Currently, only very small innovative projects are being started that could be characterised as pilot projects. Due to its size these projects are not presented to the NRA for approval but financed through the general tariff as far as we understood. Therefore, respondents have not identified any need to improve the NRF in terms of innovation, but this may also be due to a lack of experience in the regulatory treatment of such projects. Because of the lack of experience targeted improvements can hardly be identified from the analysis of the regulatory practice. But the lack of innovative projects could be interpreted as a need for a more explicit statutory reference to innovation. During the last years, Croatia faced a high increase of line length due to the gasification of the country. A side effect of this is that the Croatian tariffs for system usage are among the highest in Europe. According to some stakeholders, the limitation of further tariff increases is regarded as sometimes being restricting, especially regarding security of supply projects. Interviewees remark that an alternative for financing such projects are EU funds but these funds only cover projects between EU countries. So, many projects, especially the southern gas corridor, connect EU countries with non-EU countries and therefore no EU fund covers such projects. This problem can hardly be solved by changing the national legal framework but needs to be discussed at EU level.

#### **Options for improvement**

Although there were no major complaints about the NRF currently in place for innovation and security of supply, using the issues drawn from the above discussion, the following options for improvement could be worth being considered:

- (i) Statutory reference to innovation;
- (ii) Social cost benefit analysis; and
- (iii) Consultation on 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 analyses. It is divided into two main sections, Section 2, which is related to electricity, and Section 3, which is related to gas. Each of these sections examines the legal framework (Section 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 3.1 for electricity and Section 3.2 for gas, we examine the regulatory practice in Croatia, 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 Croatia. 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 the construction of conventional assets like AC overhead lines or pipelines with conventional materials and construction methods down to novel concepts of system automation and operation based on recent R&D achievements. Innovation aims at providing the desired level of transmission capacity – determined by the objectives of security of supply (see above) – in a way that is in some way superior to the conventional way, e.g.:

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

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

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

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

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

## 2. ELECTRICITY

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

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

While overall responsibility for the energy sector is placed with the Ministry of Environment and Energy, the energy activities in Croatia are regulated by the Croatian Energy Regulatory Agency (the “**CERA**”), an autonomous, independent and non-profit public institution with obligations, authorities and responsibilities specified in the Act on the Regulation of Energy Activities<sup>1</sup> (the “**AREA**”), the Energy Act<sup>2</sup> (the “**EA**”) and other acts regulating specific energy activities, such as (applicable for section), the Electricity Market Act<sup>3</sup> (the “**EMA**”). The CERA in terms of its competence, and the AREA and the EA in terms of regulation, are equally applicable for electricity and gas.

For the purposes of the Legal Framework in Croatia, transmission of electricity is defined as the *transport of electricity using an interconnected extra high and high-voltage transmission network for the purpose of delivery of the electricity to end buyers or the DSO, however it does not include distribution*<sup>4</sup>.

One of the focal ideas of the AREA is to promote investments into the energy sector<sup>5</sup>. Under the AREA, CERA is *inter alia* envisaged to approve investment, development and construction plans pursuant to laws regulating certain areas of the energy market such as electricity and gas; monitor the alignment of investment, development and construction plans of the national DSO and TSO with the plans of the ENTSO-E; cooperate with other national regulators with the goal of having an efficient competitive market and enhancing the security of distribution without discrimination between the suppliers from other EU member states.

The EA prescribes<sup>6</sup> that the fundamental document, which determines the energy policy and plans energetic development is the Energy Development Strategy<sup>7</sup> (the “**Strategy**”) which was adopted in October 2009 by the Parliament on the government’s proposal, encompassing the period until 2020. One of the Strategy’s development guidelines and goals is preparation of prerequisites for further development of electricity transmission and distribution network and application of new transmission and usage of electricity<sup>8</sup>.

The basic goals of the regulation of energy activities, according to EMA are: **a)** ensuring objectivity, transparency and non-discrimination in the carrying out of energy activities; **b)** looking after the implementation of the principle of regulated access to the network/system; **c)** setting the methodology for determination of tariff elements; **d)** establishing an efficient energy market and market competition; **e)** protection of energy customers and energy undertakings; and **f)** to promote: **i)** efficient and rational use of energy; **ii)** entrepreneurship in the energy sector, **iii)** investment in the energy sector, and **iv)** environmental protection.

Under the EMA, CERA is *inter alia* envisaged to: **a)** perform the certification procedure, during which it certifies that the national transmission system operator HOPS LLC (the “**TSO**” or “**HOPS**”) is compliant with the rules prescribed in the EMA (HOPS is indirectly state-owned); **b)** review the report of completed investments in constructing and re-constructing the transmission system; **c)** receive the draft proposals of the TSO’s decisions on the investment plan or specific investments in the transmission system; **d)** monitor the investments carried out by the TSO and if the investments were not carried out without a valid reason, either (i) request the TSO to complete the investments, (ii) organise a tender to carry out the investment, or (iii) order the TSO to increase its share capital for the purpose of raising funds from investors to finance the investments; **e)** draft and issue the Transmission System Network Code; **f)** determine the TSO’s tariff; and **g)** draft and refine the Methodology for determining the amount of tariff items for transfer of electricity (the “**Methodology**”).

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<sup>1</sup> Official Gazette 120/2012.

<sup>2</sup> Official Gazette 120/2012, 14/2014, 95/2015, 102/2015.

<sup>3</sup> Official Gazette 22/2013, 95/2015, 102/2015.

<sup>4</sup> Article 3 Paragraph 2 Subparagraph 53 of the EMA.

<sup>5</sup> Article 5 Paragraph 2 Subparagraph 3 of the AREA.

<sup>6</sup> Article 5 of the EA.

<sup>7</sup> Official Gazette 130/2009.

<sup>8</sup> Section 6.4.1 the Strategy.

General obligations of all system operators performing electricity activities such as transmission of electricity, is to ensure: **a)** security of electricity supply; **b)** required or agreed quality of electricity supply, **c)** a proposal for the amounts of tariff items determined according to regulated conditions, **d)** the use of primary energy sources, **e)** environmental protection, and **f)** protection of citizens' health, lives and property and customer protection.<sup>9</sup>

The EMA provides the definition of the TSO (HOPS) in Croatia, defining it as a natural or legal person responsible for:

- (i) maintenance, upkeep, development and construction of the transmission system;
- (ii) cross-border transmission lines towards other networks; and
- (iii) securing the long term capability of the network to satisfy reasonable requests for electricity transmission.

HOPS owns and operates the transmission system in Croatia.

In accordance with its obligations under the EMA, in December 2017 the Management Board of HOPS issued a "10-year Plan for development of the transmission network" (the "**10-year Plan**") to CERA for its approval. The 10-year Plan is issued yearly, and which *inter alia* includes current investments and those, which must be made in the respective term, a time frame for materialisation of all investment projects and a projection of transmission network development. The 10-year Plan represents the basis for CERA to approve the transmission tariff, and thus is the fundamental element of operations and income for HOPS.

HOPS has successfully completed the certification procedure and was granted with the certificate from CERA on 22 February 2016 in regard to satisfaction to all criteria prescribed by the law. The certification proves the independence and compliance of HOPS with the EMA's requirements, on several levels, such as financial, technical, HR and others prescribed by the EMA.

### ***Undertaking investments***

As explained above, HOPS has issued the 10-year Plan for 2018 where HOPS has opined and explained the need for continuing investment in revitalisation, replacing and construction of the current units of the transmission system on one hand, and in new units on the other.

Investments envisaged as part of the 10-year Plan include investing in actions which would enable better usage of current, new and other capacities, application of new technologies (HTLS conductors) and installing devices based on energy electronics (FACTS) or VSR devices. Some of these are discussed in Section 2.2.4.

### **Role of NRA**

CERA's role under the Legal Framework, specifically the AREA and the EMA is already described above. On top of this, we would like to underline that CERA is competent for reviewing and approving the 10-year Plan proposed by the TSO. The publication of the 10-year Plan is preceded by a public discussion on the matter and liaisons with market participants (CERA, TSO, DSO, producers, suppliers, traders), where they are entitled to submit their suggestions and remarks on the draft proposal of the 10-year Plan.

In addition, in September 2015, CERA has, pursuant to Article 13, paragraph 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 and repealing Decision No. 1364/2006/EC and amending Regulations (EC) No. 713/2009, (EC) No. 714/2009 and (EC) No. 715/2009, adopted the Methodology and criteria for evaluating investments into infrastructure projects in the area of electricity and gas (the "**Methodology**") of common interest in the EU.

### **Institutional or procedural constraints on the performance of these roles**

The Legal Framework does not in practice allow for the introduction of the competition in this sector, which sometimes has negative effect on certain business practices with regard to the connection, and development of renewable projects and other third-party generation projects - such as lengthy procedures and slowness of administrative bodies involved in the procedure.

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<sup>9</sup> Article 6 of the EMA.

It could be argued that the main legal deficiency is the lack of a specific duty for the TSO to be innovative, as the current calculation of the tariff does not achieve the desired results. Also, legal uncertainty and constant changes in law represent a significant problem for both the TSO and other market participants.

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

Next to CERA, the Ministry competent for energy assumes the role in preparing and monitoring the execution of the plans for energy development.

In case of construction of new transmission network, various parties may be involved in the procedure. We can imagine involvement of authorities such as Water Management Company, Forestry Management Company, Environmental Protection Agency, local and regional spatial, construction and other authorities. Before the construction starts and even before the construction permit is issued, some or all of the bodies may be called to participate in the process and requested to issue its approval for the construction.

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

Investment projects intended for developing the transmission network are financed from the funds collected from the fee specified in the tariff and approved in the final investment decision. The 10-year Plan in terms of investments is divided into two principal sections: **1)** the plan for 2017 – 2019 and **2)** the plan for 2020 – 2026.

The methodologies for determining the amount of tariff items for power infrastructure activities in the Republic of Croatia are based on the cost-plus method, which is a different methodology from that used to calculate the gas transmission tariff. The cost-plus method applied stipulates a regulatory period of one year (it is approved by CERA every year). The amount of tariff items for the following regulatory year is based on the recognized total costs and investments realized in the previous regulatory year, which have been recognized and included in the regulatory asset base (RAB), realized and estimated total costs for the current regulatory year and planned total costs for the considered future regulatory year (which is part of the 10-year Plan). The expenses include eligible operating expenses (the “**OPEX**”) and eligible capital expenses (the “**CAPEX**”).

OPEX includes the costs of electricity losses, maintenance, measurement and billing, procurement of auxiliary services, staff costs and other operational expenses.

CAPEX includes the amortization cost and the return on regulated assets. It recognizes an equity capital investment into a regulated energy entity, i.e. it provides sufficient funds for the required investments into the construction and re-construction of the system and to cover the rate of return on invested capital, as prescribed by the relevant Methodology. Regarding capital expenses from the regulatory standpoint, the following elements have to be determined:

- the system operator assets recognized as regulated assets, i.e. regulatory asset base (RAB);
- the method of calculating the amortization;
- the rate of return on regulated assets (RoR).

Regulated assets consist of fixed tangible and intangible assets in use, which is a part of the transmission or distribution system. The planned investments into the construction and reconstruction of the system must be technically justified by HOPS and economically efficient. Only after the approved project is operational, the investment is included in the regulatory asset base and therefore there is no risk to the system operator. The application of the subject approach reduces the risk of investment and provides more investment incentives since the eligible capital expenses, i.e. amortization and return on regulated assets, are determined by an ex-ante approach of the approval of investment plans as part of the analysis and approval of the request for the determination, i.e. change of the amount of tariff items. The aforementioned eliminates the risk of not covering the costs of infrastructure projects if they are deemed eligible and economically efficient by CERA.

### **Mechanisms to foster innovation:**

Except that revenues of regulated activities are a direct function of the regulated asset base (RAB), there are no specific financing mechanisms designed to incentivise investment in innovation or innovative projects. However, it could be interpreted that the 10-year Plan and the Methodology as such serve as a platform for the TSO to invest in innovation.

***Measures to establish a balance between investing in new or innovative network infrastructure to meet the needs of current and future users in a timely manner and avoiding investment in stranded assets***

The Croatian market, and accordingly the Croatian TSO (HOPS), has not yet reached the level, which would include incentives in investment in innovation or innovative projects. Please see above and Sections 2.1.1 and 2.1.2 to in relation to the 10-year Plan and the Methodology.

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

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

We were not able to find any specific duties of HOPS, which are aimed at encouraging innovation. The EMA only provides a general rule that the TSO is obliged to “develop” secure, reliable and efficient transmission system and secure “technical prerequisites” for accepting electricity into the transmission system. However, according to the yearly report published by HOPS for 2016, HOPS has “actively operated in the area of research and development” which suggests that although there is no specific duty to innovate, that the current system allows for some innovation.

The TSO has an obligation to achieve savings and increase efficiency, so in fulfilling this obligation; the TSO is stimulated / encouraged to promote future investments and encourage innovation as they may lead to savings and more efficient operations.

**Specific duties of the NRA aimed at encouraging innovation**

On top of approving the investment, development and construction plans pursuant to the law regulating certain areas of energy market and monitoring the alignment of investment, development and construction plans of the national TSO with the plans of the ENTSO-E, CERA cooperates with the Ministry in preparing and monitoring the execution of the plans for energy development, including the 10-year Plan. However, we could not find provisions in the Legal Framework, which specifically envisage and/or include encouragement of innovation as one of CERA's goals and/or tasks.

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

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

According to the EMA, one of tasks HOPS has is to plan investments, which shall secure long term capability of a transmission system, which can satisfy reasonable consumption and safeguard the security of supply<sup>10</sup>. Also, according to the EMA, the 10-year Plan must include effective measures, which shall ensure the adequacy and security of supply<sup>11</sup>.

Furthermore, HOPS is, in particular, obliged to contribute to securing the supply with adequate transmission capacities and reliability of the transmission grid<sup>12</sup>. Once a year – after being approved by CERA – HOPS publishes the report on security of supply in the transmission grid for the previous year<sup>13</sup>.

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

CERA has the duty to set the conditions of quality of the energy supply that HOPS must adhere to. CERA also produces the general terms of energy supply in Croatia and monitors the contract terms of supply agreements by reviewing and approving the suppliers' Terms of Service.

**2.2. Regulatory practice**

**2.2.1. Overview over regulatory practice in Croatia**

The general regulatory principle can be described as cost-based Cost+ system. Thus, it is generally incentivising investments and eliminating the risk of not covering the costs of infrastructure projects if they are deemed eligible and economically efficient by the NRA.

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<sup>10</sup> Article 18 Paragraph 10 Subparagraph 6 of the EMA.

<sup>11</sup> Article 25 Paragraph 3 of the EMA.

<sup>12</sup> Article 30 Paragraph 1 Subparagraph 2 of the EMA.

<sup>13</sup> Article 32 Paragraph 2 of the EMA.

Please note that we have not received any feedback to our questionnaires and requests from the electricity sector. Therefore, a description and analysis of the regulatory practice cannot be given.

**2.2.2. Regulatory practice related to innovation**

(see above).

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

(see above).

**2.2.4. Illustrative specific projects**

The following project is an example of an innovative project.

The SINCRO.GRID project is the only real example of something which can be understood as innovative because it is based on the application of Smart Grid by utilising advanced technical systems and algorithms, with the goal of enhancing the quality of the energy system, increasing the transmission capabilities of the current grid and the ultimate goal of securing the integration of renewables and raising the security of electricity supply to end customers. Even though the project was nominated and enlisted to the PCI list in 2015, it is, according to the publicly available data, still in its formative investment phase. From the available information it is hard to tell whether this is due to regulatory barriers or for other reasons.

**2.3. Options for improvement**

**2.3.1. Options to change regulatory practice**

Due to the lack of response, we could not identify any improvement options.

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

(see above).

**2.3.3. Impact assessment**

(see above).





### 3. GAS

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

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

While overall responsibility for the energy sector is placed with the Ministry of Environment and Energy, the energy activities in Croatia are regulated by the Croatian Energy Regulatory Agency (the “CERA”), an autonomous, independent and non-profit public institution with obligations, authorities and responsibilities specified in the Act on the Regulation of Energy Activities<sup>14</sup> (the “AREA”), the Energy Act<sup>15</sup> (the “EA”) and other acts regulating specific energy activities, such as the applicable gas legislation, the Gas Market Act<sup>16</sup> (the “GMA”). The CERA in terms of its competence, and the AREA and the EA in terms of regulation, are equally applicable for electricity and gas.

For the purpose of the Legal Framework in Croatia, gas transmission is defined as “transmission of gas through the transmission system, including gas supply and its trade, as well as gas transit and ancillary services”<sup>17</sup>, while the transmission system is defined as “a facility owned by and/or managed by the transmission system operator, consisting of a system of high-pressure pipelines, but excluding an upstream pipeline network and other high-pressure distribution pipelines, including gas for technological capacities used exclusively by the transmission system operator, linepack and other relevant facilities and equipment used for gas transmission, monitoring and management, measurements and data transfer”<sup>18</sup>.

One of the focal ideas of the AREA is to promote investments into the energy sector<sup>19</sup>. Under the AREA, CERA is *inter alia* envisaged to approve investment, development and construction plans pursuant to law regulating certain areas of energy market such as gas and electricity; monitor the alignment of investment, development and construction plans of the national DSO and TSO with the plans of the ENTSO-G; cooperate with other national regulators with the goal of having an efficient competitive market and enhancing the security of distribution without discrimination between the suppliers from other EU member states.

The EA prescribes<sup>20</sup> that the fundamental document, which determines the energy policy and plans energetic development is the Energy Development Strategy<sup>21</sup> (the “Strategy”) which was adopted in October 2009 by the Parliament on the government’s proposal, encompassing the period until 2020. One of the Strategy’s development guidelines and goals is preparation of prerequisites for further development of gas transmission and distribution network and application of new transmission and usage of natural gas<sup>22</sup>.

Under the GMA, CERA is *inter alia* envisaged to: **a)** perform the certification procedure, during which it certifies that the national transmission system operator<sup>23</sup> Plinacro LLC (the “TSO” or “Plinacro”) is compliant with the rules prescribed in the GMA (Plinacro is state-owned); **b)** review the report of completed investments in constructing and reconstructing the transmission system; **c)** receive the draft proposals of the TSO’s decisions on the investment plan or specific investments in the transmission system; **d)** monitor the investments carried out by the TSO and if the investments were not carried out without a valid reason, either (i) request from the TSO the completion of these investments, (ii) organize a tender to carry out the investment or (iii) order the TSO to increase its share capital for the purpose of raising funds from investors to finance the investments; **e)** draft and issue the Transmission System Network Code; **f)** determine the TSO’s tariff and **g)** draft and render the Methodology for the determining the amount of tariff items for gas transmission.

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<sup>14</sup> Official Gazette 120/2012.

<sup>15</sup> Official Gazette 120/2012, 14/2014, 95/2015, 102/2015.

<sup>16</sup> Official Gazette 18/2018, effective as of 3 March 2018.

<sup>17</sup> Article 3 Paragraph 2 Subparagraph 58 of the GMA.

<sup>18</sup> Article 3 Paragraph 2 Subparagraph 59 of the GMA.

<sup>19</sup> Article 5 Paragraph 2 Subparagraph 3 of the AREA.

<sup>20</sup> Article 5 of the EA.

<sup>21</sup> Official Gazette 130/2009.

<sup>22</sup> Section 8.2 Paragraph 1 Item 8 and Section 8.3 Paragraph 2 of the Strategy.

<sup>23</sup> Article 2 Paragraph 34 of the GMA.

General obligations of all system operators performing gas activities such as transmission of gas, is to ensure: **a)** security of gas supply; **b)** required or agreed quality of gas supply, **c)** a proposal for the amounts of tariff items determined according to regulated conditions, **d)** the use of primary energy sources, **e)** environmental protection, **f)** protection of citizens' health, lives and property and customer protection.<sup>24</sup>

The GMA provides the definition of the TSO (Plinacro) in Croatia, defining it as an energy subject which:

- (i) performs the activity of gas transmission;
- (ii) has the responsibility for the performance, maintenance and development of the transmission network, where feasible for connecting it with other networks; and
- (iii) has the responsibility for securing the long-term capability of the network to satisfy reasonable needs for gas transmission.

The GMA further provides that Plinacro (as an independent subject, although State owned) freely decides on the funds needed for developing and constructing the transmission system, as well as acquiring loans and increasing share capital in that respect. Plinacro owns and operates the transmission system in Croatia. Pursuant to the provisions of the GMA<sup>25</sup>, on 10 November 2003 CERA issued a licence<sup>26</sup> to Plinacro, allowing it to perform the energy activity of gas transmission.

In accordance with its obligation under the GMA<sup>27</sup>, Plinacro has drafted and issued the Transmission System Network Code (the "**Code**") which governs the description of the transmission system, development, construction and maintenance of the transmission system.

In accordance with its obligations under the GMA<sup>28</sup>, in March 2017 the Management Board of Plinacro issued a "10-year Plan for development of the transmission network" (the "**10-year Plan**") to CERA for its approval. The 10-year Plan is issued yearly, and which *inter alia* includes current investments and those, which must be made in the respective 10-year term, a time frame for materialisation of all investment projects and a projection of transmission network development. The 10-year Plan represents the basis for CERA to approve the transmission tariff, and thus is the fundamental element of operations and income for Plinacro.

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

As explained above, Plinacro has issued the 10-year Plan in March 2017 (a new one is expected to be issued in 2018) where Plinacro has opined and explained the need for constructing new capacities of the transmission system, primarily because of the great potential which the LNG terminal (valued approx. EUR 800,000,000) might bring, if it is built on the island of Krk in Croatia. The current 10-year plan does not include any upgrade of existing assets.

### **Role of NRA**

CERA's role under the Legal Framework, specifically the AREA and the GMA has already been described above. On top of this, we would like to underline that CERA is competent for reviewing and approving the 10-year Plan proposed by the TSO. The publication of the 10-year Plan is preceded by a public discussion on the matter and liaisons with market participants (CERA, TSO, DSO, producers, suppliers, traders), where they are entitled to submit their suggestions and remarks on the draft proposal of the 10-year Plan.

In addition, in September 2015, CERA has, pursuant to Article 13, paragraph 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 and repealing Decision No. 1364/2006/EC and amending Regulations (EC) No. 713/2009, (EC) No. 714/2009 and (EC) No. 715/2009, adopted the Methodology and criteria for evaluating investments into infrastructure projects in the area of electricity and gas (the "**Methodology**") of common interest in the EU.

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<sup>24</sup> Article 7 of the GMA.

<sup>25</sup> Article 2 Paragraph 3 of the GMA.

<sup>26</sup> Licence registry number 080304171-0030-08/03.

<sup>27</sup> Article 84 of the GMA.

<sup>28</sup> Article 27 Paragraph 1 Subparagraph 14 of GMA.

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

Next to CERA, the Ministry competent for energy assumes the role in preparing and monitoring the execution of the plans for energy development.

For construction of new transmission network, various parties may be involved in the procedure. We can imagine involvement of authorities such as Water Management Company, Forestry Management Company, Environmental Protection Agency, local and regional spatial planning, construction and other authorities. Before the construction starts and even before the construction permit is issued, some or all of the bodies may be called to participate in the process and requested to issue its approval for the construction.

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

Investment projects intended for developing the transmission network are financed from the funds collected from the fee specified in the tariff and approved in the final investment decision. According to the 10-year Plan, there are four groups of development projects of the transmission system:

- Group A Projects – projects which have, within one of the previous 10-year plans, been granted with the final investment decision (the “FID”) by the Ministry or the CERA (which means that financing is secured);
- Group B Projects – projects for which the passing of the FID is proposed by CERA, and which are envisaged to be in operation between 2018 and 2022;
- Group C Projects – projects considered to be placed in operation between 2017 and 2022, but which do not have a proposal for FID by CERA; and
- Group D Projects – projects considered to be placed in operation after 2021.

For Group A and B Projects, the financing has been foreseen and approved by CERA, while for Group C and D Projects, the financing is to be considered at a later date.

In addition, the TSO is allowed and encouraged to apply for funding from the EU, especially because certain projects listed in the 10-year Plan are also listed on the PCI list of the EU, as well as on the PECO list.

According to the Methodology, for determining the amount of tariff items for gas infrastructure activities in the Croatia are based on the incentive regulation method, i.e. on the revenue cap method, which is different from calculating the electricity transmission tariff. Thereby, projected allowed revenue shall cover reasonable operating expenses generated when performing the energy activity and ensure the return on regulated assets. The revenue cap method applied stipulates the regulatory period as a multi-annual period for which, separately for each regulatory year, the allowed revenues are defined, which consist of eligible operating expenses (the “OPEX”) and the eligible capital expenses (the “CAPEX”) and the amount of tariff items.

The allowed OPEX is projected for the regulatory period on the basis of the  $1 + \text{CPI} \times X$  formula (CPI = projected consumer price index for the regulatory year). In addition to the efficiency factor X, in the OPEX part of the calculation, a profit-sharing mechanism is also stipulated as an important incentive element for the system operator, which is implemented in such a manner that after expiry of the regulatory period the base OPEX for the following regulatory period is defined so that the system operator retains 50% of the realized savings from the base year.

The eligible CAPEX, which includes the depreciation cost and the return on regulated assets, recognizes an equity capital investment into a regulated energy entity, i.e. provides sufficient funds for the required investments into the construction and re-construction of the system and to cover the rate of return on invested capital as prescribed by the relevant Methodology. The regulated assets consist of tangible and intangible assets in use, which is a part of a particular gas system, and investments under an approved system development plan that are taken into account for the regulatory year in which it shall be in use. Capital expenses, i.e. depreciation and return on regulated assets, are not included in direct efficiency improvement mechanisms, but are defined by an ex-ante approach as part of approving the investment plans and the amount of tariff items, which reduces the investment risk and provides more investment incentives.

***Mechanisms to foster innovation:***

There are no specific financing mechanisms designed to incentivise investment in innovation or innovative projects. However, it could be interpreted that the 10-year Plan and the Methodology as such serve as a platform for the TSO to invest in innovation.

***Measures to establish a balance between investing in new or innovative network infrastructure to meet the needs of current and future users in a timely manner and avoiding investment in stranded assets***

The Croatian market, and accordingly the Croatian TSO (Plinacro), has not yet reached the level which would include incentives in investment in innovation or innovative projects. Please see above and Sections 3.1.1 and 3.1.2 in relation to the 10-year Plan and the Methodology.

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

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

We were not able to find any specific duties of Plinacro, which are aimed at encouraging innovation. The GMA only provides a general rule that the TSO is obliged to “develop” secure, reliable and efficient transmission system and secure “technical prerequisites” for accepting gas into the transmission system. On top of that, the Strategy provides that the transmission system of Plinacro shall enable construction of gas fuelled power plants.

The TSO has an obligation to achieve savings and increase efficiency, so in fulfilling this obligation the TSO is stimulated / encouraged to promote future investments and encourage innovation as they may lead to savings and more efficient operations.

**Specific duties of the NRA aimed at encouraging innovation**

On top of approving the investment, development and construction plans pursuant to law regulating certain areas of energy market and monitoring the alignment of investment, development and construction plans of the national TSO with the plans of the ENTSO-G, CERA cooperates with the Ministry competent for energy in preparing and monitoring the execution of the plans for energy development, including the 10-year Plan. However, we could not find provisions in the Legal Framework, which specifically envisage and/or include encouragement of innovation as one of CERA's goals and/or tasks.

Further to our input in Section 3.1.3 above, it should be noted that an important incentive element within the applied regulatory method is the regular audit of the allowed revenues, which is performed after the expiry of the regulatory period, and as part of which the difference is determined between the realised revenue (R) and the audited allowed revenue (AI) to be distributed to the following regulatory period, thereby eliminating the risk of under-recovery of the costs of an approved asset. Since the applied revenue cap method guarantees to the system operator the level of revenue in the medium term, a significant part of the market risk is shifted to the system users. The reduction of market risk also affects the reduction of the liquidity risk and hence the reduction of the cost of financing the investment activities.

An additional measure in the gas sector is the possibility of introducing a regulatory account. This is an optional model of economic regulation, which provides the possibility for the TSO, in the later years of the regulatory period, for the reimbursement of the revenue realised in the early years in an amount less than the allowed revenue that would have resulted from the application of the standard regulatory model.

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

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

Under the GMA, Plinacro is obliged to cooperate and work closely with other gas market participants, including those in the supply sector, by providing information to participants in the gas market whose equipment is directly connected to the transmission system regarding the scope, date and duration of gas transmission discontinuation and the expected reduction of transmission system capacity, providing prescribed information about investment projects pertaining to the transmission system, and the planned withdrawal of particular transmission system facilities from plants, etc.

According to the GMA, the 10-year Plan must include planned investments in construction and re-construction of the transmission system and these must be technically viable and economically effective, in order to secure the appropriate degree of security of gas supply. Finally, Plinacro has the obligation to secure the bi-directional capacity in cross-border interconnections, as prescribed in the EU Regulation 994/2010.

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

CERA has the duty to set the conditions of quality of the gas supply that Plinacro must adhere to. CERA also produces the general terms of energy supply and monitors the contract terms of the supply agreements by reviewing and approving the suppliers' Terms of Service.

## **3.2. Regulatory practice**

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

The general regulatory principle can be described as a hybrid approach where CAPEX is calculated using a cost-plus mechanism and OPEX is calculated using an incentive-based method. An audit of allowed revenues and reconciliation eliminates the risk of under-recovery of the costs of an approved asset. Both the TSO and the NRA have no specific statutory duties to encourage innovation. But the TSO has an obligation to be efficient which may imply innovation if the result of the innovation is lower costs. Further, the TSO issues a development plan for next 10 calendar years, on an annual basis. The current plan includes the construction of new capacity but no upgrade of existing assets. The NRA reviews and approves the network development plan, ensures the alignment with the EU wide development plan and monitors implementation of the plan.

### **Main regulatory barriers**

We received only limited response from the gas sector. Therefore, the analysis of the regulatory practise might not cover views of all relevant stakeholders.

During the last years, Croatia faced a high increase of line length due to the gasification of the country. A side effect of this is that the Croatian tariffs for system usage are among the highest in Europe. According to some stakeholders, the limitation of further tariff increases is regarded as sometimes being restricting, especially regarding security of supply projects.

So, some interviewees name one of the potential regulatory barriers from annex III (Investments in security of supply – projects without commercial benefits) as a possible issue.

It could be argued that the main legal deficiency is the lack of a specific duty for the TSO to be innovative, as the current calculation of the tariff does not achieve the desired results. Yet, interviewees do not report any severe issues but also, they remark that there are not many innovative projects being implemented presently. Currently, only very small innovative projects are being started that could be characterised as pilot projects. Due to its size, these projects are not presented to the NRA for approval but financed through the general tariff as far as we understood. Therefore, respondents have not identified any need to improve the NRF in terms of innovation, but this may also be due to a lack of experience in the regulatory treatment of such projects. Due to the lack of experience, we could hardly identify targeted improvements from the analysis of the regulatory practice. But the lack of innovative projects could be interpreted as a need for a more explicit statutory reference to innovation.

Also, legal uncertainty and constant changes in law are said to represent a significant problem for both the TSO and other market participants. Thus, the interviewees appear to be reluctant to further changes to the law.

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

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

- Improve support for security of supply investments with no or little commercial benefits;
- Foster application of innovative solutions.

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

The TSO has no specific statutory duties to encourage innovation. But the legislation contains an implied duty to innovate due to the general statutory duties of operating in an efficient, economic and effective manner. So, the TSO has got the obligation to be efficient which may

imply innovation if the result of the innovation is lower costs. The NRA has no specific statutory duties to encourage innovation.

### **Innovative projects and adequacy of the NRF relating to its support for these projects**

As already described, only very few and very small innovative projects are being started. Drone inspections are used for leakage detection for example. Recently, a revitalisation project of old, onshore pipeline with smaller diameter using flexible pipe has been started. This project has a pilot nature, as this technology has never been used in high pressure systems, so it is being tested for a small line length. Compared to the total cost for maintenance the project costs are somehow negligible. Therefore, the project is not presented to the NRA for approval but financed through the regular maintenance budget.

Due to the lack of experience, we could hardly identify targeted improvements from the analysis of the regulatory practice. But the lack of innovative projects could be interpreted as a need for a more explicit statutory reference to innovation.

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

#### **Security of supply projects and adequacy of the NRF relating to its support for these projects**

The regulation regarding security of supply is seen as generally adequate to guarantee sustainable continuity of security of supply.

The interviewees regard the following categories linked to security of supply:

- Interconnectors with other countries;
- Connections with new sources;
- Increasing pipeline pressure;
- Building of compressor stations.

In Croatia, efforts are being made to limit further tariff increases as the tariffs are among the highest in Europe. Usually, any new line must go through an open season act or be presented at a booking platform (e.g. PRISMA) to prove its commercial attractiveness. When this is proved, the project will receive an approval. On the other hand, projects benefitting the security of supply but with (expected or proven) low commercial use will have issues during the approval process, particularly when an effect on tariffs is likely. So, improvements to support security of supply investments with no or little commercial benefits might be worth considering.

Interviewees remark that an alternative for financing such projects are EU funds but these funds only cover projects between EU countries. So, many projects, especially the southern gas corridor, connect EU countries with non-EU countries and therefore no EU fund covers such projects. This problem can hardly be solved by changing the national legal framework but needs to be discussed at EU level.

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

The following projects are examples of the most significant security of supply projects and illustrate how the regulatory regime works in practice.

The two most significant projects in the Republic of Croatia are: the LNG terminal on the island of Krk (having the largest potential for development of overall gas business) and the Ionian-Adriatic Pipeline (IAP). Since the Croatian gas transmission system has reached a high level of development, its further development will be mostly determined by the scope and dynamics of implementation of these projects.

Although significant progress has been made in preparation of these projects, particularly the project of the LNG terminal on the island of Krk, they have not yet reached the maturity to take a final investment decision.

Having realised the potential of the LNG terminal and the impact it may have not only for Croatia but for the whole region (Slovenia, Hungary, Bosnia and Herzegovina, Serbia, Austria), a non-binding *Open Season* procedure was published in 2016. The results of the *Open Season* have shown that special interest exists for gas transmission and export from the LNG terminal to Hungary. Because of that, the TSO has prepared a couple of options all of which assume enlargement of the current technical capacities for the interconnection point "Dravaszerdahely"

in the direction from Croatia to Hungary. The TSO is currently preparing documents for publishing a binding *Open Season* procedure, the results of which will show the real interest for transmission of LNG and will give a basis for deciding on the best option (capacity, amount and dynamics). Generally, it is said that *Open Season* procedures (or the presentation of the project on a booking platform, such as PRISMA) are usually requested to verify the commercial interest in a project. If this interest is proven, projects will likely be approved by the NRA.

Since the Ionian-Adriatic Pipeline (IAP) project is still in the early stages and considering that even the non-binding *Open Season* procedure has not yet been published, no further technical details as well as aspects of the regulatory treatment can be reported.

Mostly for the public health and environmental reasons, the Republic of Croatia has signed a protocol with Republika Srpska (entity of Federation of Bosnia and Herzegovina) in order to ensure that the oil refinery in Republika Srpska is connected to the Croatian gas transmission system. It is still not clear if this connection project is going to be accommodated in the existing transmission operator's system or as a separate supply line of project promoter with or without third party access right.

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

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

The above discussion shows that only a small number of potential improvement needs could be identified. The lack of innovative solutions could be regarded as worthy for improvement. Furthermore, uncertainties regarding the support for security of supply investments with no or little commercial benefits could be removed.

##### **(i) Statutory reference to innovation**

There are no statutory powers or duties aiming at encouraging innovation. 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, a statutory reference to innovation could be included into the regulatory framework.

##### **(ii) Social cost benefit analysis**

The stakeholder seek certainty regarding the support for security of supply investments with no or little commercial benefits, on which the regulation is said to be more focussed on. A first step in this direction would be introducing the requirement to conduct a Social CBA. This could be done on multiple levels: on the level of the national net development plan and on project level for larger or cross-border projects. On project level, the SCBA could be a requirement before approval of the final investment decision or before approval of the cost recovery.

##### **(iii) Consultation on investment plans**

On both the national net development plan and on project level, stakeholder consultations could increase the likelihood that the output will ultimately be beneficial to the consumers, thereby moving towards a more output-focussed regulation. Stakeholder consultation can also be used to help shaping the long-term perspective on innovation of option (i) and to overcome reluctance of security of supply projects with low commercial benefits. Yet, the organisation of stakeholder consultations has disadvantages, such as the additional organisational burden on the party organising the consultation (the TSO or NRA) and a potential delay in implementing an investment project, even though consultations for certain types of infrastructure projects as well as parts of the planning processes already exist. Hence, one needs to think carefully how often and for which purposes one wants to additionally consult stakeholders.

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) (statutory reference to innovation), we expect that this could be implemented by including such a requirement in the AREA and the Strategy through the Croatian Legislative Process<sup>29</sup>.

Turning to option (ii) (social cost benefit analysis), the suggestion of incorporating a mandatory requirement in legislation for the TSO to conduct a SCBA of the investment portfolio included in the national net development plan and/or the requirement to provide the NRA with a SCBA of an individual project in the process of cost recovery approval, could be implemented by including such an obligation in the Code, and if necessary, in the GMA as well, through the Croatian Legislative Process.

As regards option (iii) (consultation on investment plans), the suggestion of incorporating a mandatory requirement in legislation for the TSO to explain what alternatives have been looked at when developing the TYNDP or the national plan, could be implemented by including such an obligation in the Code, through the Croatian Legislative Process.

### **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, the share of innovative projects is expected to increase.

Regarding option, (ii) effort and benefit must be weighted strongly against each other. Depending on the implementation a social CBA can result in a highly increased work for the NRA and the TSO. First, unambiguous measurement values must be found for new criteria. Also, when taking qualitative criteria into account, the risk exists that CBA results are influenced by individual assessments and therefore are not clear. As mentioned in option (iii) and the other options above, stakeholder consultations can contribute to moving to a more output-focussed regulation. Yet, too many consultations will increase the organisational burden of the TSO and/or the NRA and possibly reduce the willingness of stakeholders to participate in the consultation. Moreover, consultations possibly lead to time lags. Therefore, consultations as

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<sup>29</sup> The Legislative process is initiated by submitting the proposal of the law (or amendment) to the Chairman of Parliament, which then sends the proposal to the chairman of all working bodies, MPs and the PM. Every representative, clubs of representatives, working bodies of the Parliament and the Government may propose laws. Before discussing a proposal, the chairman of the working body and the Legislative Committee of the Parliament are obliged to include the draft proposal on the agenda of the session of the working body and conduct the debate. After the session, the working body submits its report to the Parliament with the views, comments and suggestions made in the course of its deliberations. The reports are forwarded to the Chairman of the Parliament, who submits them to the proponent of the law, to the chairman of the working bodies and to the deputies. After a draft of the law is made, there is a mandatory debate, which is carried out in two readings. The first reading of the law includes introductory presentation of the proponent, general discussion of the draft law, discussion of the details, the text and the positions of the working bodies that considered the proposal, aiming to reach a conclusion on the need to pass the law. This conclusion sets out the views, suggestions and opinions regarding the proposed law. Opinions are referred to the proponent for the purpose of preparing the final draft of the law. The proponent of the draft law is obliged to submit the Final Proposal of the Law within six months from the date of the adoption of the draft law and provide detailed elaborations. The final draft law is submitted in the form in which the law is passed. The second reading of the law is the second part in the law-making process, which is conducted at the session of the Parliament. It encompasses discussion of the text of the final draft law, the positions of the working bodies, discussion and decision on amendments, and finally, passing the law. Voting is usually public, and is carried out by hand lifting, by roll-call or electronic voting. Legislation, decisions, resolutions, conclusions and other acts are adopted by the majority of votes. The Chairman of the Parliament signs the adopted law and sends it to the President of the Republic of Croatia for proclamation purposes. The President of the Republic declares the law within eight days from the date when they were voted in the Parliament. Before a law comes into force, it needs to be published in the Official Gazette of the Republic of Croatia.



instrument need to be used wisely. Except for those projects encountering funding issues that cannot solely be solved by changes in the NRFs, 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, the share of innovative projects is expected to increase.



## ANNEX I: TYPOLOGICAL INVESTMENTS – ELECTRICITY

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

Category	Examples of solutions
New transmission lines based on innovative technology or change of technology of existing lines	<ul style="list-style-type: none"> <li>• New HVDC lines (→allow to control the power flow; less expansive for long distance transport; undergrounding less complex);</li> <li>• Replacement of HVAC by HVDC lines (→less complex and less expensive; more compact design);</li> <li>• Underground cables or GIL (→ more expensive than OHL but can help improving public acceptance and accelerate the authorisation process);</li> <li>• Design of overhead line poles (→can help improving public acceptance and accelerate the authorisation process);</li> <li>• Replacement of conventional overhead line conductors by high-temperature conductors (→more expensive than conventional ones but can allow to provide additional capacity at a lower cost level and more quickly than by building completely new lines).</li> </ul>
Introduction of dynamic capacity rating with the aim of utilising existing transmission lines or transformers at higher levels	Spectrum of technological options ranging from a differentiation of rating levels according to fixed time intervals (e.g. seasonal or time-of-day) down to online monitoring of equipment temperature and adaptation of capacity rating in real-time operation.
Installation of power flow control components in order to better adapt power flow patterns to capacities and topology of the existing grid.	<ul style="list-style-type: none"> <li>• Phase-shifting transformers;</li> <li>• Semiconductor-based FACTS elements (including HVDC converters).</li> </ul>
Investment into components contributing to ancillary services provision (reactive power / voltage control, short-circuit power, momentary power reserves and black-start capability)	<ul style="list-style-type: none"> <li>• Purely phase-shifting generators (→offer operational flexibility and can serve to improve cost efficiency);</li> <li>• FACTS elements (→ see above).</li> </ul>
New or extended power system control and automation technology with the aim to lower the risk of disturbances threatening security of supply	<ul style="list-style-type: none"> <li>• Improvements in observability and controllability based on conventional sensor and actor devices;</li> <li>• Wide-area measurement systems (aiming at synchronously measuring power phasor angles at the grid nodes to improve observability);</li> <li>• Real-time dynamic security assessment tools (aiming at observing stability phenomena beyond static voltage/current measurements).</li> </ul>

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

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Category	Examples of solutions
Partial automation of system operation processes aiming at better utilisation of existing grid capacities	Automatic switching of network devices (in connection with adaptive protection schemes) or of generation-side or demand-side flexibilities in case of grid component outages in order to reduce the demand for (n-1) capacity reserves.
Improvement of approaches to curative congestion management providing the possibility to operate systems closer to their technical limits and/or to improve security of supply	<ul style="list-style-type: none"><li>• Generation-side flexibilities (especially renewables);</li><li>• Demand-side flexibilities (DSM/DR);</li><li>• Storage components; and</li><li>• Technologies coupling the electricity sector with other sectors (gas, heat, traffic).</li></ul>

## ANNEX II: TYPOLOGICAL INVESTMENTS – GAS

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

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

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

Category	Examples of solutions
Increased need for flexibility for market development and security of supply.	<ul style="list-style-type: none"><li>• (Power-to-gas) Usage of excess pipeline capacity as “energy” storage of excess wind or solar energy by utilizing electrolysis (an efficient utilization of the excess of electricity produced by non-programmable sources of energy);</li><li>• Increase withdrawal and injection capacity in storages by incentivising investments supporting flexibility (support of gas market liquidity and security of supply level);</li><li>• Allowance of higher pressure in selected pipeline/routes (increase of flexibility of the supply side).</li></ul>
Incentivise and facilitate upgrade of biogas to the transmission system.	<ul style="list-style-type: none"><li>• Investments in upgrade of biogas to transmission system (support of gas market liquidity and security of supply).</li></ul>
Digitalisation of operations, through e.g. drone inspections and artificial intelligence (AI), resulting in a safer and cost-efficient operation.	<ul style="list-style-type: none"><li>• Drone inspections and AI in combination with modern SCADA systems can serve as input to reliability based operation and maintenance (lower maintenance cost and reduction of unforeseen/unplanned shutdowns).</li></ul>
In order to support security of supply and add liquidity to the gas market, there is a need to build interconnectors in Europe.	<ul style="list-style-type: none"><li>• More reverse flow systems could be considered to increase flexibility in the supply routes (reduction of dependency and power of trading of the large gas suppliers);</li><li>• Enhancement of available gas supply in situation of supply crisis;</li><li>• possibility of arbitrage a price convergence between markets to support the development of the internal market.</li></ul>



### ANNEX III: POTENTIAL REGULATORY BARRIERS FOR PROJECTS

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

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

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