

## PROFESSIONAL PAPER

# REGULATORY FRAMEWORKS RELATED TO ELECTRICITY AND GAS INFRASTRUCTURE: CROATIA IN THE CONTEXT OF THE EUROPEAN UNION

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**ABSTRACT:** The paper deals with the issues related to the regulatory framework pertaining to electricity and gas infrastructure within the European Union in general and Croatia in particular. The data and the analysis we put forward in the paper are drawn from a recent European Commission report which addressed the areas of innovation and security of supply of gas and electricity. We first present the broader EU context, and then we assess the regulatory framework in Croatia in order to see how it compares to other EU countries. On the whole, the regulations pertaining to the security of supply of gas and electricity are largely standardized across the EU, and they can generally be judged as satisfactory, both in Croatia and in the EU as a whole. Nevertheless, there is much less standardization when it comes to the national regulatory frameworks governing the area of innovation, and there are significant differences between various EU member states in this context. The regulatory environment in Croatia in particular was judged as insufficiently conducive to innovation within the electricity and gas sectors, so the country is encouraged to undertake a certain number of reforms in order to catch up with the EU standards.

**Key words:** *Electricity infrastructure, gas infrastructure, security of supply, innovation, European Union, Croatia*

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## 1. INTRODUCTION

The paper will address the issues related to the regulation of gas and electricity supplies within the European Union (EU). We will be looking at two main aspects in this context: (i) security of supply; and (ii) innovation. The main focus of the paper will be the regulatory framework related to gas and electricity infrastructure in Croatia, which will be put within the larger EU context and compared to other EU countries. The main source that will be used in the paper is the European Commission (EC) report on the regulation of electricity and gas within the EU (referred to from now on simply as the ‘EC Report’) and, more specifically, the chapter on Croatia, which appears in Annex I of the report.<sup>1 2</sup>

Before we focus on the main subject of the paper, we will first provide a brief introduction into the areas of electricity and gas infrastructure in general (in Section 2). Section 3 will provide a broader overview of the regulatory framework pertaining to gas and electricity in the EU, with a special focus on security of supply and innovation. In section 4, we will focus on the situation in Croatia in particular, comparing it to other EU countries, and assessing which aspects of Croatia’s regulatory framework require further improvement in order to reach the level of more developed EU countries. In the conclusion we then recapitulate the main points of the paper.

## 2. ELECTRICITY AND GAS INFRASTRUCTURE: GENERAL OVERVIEW

In this section we will provide a brief introduction into the areas of electricity and gas infrastructure, explaining what they consist of and what sorts of potential problems they may present, which are then addressed in the EC Report.

The most important element within the electricity infrastructure is the electrical grid, which can be defined as an interconnected network set up to deliver electricity from producers to consumers (Kaplan, 2009). The electrical grid mainly consists of the following: generating stations that produce electric power; electrical substations that prepare electrical voltage for transmission or for distribution; high-voltage transmission lines that carry

<sup>1</sup> The title of the report is: ‘Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure?’. The entire report can be found on <https://op.europa.eu/en/publication-detail/-/publication/6700ba89-713f-11e9-9f05-01aa75ed71a1/language-en/format-PDF/source-96288082>. The annex on Croatia in particular can be accessed separately at <https://op.europa.eu/en/publication-detail/-/publication/945b521e-7ab6-11e9-9f05-01aa75ed71a1/language-en/format-PDF/source-97530528>.

<sup>2</sup> For the sake of simplicity, from now on, when we reference the broader report, it will be referred to as the ‘EC Report’, whereas the specific annex on Croatia will be referred to simply as ‘Annex I’ (since the chapter on Croatia is the only part of Annex I that we will be referencing in the paper).

power from sources to demand centers; and distribution lines that carry power from these demand centers to end users.<sup>3</sup>

When it comes to gas infrastructure, it basically consists of the entire production and distribution chain that converts natural gas obtained from the earth to the final product consumed by end users. There are various types of facilities that constitute gas infrastructure, some of which are: natural gas processing plants (used to convert raw natural gas into sales gas that can be pipelined to the end users); storage and transport facilities (e.g. pipelines, LNG carriers, tank trucks etc.); gas and steam turbines, among other types of infrastructure.<sup>4</sup>

While the electricity and gas infrastructure is essential for the functioning of any modern economy, it is also associated with a certain number of risks, dangers and vulnerabilities. When it comes to electricity infrastructure, it can be subject to blackouts, damage to transmission lines, circuit breaks etc. As for gas infrastructure, it presents risks of explosions, toxicity, as well as broader negative environmental effects. One of the main functions of the EC Report that this paper is based on is to assess how these risks and vulnerabilities can be mitigated through improvements in the regulatory framework related to electricity and gas infrastructure.

### **3. GAS AND ELECTRICITY INFRASTRUCTURE IN THE EU: REGULATORY FRAMEWORK PERTAINING TO THE SECURITY OF SUPPLY AND INNOVATION**

As we outlined in the introduction, the EC Report addresses the regulatory framework within the EU in relation to two main aspects: on the one hand, security of supply, and the other hand, innovation in electricity and gas infrastructure. The report assesses the current situation in this context across the EU, identifies certain problematic areas in different EU countries, and then provides recommendations for improvement. In this section we will give a more general overview of the regulatory environment pertaining to gas and electricity infrastructure in the EU as a whole, whereas the following section will focus in more detail on the Croatian context.

The main aspect of the regulatory framework pertaining to gas and electricity infrastructure that the EC Report focuses on is the relation between the Transmission System Operators (TSOs from now on) for oil and gas and National Regulatory Authorities (NRA) across EU countries. The main function of TSOs is to operate, maintain and develop the transmission networks for oil and gas, and this function is provided by different national operators (which may or may not be State-owned) in different EU countries (EC

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<sup>3</sup> [https://en.wikipedia.org/wiki/Electrical\\_grid](https://en.wikipedia.org/wiki/Electrical_grid)

<sup>4</sup> [https://en.wikipedia.org/wiki/Natural\\_gas#Processing](https://en.wikipedia.org/wiki/Natural_gas#Processing)

Report, 23). The main function of NRAs is to license TSOs and supervise their performance, as well as fix or approve transmission and distribution tariffs (EC Report, 24). The report assesses the relation between NRAs and TSOs in different EU countries with a view of fostering greater security of supply and innovation.

When it comes to security of supply, the duties of the TSOs are explicitly set out in all of the EU member states' regulatory frameworks, and there is generally a high level of commonality and consistency across member states when it comes to ensuring the security of supply of electricity and gas. This issue has already been addressed in a number of previous EU agreements as well as in various pieces of EU legislation (e.g. Third Energy Package, TEN-E Regulation, Security of Gas Supply Regulation, etc.), and the situation pertaining to the security of supply has generally been deemed as satisfactory (EC Report, 9). Some of the measures that are used to ensure the security of supplies are the following: transmission grid expansion, increased cross-border trading options, new technologies or the more optimal use of existing technologies etc. (EC Report, 13, 17). The investment in these measures has generally been judged as sufficient, although certain delays in investment have been identified in specific countries.

When it comes to the area of innovation within the electricity and gas infrastructure, the situation across EU countries becomes considerably more complicated and unequal. There are significant differences between various EU member states when it comes to the regulatory frameworks and the degree of investment pertaining to innovation. In fact, there are differences between various countries in the very definition that they apply to the notion of innovation in this context: for instance, certain countries restrict innovation only to the area of Research & Development, while others adopt a broader view of innovation, such as the UK, which applies the notion of innovation also to the operational and commercial aspects related to the gas and electricity infrastructure (EC Report, 39). Some of the examples of innovative technologies that are used in the EU include: carbon footprint improvement measures (e.g. waste heat collection, pipeline evacuation with mobile compressors etc.) in the context of gas; or measures to ensure greater stability in the energy delivery in the context of electricity (e.g. synchronous condensers used by the Danish TSO) (Ibid.).

When it comes to the regulatory framework pertaining to innovation in gas and electricity infrastructure, the EU member states can be divided in two broad categories: a) countries that make explicit references to innovation in their regulatory framework; b) countries that make no explicit reference to innovation in their regulatory framework. As for investment in innovation, the report establishes a rough "East-West divide" in this context: "Western European" countries (e.g. France, Germany, Italy) provide considerable investment towards innovation measures within their electricity and gas infrastructure, while countries situated more to the East (e.g. Bulgaria, Croatia) invest much less in innovation, providing financial support to only a small number of innovative projects, which are non-costly and limited in scope (EC Report, 38).

The EC Report then goes on to identify a certain number of issues and problematic areas pertaining primarily to innovation (and to a lesser degree to the security of supply) within the EU electricity and gas infrastructure (EC Report, 40-44). The main issues that were identified in the report are the following:

- a) Projects that are socially beneficial but not judged as economically viable are not sufficiently incentivized. This includes a bias towards solutions that are based on capital expenditure (CAPEX) over those based on operational expenditure (OPEX), because the former are generally more financially viable than the latter.
- b) No specific provisions related to innovation (e.g. allowances, duties etc.): many EU countries do not make an explicit mention of investment into innovation within their legislative framework pertaining to electricity and gas infrastructure.
- c) TSOs are deterred from risky investments (even if such investments are potentially beneficial, especially in the long term) due to perceived high project risk and/or high penalties for not meeting deadlines.
- d) Regulatory uncertainty and lack of clarity of mandate pertaining to certain innovative fields.

Problems listed in a)-d) can be more or less acute depending on the country and, as we will see in Section 4, the regulatory framework in Croatia in particular exhibits a number of these problems.

Once the main problems have been identified, the report then goes on to recommend a number of solutions which may serve as remedies to those problems (EC Report, 61-62). The primary recommendations suggested in the report are listed below:

- (i) Requirement to consider innovative solutions: for instance, the regulatory framework in EU member states should oblige TSOs to apply innovative solutions, which may be further financially incentivized.
- (ii) Perform social cost-benefit analyses for larger projects, in order to ensure that such projects produce wider societal benefits.
- (iii) Clarify the role of TSOs in innovative fields, in order to distinguish between the areas where the market may provide innovative solutions and those areas where the TSOs will need to step in.
- (iv) Mitigate the bias towards CAPEX-based solutions (see the problem identified in a) above) by encouraging OPEX-based solutions, including through financial incentives.
- (v) Organize broader consultations on national network development plans and investment plans.

Once again, the recommendations listed in (i-v) can be more or less needed depending on the country. In the following section, we will see how the broader EU picture we just described is reflected on the national level in Croatia.

#### **4. REGULATORY FRAMEWORK PERTAINING TO ELECTRICITY AND GAS INFRASTRUCTURE IN CROATIA**

In addition to describing the broader EU situation in relation to innovation and security of supply within the electricity and gas infrastructure, The European Commission report that we are referring to in the paper also contains annexes (Annex I in particular) where the more specific situation in each individual EU member state, including Croatia, is addressed. In this context, the report identifies the problematic areas observed in different countries, as well as examples of good practices that can serve as a model for other countries. When it comes to Croatia, it must be said that the country is more often mentioned in the context of problems than in the context of good practices, so there is considerable room for improvement when it comes to the country's gas and electricity infrastructure as well as the regulatory framework pertaining to it.

A distinction needs to be made in this context between security of supply, on the one hand, and innovation, on the other. When it comes to the security of supply, Croatia is relatively close to the EU standard. As we already explained in the previous section, the regulatory frameworks pertaining to the security of supply of electricity and gas in the EU are largely standardized, defined in the EU legislation and in previous EU agreements, so there is not a great degree of variation between different EU countries in this context. When it comes to innovation, on the other hand, Croatia still has a lot of room for improvements, particularly when compared to the countries of Western and Northern Europe. Therefore, the discussion in this section will largely center on the area of innovation.

Before we focus on the more specific issues related to innovation within the electricity and gas infrastructure in Croatia, we will first describe the broader regulatory framework pertaining to these sectors. The responsibility for the oversight of the Croatian energy sector as a whole, which encompasses electricity and gas infrastructure as well, is placed within the Ministry of Environment and Energy. The more specific duties pertaining to the regulation of energy activities in Croatia are the responsibility of the Croatian Energy Regulatory Agency (CERA), which is charged for approving investment, development and construction plans within the gas and electricity sector (Annex I, 11).

It should be noted, however, that the gas and electricity sector in Croatia are not entirely owned and operated by the State, and in this sense Croatia differs from some other EU countries, such as Denmark, Estonia or Poland, where both the gas and the electricity TSO are State-owned (EC Report, 108-9). The gas TSO in Croatia ('Plinacro') is State-owned, but it is legally defined as an independent subject, whereas the electricity TSO

(‘Hrvatski operator prijenosnog sustava’ or ‘HOPS’ for short) is not directly owned by the State (Annex I, 11, 17). Moreover, the national regulatory agency charged with regulating the gas and electricity sector in Croatia (i.e. CERA) is an autonomous and independent institution, which is also not under the direct control of the State (Annex I, 11). Therefore, as a whole, it can be said that the State does not play as much of a role when it comes to governing the gas and electricity sector in Croatia as it does in some other EU countries, such as those mentioned above.

One of the main functions of the national regulatory agency in the context of gas and electricity in Croatia is to regulate and provide financing to these sectors (e.g. fixing tariffs and ensuring other types of investment). Financing and investment is particularly important when it comes to fostering innovation within the gas and electricity sector, so the EC Report on Croatia pays particular attention to this issue. In this context, Croatia applies what has been defined as a “hybrid regulatory framework”, which combines both cost-based and incentive-based regulation pertaining to the financing of the energy sector (a similar type of approach is also applied in other EU countries, such as Italy or Portugal, for instance) (EC Report, 30).

When it comes to the electricity infrastructure in Croatia, its financing gravitates more towards the cost side but maintains some elements of incentive as well, using what has been defined as a “cost-plus” model (a similar financing model is applied in Slovakia as well) (EC Report, 92-93). This model functions on a year-by-year basis, and the amount of tariffs for the following year is calculated on the basis of total costs and investments realized in the previous year (Annex I, 13). When it comes to gas, on the other hand, the financing model is more hybrid, combining both the elements of cost and the elements of incentive: Capital Expenditure (CAPEX) is calculated using a cost-based method, while Operational Expenditure (OPEX) is calculated using an incentive-based method. The cost aspect in the context of CAPEX includes mechanisms such as the depreciation cost and the return of regulated assets. When it comes to OPEX, on the other hand, an important incentive element is the profit-sharing mechanism whereby the systems operator retains 50% of the achieved savings for the base year (Annex I, 19).

The financing of the gas and electricity infrastructure in Croatia, as well as in other EU countries, is determined on the basis of regulatory periods. Croatia in particular issues a broader 10-year development plan for its energy sector, and this broader plan is then subdivided into shorter regulatory periods. Depending on the country, these regulatory periods usually range between 1 and 8 years. Croatia is one of the countries with the shortest regulatory periods in the EU. In the context of gas, the regulatory period is just 1 year (the only other EU countries with the 1-year regulatory period are Austria and Bulgaria) (EC Report, 98). When it comes to electricity, the regulatory period is not clearly outlined, but it usually functions on a yearly basis as well (Annex I, 13). These periods are then used to assess the need for financing and investment into the gas and electricity sector.

The regulatory framework pertaining to investment towards the security of supply of electricity and gas in Croatia is judged as largely satisfactory and on a par with EU standards, since this is an area where there is a greater degree of convergence across the EU countries in general (see Section 3 of this paper).

In this context, the duties of the Croatian transmission operators are clearly outlined within the legal and regulatory framework. The electricity TSO (i.e. 'HOPS') is tasked with planning investments in order to secure the long-term capability of the transmission system, ensure the reliability of the transmission grid, and safeguard the security of supply more broadly (Annex I, 14). The gas TSO ('Plinacro') is tasked with planning the investments in construction and re-construction of the transmission system in order to ensure the security of the gas supply (Annex I, 22). Once again, these types of regulations pertaining to the security of supply of electricity and gas are generally judged as satisfactory within the broader EU context.

When it comes to the area of innovation, on the other hand, the regulation of the gas and electricity sector in Croatia has been judged as lagging behind the EU standards in several aspects, and thus needs to be improved. On a broader EU level, the EC Report classifies different member states into two broad categories in this context: (i) countries that explicitly mention innovation as an objective within their regulatory framework (either at the level of legislation or in other types of regulations); and (ii) countries that make no specific mention of innovation in their regulatory framework (EC Report, 38). Croatia presents a mixed picture in this context: it can be grouped in category (i) when it comes to electricity infrastructure (together with countries such as Austria, Belgium, Denmark, France, Germany etc.) and in category (ii) when it comes to gas infrastructure (together with countries like Czechia, Estonia, Greece, Hungary or Italy, among others) (EC Report, 104). Nevertheless, even in those areas where innovation is set as a goal within the regulatory framework, the actual concrete measures and investment aimed at fostering innovation have been judged as not entirely satisfactory.

When it comes to innovation in the electricity infrastructure, the national regulatory framework in Croatia stipulates the need for the application of new technologies, especially if the innovation within this sector leads to greater cost cutting and efficiency saving (Annex I, 14). As a result, the HOPS report from 2016 has indicated that the transmission operator has been actively engaged within the Research & Development sector (Ibid.). This suggests that the current regulatory framework pertaining to electricity infrastructure in Croatia allows for some innovation to take place. Nevertheless, there are still no specific financing mechanisms designed to incentivize investment into innovation and innovative projects in this area (Ibid.).

Therefore, the regulatory framework pertaining to innovation within the electricity sector in Croatia still needs to be improved if the country is to catch up with EU standards in this context.

When it comes to gas infrastructure, on the other hand, no specific statutory duty to innovate is set out within the Croatian national regulatory framework, as was already

mentioned above. The regulatory framework only mentions the obligation of efficiency, which may imply innovation if it results in the lowering of costs, but there is no explicit mention of innovation per se. There are also no specific financing mechanisms aimed at fostering innovation within the gas infrastructure, similarly as was noted earlier in the context of electricity. As a result, only a small number of innovative pilot projects are currently being planned and put to practice within the gas and electricity sector in Croatia (Annex I, 21).

This is where we return once again to the more general “East-West” split within the EU that was noted earlier in Section 3 in relation to the investment in innovation within the electricity and gas infrastructure. “Western countries”, such as France, Germany or Italy, provide substantial investment towards innovations in areas such as transport efficiency or carbon footprint improvements measures, among others. On the other hand, “Eastern countries”, including Croatia, only have a few projects which target innovation within the energy sector, and these projects are usually relatively small and non-costly (EC Report, 38).

The only major exception to this rule is the SINCRO grid, which is a large project involving electricity infrastructure (currently in its formative investment phase) commonly planned by Croatia and Slovenia. The SINCRO grid presents one of the few examples of good practices where Croatia can be seen as a model for other EU countries, because this electricity infrastructure project uses advanced technical solutions and algorithms which have a potential to enhance the quality of the energy system as a whole (Annex I, 15). When it comes to innovation within the gas infrastructure, on the other hand, the EC Report could identify only a few small innovative projects (e.g. drone inspections for gas leakage detection or the revitalization of old off-shore pipelines through the use of flexible pipes) currently taking place in Croatia (Annex I, 22).

All of the data and assessments we put forward so far clearly indicate that Croatia has a lot of room for improvement when it comes to the regulation of its electricity and gas infrastructure, particularly as it pertains to innovation within these sectors. The financing of innovative projects is inadequate and innovation in general is not sufficiently emphasized as an objective within Croatia’s legal and regulatory framework. The problem of financing is particularly acute within the gas sector, due to increases in operational costs within this sector. The significant recent increase in the scope of gas pipelines which was the result of the greater gasification of the country has seen the Croatian gas tariffs skyrocket to become one of the highest and costliest in Europe (EC Report, 36). Such a high existing cost of tariffs limits the possibilities of financing within the gas sector, because the State cannot use further increases in tariffs (for both economic and political reasons) as a means to invest in further innovation within the sector.

The EC Report also identifies a number of additional deficiencies within Croatia’s regulatory framework pertaining to the electricity and gas infrastructure, such as the ones listed below (Annex I, 12-13):

- (i) The legal framework is not conducive to a greater introduction of market-driven competition to the energy sector, which can have a negative effect on certain business practices within the sector.
- (ii) The administrative procedures involved in the licensing of new projects are often too slow and cumbersome.
- (iii) The constant changes within the legal framework and amendments to existing laws lead to uncertainty, which is not favorable for investment.

Croatia is not unique in the EU context when it comes to these problems, because similar difficulties and deficiencies were noted by the EC Report in a number of other EU countries as well, but these are some of the issues that Croatia needs to address if it is to come closer to the EU standards when it comes to the regulation of its gas and electricity infrastructure.

Finally, the EC Report identifies a number of improvement measures that Croatia should consider implementing in order to enhance the quality of its regulatory framework pertaining to the electricity and gas infrastructure. The main recommendations outlined in the report are those listed below (EC Report, 12; Annex I, 23):

- (i) Consider innovative solutions and, more specifically, introduce statutory reference to the requirement for innovation (similar recommendation was also made for countries like Austria, Greece, Portugal or Germany, among others).
- (ii) Perform social cost-benefit analyses, specifically to foster projects with lower commercial benefits (same recommendation as for Belgium, Denmark, Hungary, Slovenia etc.).
- (iii) Consult with the relevant stakeholders when elaborating national development plans (as was recommended for Bulgaria, Luxemburg, Spain, Portugal etc.).

These are some of the same recommendations that were also made on a broader EU level (see the end of Section 3), so the suggested improvement measures listed above are not just required in Croatia but in a number of other EU countries as well, including some of the most developed countries such as Germany. Nevertheless, as we noted in the beginning of this section, Croatia is more often cited in the context of problems than in the context of good practices, so the country will need to improve its regulatory framework pertaining to gas and electricity infrastructure if it wants to catch up with the EU standard within these areas.

## 5. CONCLUSION

The paper addressed the issues related to the regulatory framework pertaining to electricity and gas infrastructure in the European Union in general and in Croatia in particular. The regulations in this context were judged as broadly satisfactory, both in Croatia and in the EU as a whole, when it came to the security of supply of gas and electricity, but the regulatory framework pertaining to innovation presented a more complex picture, with certain EU member states lagging behind others. Croatia in particular was shown to exhibit a number of deficiencies in this area, so it will need to improve and modernize its legal and regulatory framework in order to foster a more favorable environment for innovation within the gas and electricity sector.

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