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EU and domestic regulation on the production of renewable hydrogen, constitutional issues related to the domestic regulation**

Abstract

The purpose of the present article is to review the relevant, recently published EU and national strategy documents, the role of hydrogen set out in them, and some key regulatory elements concerning hydrogen in the field of energy, following the introduction of renewable hydrogen and its possible uses. The article also focuses on the principles of the Fundamental Law, which are related to hydrogen and its uptake, and shares the constitutional dilemmas that can be related to the currently limited domestic regulation concerning hydrogen. It should be emphasized that partial amendments are already being made to the relevant regulations of the European Union, and the development of the domestic regulation is expected to begin in the short term, thus contributing to the achievement of the 2050 carbon-neutrality goal and laying down the basics of the hydrogen economy.
Keywords: hydrogen, renewable hydrogen, Fundamental law, Hydrogen Europe, natural gas, National Energy Strategy.

Introduction

The production of renewable hydrogen is not a new topic in the energy sector, but in the second half of 2020 it was given particular attention at virtual conferences and forums in Hungary. It is being addressed by all key players and they intend to take substantive steps to mobilize its potential as soon as possible to achieve the 2050 goal of climate neutrality. But what is renewable hydrogen and to what extent does the legal environment of the European Union and Hungary enable the production and admission of renewable hydrogen, and to what extent is the domestic regulation in line with the Fundamental Law?

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1. What is clean hydrogen?

Hydrogen is considered worldwide as one of the energy carriers that will be able to replace fossil fuels for the sustainable development of humanity. In case hydrogen is produced from renewable sources (renewable hydrogen), it can help the realization of the principle of carbon neutrality.[1]

Hydrogen, similar to electricity, is an energy carrier that cannot be 'mined' using conventional methods. Hydrogen and electricity are also similar in that as energy carriers they both require serious storage tasks.[2]

In general, hydrogen can be produced in two ways: by electrolysis and from fossil fuels. The majority is excited about the electrolysis, as this method decomposes water to hydrogen and oxygen by using electricity. If the electricity used for the electrolysis comes from renewable energy sources (e.g. solar cells, wind power plants), the process ensures a sustainable way of producing energy. That is why it is called renewable hydrogen.[3]

Alternatively, hydrogen can be produced from fossil fuels as well. The most popular and cost-effective method to do so is the steam reforming of methane, the basic substance of which is methane, which forms natural gas. The hydrogen produced this way is called grey hydrogen. When hydrogen is produced from fossil fuels, but it does not lead to greenhouse gas emissions, it is called blue hydrogen. Although blue hydrogen is unsustainable, it goes with low carbon emissions.[4]

The challenge of the production of renewable hydrogen is that a biological system, which is suitable for the task of water-decomposition (i.e., the production of oxygen and hydrogen gas) of the energy available in the form of solar energy, does not exist in nature. Consequently, one of the key challenges could be the artificial development of microorganisms with the methods of molecular biology, which are able to produce oxygen and hydrogen gas by water-decomposition. This is a challenge that requires a global collaboration in research and development.[5]

But what are the fields of use of renewable hydrogen? The best-known use is related to transport, where manufacturers have developed several hydrogen-powered vehicles that could be alternatives to electric vehicles in the coming years.

At the same time, global society is most in need of hydrogen in sectors that cannot be easily electrified. The most urgent is the industrial use, as the carbon intensity of our basic activities need to be reduced as soon as possible: from the production of steel, to cement. Electricity cannot be used to carry out these activities, but as hydrogen can also be used to generate heat without emission of greenhouse gases, it offers a suitable alternative in respect of fossil fuels. Its application is similar to natural gas in many respects, which allows it to be used as a fuel in industrial processes, in heat supply or even in the operation of generators for electricity production.[6]

[1] Kovács, Fülöp, Herbel, Nyilasi & Rákhely 2010, 20–21.
[2] Ibid.
[3] Szabó 2020.
[4] Ibid.
[5] Kovács, Fülöp, Herbel, Nyilasi & Rákhely 2010, 20–21.
[6] Szabó 2020.

Another important option for use is energy storage. There are 'little' problems with electricity storage, such as the scarcity or weight of resources required to produce batteries, as well as its costs. However, these issues are obscured by an even more significant problem, namely that the popular forms of energy storage, such as lithium-ion batteries, can only store energy economically for 1-2 days at best. To make the current energy system carbon neutral, seasonal differences between demand and supply from renewables need to be overcome. To put it simply, popular renewables, such as solar cells, operate with significantly higher utilization in the summer, while the consumers' energy demand is generally higher in the winter (one only need to think of the demand for heating). Hydrogen can bridge this gap: energy produced during the summer season (from potentially renewable energy sources) could help to satisfy needs in the winter season.[7]

It is an important aspect, that transporting hydrogen is significantly cheaper than transporting electricity. The infrastructure necessary to transport the latter is 10 to 20 times more expensive than what the former one requires. Furthermore, existing natural gas infrastructure can facilitate the transport and distribution of hydrogen, which can further reduce costs and demand for raw materials, however, many questions may arise about exactly which infrastructure elements can be converted for this purpose, how, and at what cost.[8]

Finally, as the intensive research tasks and industrial use were mentioned, Hungarian researches on electrolysis technologies, which are the basis for renewable hydrogen production, have recently produced leading-edge results.

Researchers and their industrial partners in Szeged have developed an energy-efficient electrolysis technology using only water and carbon dioxide, which was the first in the world to exceed the dream limit of 1 ampere / square centimeter density in the production of carbon monoxide. The carbon monoxide produced this way can be utilized as a high-value product directly in the petrochemical value chain.[9]

2. The constitutional aspects of sustainable development and environmental protection

After learning what renewable hydrogen is and what kind of uses it has, I will first review the Fundamental Law as the basis for the regulatory environment for renewable hydrogen. The Fundamental Law sets out two main milestones to be raised concerning the topic of the present article:

The National Avowal states that *"[w]e bear responsibility for our descendants and therefore we shall protect the living conditions of future generations by making prudent use of our material, intellectual and natural resources."*[10]

[7] Ibid.
[8] Ibid.
[9] Szegedi Tudományegyetem Hírportál (2020) Az SZTE kutatói is segítik a hidrogén felhasználását a zöld gazdaságban
[10] The Fundamental Law of Hungary.

The above principle is explained more specifically in Article P) and Article XX. of the Fundamental Law. According to paragraph (1) of Article P) of the Fundamental Law: *"Natural resources, in particular arable land, forests and the reserves of water, biodiversity, in particular native plant and animal species and cultural values, shall form the common heritage of the nation, it shall be the obligation of the State and everyone to protect and maintain them, and to preserve them for future generations."*[11]

Furthermore, Article XX. of the Fundamental law states that: *"(1) Everyone shall have the right to physical and mental health. (2) Hungary shall promote the effective application of the right referred to in paragraph (1) through agriculture free of genetically modified organisms, by ensuring access to healthy food and drinking water, by organizing safety at work and healthcare provision and by supporting sports and regular physical exercise as well as by ensuring environmental protection."*[12]

It can be seen from the cited provisions, that the Fundamental Law further developed the environmental values and approach of the Constitution and the Constitutional Court. Paragraph (1) of Article P) does not define exhaustively the range of natural assets to be protected, but it does define what the protection of the environment actually means as a public and civic duty: 1. protection, 2. sustenance, 3. preservation for future generations. Thus, the public obligation was independently regulated and emphasized in paragraph (1) of Article P) of the Fundamental Law. It is a significant progress of the Fundamental Law, that it extended the scope of subjects of such obligation. While in the Constitution only the public obligations were emphasized concerning environmental protection, the Fundamental Law speaks about the obligations of 'everyone', including civil society and each citizen.[13]

Therefore, on the one hand, the Fundamental Law describes the substantive elements of environmental protection as a public and civic obligation, in which preservation for future generations is also emphasized.

Furthermore, according to Article N) of the Fundamental Law, *"Hungary shall observe the principle of balanced, transparent and sustainable budget management."*[14]

Consequently, the Fundamental Law considers the fact that the effectiveness of fundamental rights, the democratic and efficient functioning of the state, the security of persons living in Hungary as well as of the organizations operating here can only be adequately guaranteed if the country's social and economic balance is not endangered by serious public finance problems. Based on that, the balanced, transparent, and sustainable budgetary management appears in the Fundamental Law. Of these, balance serves predictable functioning of the state, transparency serves democratic public life involving informed and responsible citizens, and *sustainability* serves responsibility for the fate of future generations as well, in addition to the primary financial goals.[15]

[11] Ibid.
[12] Ibid.
[13] Gáva, Smuk & Téglási 2017, 35.
[14] The Fundamental Law of Hungary.
[15] Gáva, Smuk & Téglási 2017, 33–34.

So, on the other hand, sustainability, i.e. responsibility for the fate of future generations is also reflected by the Fundamental Law in state budgetary management. Development is sustainable if the development of the economy results in continuous social prosperity within the limits of ecological carrying capacity, preserving natural resources for future generations.[16]

This also means that from an environmental, environmental regulatory point of view, and during the use of budgetary resources, the possible use of all renewable energy sources must be examined and made possible, which can ensure the achievement of carbon neutrality as soon as possible, but by 2050 at the latest. These milestones set out in the Fundamental Law should be kept in mind when examining the current regulatory environment for renewable hydrogen.

3. The European Union Strategy and regulatory elements related to hydrogen

3.1. The European Union's Hydrogen Strategy

Before the overview of the Hungarian legislation, let us take a look at the European Union framework for the regulation of renewable hydrogen. On 8 July 2020, the European Commission's document, called 'A hydrogen strategy for a climate-neutral Europe' was published (hereinafter: EU Hydrogen Strategy).

According to the EU Hydrogen Strategy, hydrogen can be used as a feedstock, a fuel or an energy carrier and storage, and has many possible applications which would reduce greenhouse gas emissions across industry, transport, power and building sectors.[17]

The document outlines three steps on the path towards a European hydrogen eco-system: (1) 2020-2024 – support for the installation of at least 6 GW of renewable hydrogen electrolysers and the production of up to 1 million tonnes of renewable hydrogen in the EU. (2) 2025-2030 – hydrogen needs to become an intrinsic part of an integrated energy system with a strategic objective to install at least 40 GW of renewable hydrogen electrolysers by 2030 and the production of up to 10 million tonnes of renewable hydrogen in the EU. (3) as from 2030 – renewable hydrogen technologies will be deployed at a large scale across all hard-to-decarbonise sectors.[18]

The document mentions that renewable hydrogen is to be produced mainly from wind and solar energy in the long term, in line with the EU's climate neutrality objectives, but in the short and medium term, other forms of low-carbon hydrogen are needed as well, to rapidly reduce emissions from existing hydrogen production.

The document then presents how the situation of hydrogen can be facilitated in Europe. One of the regulatory elements of it is that *"clean hydrogen needs a supportive framework, well-functioning markets and clear rules, as well as a dedicated infrastructure and logistical network."*[19]

[16] Ibid. 83.
[17] European Commission (2020) Factsheet on EU Hydrogen Strategy.
[18] Ibid.
[19] Ibid.

The above is further specified in the document, as it states that the European Commission will work to introduce a comprehensive terminology and certification system to define renewable hydrogen and other forms of hydrogen. It will be based on life-cycle carbon emissions, anchored in existing climate and energy legislation, and in line with the EU taxonomy for sustainable investments.[20] This strategy, through supporting investment in clean hydrogen, will be critical in the context of the recovery from the COVID-19 crisis by creating sustainable growth and jobs.[21]

In order to identify the EU energy/climate policy regulations to be amended/adopted in connection with this EU Hydrogen Strategy, I will review hereinafter the document which contains Hydrogen Europe's 10 key recommendations.

3.2. Hydrogen Europe's energy/climate policy proposals for amendment

Prior to the publication of the EU Hydrogen Strategy, on 22 June 2020, Hydrogen Europe published its document called 'Hydrogen Europe's Top 10 Key Recommendations.' Hydrogen Europe is a European association representing the interests of the hydrogen industry, involving all actors in the value chain from producer to end user, as well as all stakeholders. The association's mission is to promote clean hydrogen, and to ensure that the European regulatory environment reflects the role of hydrogen, which enables a zero-emission society.

In the introductory part of the document, Hydrogen Europe states the following: *"Meeting the EU's long-term climate and energy goals and realising the promise of the Green Deal means carbon free power, increased energy system efficiency and deep decarbonisation of industry, transport and buildings. Achieving all this will require both electrons and molecules, and more specifically: clean hydrogen (renewable and low carbon hydrogen) at large scale. Without it, the EU will not achieve its decarbonisation targets."* [22]

In the following, I will address some of Hydrogen Europe's key regulatory initiatives in the field of energy, set out in the above mentioned document.

The definition of hydrogen

In the current EU regulation, according to Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources, 'renewable energy' means energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas.[23]

It can be seen that the above comprehensive definition used by the 'Renewable Directive' does not refer to renewable hydrogen.

[20] Ibid.
[21] Ibid.
[22] Hydrogen Europe (2020) The EU Hydrogen Strategy: Hydrogen Europe's 10 key recommendations.
[23] Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources.

According to Hydrogen Europe, *"a rapid agreement on a comprehensive and science-based EU-wide terminology for renewable and low carbon hydrogen is necessary to adapt national legal definitions…"*[24] Furthermore, Hydrogen Europe highlights that the adoption of a methodology for the calculation of the life-cycle carbonic emissions is needed and should also be reflected in the EU-wide terminology to allow comparability between energy sources in terms of the emissions factors.[25]

An EU-wide, uniform definition of renewable hydrogen and low carbon hydrogen is therefore needed to ensure that member states and all industry players handle this energy source in a uniform manner in the regulation and in the emerging European hydrogen market. The short-term development of the definition can be deduced from the EU Hydrogen Strategy, so its EU implementation as soon as possible is a real expectation.

Guarantee of origin

In order to establish a hydrogen market and a competitive hydrogen economy, according to Hydrogen Europe, rules shall be developed in the short term for trading with guarantees of origin for hydrogen, while in the medium- and long-term they encourage tenders for the production of renewable hydrogen, the startup of a hydrogen trade exchange,[26] and it is also recommended to develop the underlying regulation beforehand.

The concept of a guarantee of origin is currently governed by the already referred Renewable Directive.

According to paragraph 2 of Article 19 of the Renewable Directive, *"Member States shall ensure that a guarantee of origin is issued in response to a request from a producer of energy from renewable sources, (…). Issuance of guarantees of origin may be made subject to a minimum capacity limit. The standard size of guarantee of origin is 1 MWh. No more than one guarantee of origin shall be issued in respect of each unit of energy produced."*[27]

According to recital 55 of the Renewable Directive, *"guarantees of origin issued for the purposes of this Directive have the sole function of showing to a final customer that a given share or quantity of energy was produced from renewable sources. A guarantee of origin can be transferred, independently of the energy to which it relates, from one holder to another. However, with a view to ensuring that a unit of renewable energy is disclosed to a customer only once, double counting and double disclosure of guarantees of origin should be avoided."*[28]

Thus, a guarantee of origin can be subject of trade, therefore it is essential for the creation of a renewable hydrogen market.

[24] Hydrogen Europe (2020) The EU Hydrogen Strategy: Hydrogen Europe's 10 key recommendations.
[25] Ibid.
[26] Ibid.
[27] Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources.
[28] Ibid.

Recital 59 of the Renewable Directive already contains indication, that the system of guarantees of origin shall be extended to hydrogen as well: *"guarantees of origin which are currently in place for renewable electricity should be extended to cover renewable gas. (…) This would provide creditable means of proving to final customers the origin of renewable gas such as biomethane and would facilitate greater cross-border trade in such gas. It would also enable the creation of guarantees of origin for other renewable gas such as hydrogen."*[29]

Clearly, the intention to extend guarantees of origin to renewable gases has been present in the European Union for several years, and within that, the referred recital of the directive specifically mentions biomethane and hydrogen. Consequently, the short-term, EU-wide implementation of the extension of guarantees of origin to renewable gases is a real expectation, especially considering its already existing basis in the Renewable Directive.

Natural gas/Hydrogen infrastructure

In order to eliminate the regulatory elements that hinder the development and operation of hydrogen infrastructures, Hydrogen Europe also recommends amending Directive 2009/73/EC concerning common rules for the internal market in natural gas (hereinafter: Natural Gas Directive).

In this respect, the conceptual structure of the Natural Gas Directive needs to be reviewed. The subject of the Natural Gas Directive is defined in the second paragraph of Article 1 as follows: *"The rules established by this Directive for natural gas, including LNG, shall also apply in a non-discriminatory way to biogas and gas from biomass or other types of gas in so far as such gases can technically and safely be injected into, and transported through, the natural gas system."*[30]

Renewable hydrogen, as an 'other type of gas' can be included in the aforementioned scope of the Natural Gas Directive.

However, the requirement, that it must be able to be *"technically and safely injected into the natural gas network"* has to be reviewed in view of the chemical characteristics of renewable hydrogen gas, and in case of inapplicability, a different system of requirements has to be introduced for renewable hydrogen gas.

This line of reasoning is followed by recital 41 of the above Directive as well, which states that *"those technical rules and safety standards should ensure that those gases can technically and safely be injected into and transported through the natural gas system and should also address their chemical characteristics."*[31]

Furthermore, the Natural Gas Directive defines transmission and distribution as follows: (a) transmission: the transport of natural gas through a network, which mainly contains high-pressure pipelines, other than an upstream pipeline network and other than the part of high-pressure pipelines primarily used in the context of local distribution of natural gas, with a view to its delivery to customers;[32] (b) distribution:

[29] Ibid.
[30] Directive 2009/73/EC concerning common rules for the internal market in natural gas.
[31] Ibid.
[32] Ibid.

the transport of natural gas through local or regional pipeline networks with a view to its delivery to customers.[33]

The above definitions apply to natural gas networks, but as it was explained concerning the subject of the Natural Gas Directive, the rules laid down for natural gas can be applied to other types of gas, accordingly, to renewable hydrogen gas as well, if the requirements mentioned above are met. So, the current regulation could even cover the pipeline transmitting renewable hydrogen, but in case of renewable hydrogen gas, differences due to the chemical characteristics of hydrogen (different requirements for the pipeline) and elements arising from the different structure of the hydrogen industry in terms of the activities should be regulated.

Support for trans-European energy infrastructures

Hydrogen Europe proposes to amend Regulation (EU) 347/2013 concerning the trans-European energy infrastructure (hereinafter: TEN-E regulation). This regulation gives visibility to energy infrastructures – makes them of energy policy significance – and speeds up their authorization process. Under the TEN-E regulation, projects of common interest (hereinafter: PCI) will be selected based on the general and specific criteria set out therein, currently in the categories of electricity, natural gas, oil and carbon dioxide.

Hydrogen Europe initiates the following: (1) the eligibility of PCI status shall be extended to projects connected to renewable and low carbon gases, including hydrogen;[34] (2) the sustainability criterion for the selection of PCIs should be incorporated to the regulation taking into consideration the greenhouse gas emissions reduction potential;[35] (3) the retrofitting of existing cross border gas infrastructure to transport clean hydrogen as well as provisions that favour the development of new dedicated clean hydrogen infrastructure should be supported;[36] (4) as hydrogen will take up an important role in transport, it is imperative to create more synergies between the TEN-E regulation and the TEN-T regulation[37] to ensure that hydrogen transported through the TEN-E corridors can be accessed by the relevant refueling stations along the TEN-T corridor;[38] (5) 'clean hydrogen networks' should be introduced as a new thematic area under the TEN-E regulation; this shall include new hydrogen infrastructure projects as well as hydrogen transport solutions, intermediate storage and associated infrastructure projects;[39]

[33] Ibid.
[34] Hydrogen Europe (2020) The EU Hydrogen Strategy: Hydrogen Europe's 10 key recommendations.
[35] Ibid.
[36] Ibid.
[37] Regulation (EU) No. 1315/2013 on Union guidelines for the development of the trans-European transport network.
[38] Hydrogen Europe (2020) The EU Hydrogen Strategy: Hydrogen Europe's 10 key recommendations.
[39] Ibid.

During the preparation of the present article, the European Commission has published a new draft of the TEN-E Regulation. The objective of the proposal is to align regulations with the 2050 climate neutrality targets.

One of the key elements of the Commission's proposal is to exclude new traditional natural gas infrastructure and oil pipeline investments from PCIs after 2022. In terms of decarbonisation, it plans to introduce new infrastructure categories, such as smart gas grid, investments supporting the integration of renewable and decarbonised gases (biomethane, hydrogen, synthetic gases) into the grid and hydrogen infrastructure. In line with the EU Hydrogen Strategy, the draft foresees the support of hydrogen production based on renewable energy. The EU negotiations on the revision of the regulation begins in January 2021.[40]

4. Comments on the EU regulation

Based on the EU Hydrogen Strategy and the above review of the proposed regulatory changes, the following is recommended to be considered.

The first phase of the EU Hydrogen Strategy is until 2024. In order for the fundamentals of hydrogen economy to develop and the hydrogen economy to become an essential, then integral part of the energy system in the second and then the third phase as a subsystem, also, knowing the legislative process of the EU, a two-step legislative process can be effective.

This means that within a year or two, a package of hydrogen proposals containing quick-wins shall be adopted in the field of energy, which clarifies the basic definitions of the hydrogen subsystem, extends the guarantee of origin system to hydrogen, sets out basic requirements for the infrastructures to be transformed and for the new infrastructures, and at the same time, promotes and facilitates the significant uptake of hydrogen projects.

As a second step, legislation of strategic importance may take place connected to hydrogen economy, the decisive point of which could be from a legislative aspect if a separate hydrogen regulation / directive, or – taking into consideration the wide range of the possible uses of hydrogen – a comprehensive amendment package will be presented, in relation to several pieces of EU legislation.

5. The National Energy Strategy 2030 and the domestic regulatory elements related to renewable hydrogen

5.1. National Energy Strategy 2030, with an outlook until 2040

The examination of the domestic regulation shall also start with the review of a strategic document as policy document. National Energy Strategy 2030, with an outlook until 2040 (hereinafter: National Energy Strategy) refers to the possibilities of hydrogen utilization in the chapter on Gas and Electricity market as well, however, the strategic role of hydrogen energy is discussed in detail in chapter 9 called 'Energy Innovation and Economic Development'.

[40] Hungarian Energy and Public Utility Regulatory Authority, 2021.

The introduction to the chapter anticipates that *"within the framework of the energy innovation strategy, we aim to encourage the use of innovative solutions that, on the one hand, make the above outlined transformation of electricity markets smooth, and on the other hand, contribute to the goals connected to the increase of the freedom of choice of consumers and climate-friendly transformation of the energy sector."*[41]

The sub-chapter 'The role of hydrogen in the future energy system' is discussed within the above chapter, and says that within the strategic time horizon, hydrogen can play a significant role in integrating electricity generation, strengthening domestic security of supply, and achieving our decarbonisation goals. [42]

Subsequently, the different potential uses of hydrogen are outlined. First, the document refers to the use of hydrogen for storage purposes.

According to it, *"with the expansion of the use of renewable energy sources (…) the daily, weekly, or even seasonal storage of electricity, which cannot be solved with battery technologies, is becoming an increasingly critical issue. With the technology of electrolysis, it is possible to store the momentary electricity surplus in the form of hydrogen and to use it later, choosing from several options."* In its brief assessment, the National Energy Strategy indicates that *"the production of hydrogen is already one of the cheapest (…) technologies for the storage of the otherwise unusable energy"*[43] but *"the high investment cost and low efficiency of fuel cells used for the reconversion of hydrogen into electricity is still a barrier to the market based uptake of the technology, however, based on the recent forecasts, a considerable (even up to 90%) cost reduction and a significant improvement in efficiency is expected."*[44]

According to the strategy document, hydrogen produced from the surplus of renewable electricity production offers an alternative in the field of transport and it can also be used to produce electricity in units modelled on gas engines.[45]

The National Energy Strategy then discusses the industrial use of renewable hydrogen and its possible injection to the natural gas grid.

According to the document, the industrial use of renewable hydrogen *"is a solution to partially cover the hydrogen demand primarily in petroleum refining, fertilizer production and the pharmaceutical industry."*[46]

Furthermore, hydrogen, *"when blended into the gas network, could even contribute to satisfy household energy needs. This not only means the 'greening' of natural gas, but it also improves our security of supply through the reduction of import needs. By feeding hydrogen produced from electricity into the natural gas network, its storage can also be easily solved, which is a particularly important aspect considering the size of the domestic gas storage capacities. As for the technical possibilities of feeding hydrogen into the gas network, there are still many open questions, both in terms of the resistance of gas pipelines to corrosion and the performance of end-user's equipment; we will support the study of the above in the framework of pilot projects."*[47]

[41] Ministry of Innovation and Technology: National Energy Strategy 2030 – with an outlook until 2040.
[42] Ibid.
[43] Ibid.
[44] Ibid.
[45] Ibid.
[46] Ibid.
[47] Ibid.

It is a recognition to be supported, that according to the National Energy Strategy, *"hydrogen can serve as a link between the electricity and natural gas sectors through its energy and industrial use and its storability."*[48] I endorse this, adding the thought, that a strategic revision of whole energy regulation may be necessary by the middle of this decade, that the regulation of the large energy sections (electricity, natural gas) will be made in a less categorized way.

Finally, with adequate foresight, in chapter 15 of the National Energy Strategy (Flagship Projects), the government considers the implementation of the following energy innovation project as priority: *"Development of optimal operation of storage and utilization of hydrogen produced from renewable electricity (storage of hydrogen within a weekly period, ensuring its use in the natural gas system, studying the direct use of natural gas storage facilities for blending and storing hydrogen, converting hydrogen back to electricity)."*[49]

Knowledge of the results of this strategic project could significantly contribute to the large-scale domestic mobilization of hydrogen and facilitate the implementation of the corresponding strategic legislation.

In connection with the above project, a European benchmark can also be mentioned, as it was published on 27 July 2020 that the electricity generation company Iberdrola, together with the fertilizer producer Fertiberia, intends to create so far the largest green hydrogen center on the continent, which will be launched in 2021 and it will produce hydrogen from renewable energy and store it.[50]

In its communication of 18 November 2020, the Hungarian Energy and Public Utility Regulatory Authority stated that in accordance with the national strategic direction, in order to promote developments, they will pay special attention to the creation of the regulatory environment in the field of the use of hydrogen-based storage technologies and the use of hydrogen as fuel. Therefore, a specific working group was established within their organization.[51]

5.2. Domestic legislation concerning hydrogen

Following the review of the Hungarian strategy document, the present chapter on the domestic legislation covers three of the topics discussed in the chapter on the European Union's regulation (chapter 3.2), indicating the possible parallelisms and differences.

The definition of hydrogen

According to point 45. of Article 3 of Act no. 86 of 2007 on electricity (hereinafter: EA) Renewable energy source is a non-fossil and non-nuclear energy source, from which solar-, wind-, aerothermal-, geothermal-, hydrothermal energy, hydropower, or energy from biomass – including the energy from biogas (combustible

[48] Ibid.
[49] Ibid.
[50] Rácz 2020.
[51] Hungarian Energy and Public Utility Regulatory Authority, 2020.

gas from landfills and sewage treatment plants or generated from other organic materials) – can be produced.[52]

The EA, just like the Renewable Directive, does not refer to renewable hydrogen. However, the domestic regulator shall strive to introduce terminologies concerning hydrogen, considering the principles indicated in the Fundamental Law and the obligations arisen from them. Furthermore, the effective Hungarian participation in the development of the content of the European Union's regulation to be adopted soon in this regard could be expedient, as leading the way in creating a new 'European industry' and laying out its framework may bring significant national benefits in the future.

Guarantee of origin

Pursuant to point 13a of Article 3 of the EA, a guarantee of origin is an electronic document that proves to the user based on objective, transparent and non-discriminatory criteria, that a certain amount of electricity generated by a given generation unit comes from renewable energy sources or high-efficiency cogeneration.[53]

According to the first paragraph of Article 12 of the EA, the supplier may only certify the amount of electricity produced from a renewable energy source or high-efficiency cogeneration for the user with a guarantee of origin.[54]

The detailed rules of the guarantee of origin, its issuance, registration, transfer, and the reporting and information obligation of producers selling energy produced this way are determined in Governmental decree no. 309/2013 (VIII.16.) (hereinafter: Decree). Pursuant to Article 2 of the Decree, the register of guarantees of origin is kept by the Hungarian Energy and Public Utility Regulatory Authority (hereinafter: Authority).[55] The Authority shall ensure that the issuance, transfer, use and cancellation of guarantees of origin are accurate and reliable. Pursuant to paragraph (4) of Article 5 of the Decree, a guarantee of origin shall be issued for a quantity of 1 megawatt hour (MWh).[56]

The content of the regulation is the same as the regulation of the European Union. With respect to the fact, that the legal definition of renewable energy source does not refer to renewable hydrogen, the domestic regulation concerning the guarantee of origin does not cover hydrogen either.

However, "*in Hungary, a very low proportion of guarantees of origin are used to prove the renewable origin of electricity compared to the gross national electricity consumption. Between 2014 and 2016, the share of electricity certified with a guarantee of origin did not reach 1% of the domestic consumption. In 2017, this rate was already slightly above 1%.*"[57]

[52] Act LXXXVI of 2007 on electricity (EA).
[53] Ibid.
[54] Ibid.
[55] Governmental decree no. 309/2013 (VIII.16.) on the certification of the origin of electricity produced from renewable energy sources and high-efficiency cogeneration.
[56] Ibid.
[57] Hungarian Energy and Public Utility Regulatory Authority, 2018.

Consequently, the already functioning system of guarantees of origin in Hungary is still not very active, so as a first step it may be expedient to promote and exploit the domestic potential of the system of guarantees of origin.

Natural gas/Hydrogen infrastructure

The scope of Act no. 40 of 2008 on the natural gas supply (NGA) in accordance with paragraph (1) of Article 2. § covers the transmission and distribution through pipelines, storage, trade, consumption, use and settlement of natural gas.[58]

According to point 23. of Article 3 of the NGA, the definition of natural gas shall also include the types of gases according to point 26 of Article 3. Pursuant to point 26 of Article 3, gases equivalent to natural gas from biomass and other non-mining sources are artificially produced gas mixtures that can be injected into (transmitted, distributed through and stored in) the cooperating natural gas system in a proper manner from environmental and technical safety aspect under the conditions specified in the governmental decree on the implementation of the provisions of the NGA, and they can be blended with natural gas, and when this gas mixture is injected into the natural gas system, such mixture meets the quality requirements, set out in the governmental decree on the implementation of the provisions of the NGA, concerning the quality of natural gas.[59]

The domestic regulation has the same content as the European Union regulation in terms of the requirement, that the given type of gas shall be injectable into the natural gas system from the point of view of environment and technical safety, however, these gases shall also comply with the quality requirements set out in Annex 11 of the governmental decree on the implementation of the act on natural gas supply (such as combustion characteristics, impurity content, other requirements).[60]

Ultimately, in connection with the injection of hydrogen into the natural gas system, based on the results of domestic and international pilot projects, it is necessary to determine the chemical characteristics of hydrogen, also taking into consideration what kind of pipeline conversions would be necessary for the execution of the injection.

6. Constitutional reflections on domestic regulatory elements

Renewable hydrogen, as a key factor in the transformation of energy systems, has been a topic in energy professional circles for many years. Considering the principles of environmental protection and sustainable budget indicated in the Fundamental Law, the regulation of renewable hydrogen as a renewable energy source and the preparation and adoption of further regulatory proposals concerning renewable hydrogen is a clear expectation of the current framework established by the Fundamental law, which has been implemented only to a limited extent up until today.

[58] Act XL of 2008 on the natural gas supply.
[59] Ibid.
[60] Governmental decree no. 19/2009 on the implementation of the provisions of Act XL of 2008 on the natural gas supply.

Although the regulation of the field of energy, and its direction has been determined by the European Union for several decades, this does not prevent the member states from introducing regulation in areas that are not regulated by EU law. Moreover, in the light of the principles of the Fundamental Law described above, the regulation of renewable hydrogen is essential, and its absence may mean a regulatory deficit. According to paragraphs (1)-(2) of Article 46 of Act no. 151 of 2011 on the constitutional court, *"in case in the exercise of their powers, the Constitutional Court establishes the existence of unconstitutionality caused by an omission by the legislature, they call – together with the indication of a time limit – the defaulting body to perform its duties. It shall be considered as a failure to perform a legislative task - inter alia – in case the relevant content of a regulation, which can be deduced from the Fundamental Law, is incomplete."*[61] However, *"based on point c) of the above mentioned paragraph (2) of Article 46, the regulation remains so open that the Constitutional Court can form the cases of application of this legal instrument to a wide extent."*[62] Given that Article P) and XX. of the Fundamental Law stipulates the protection of the environment, including the preservation for future generations, thus it shall presume the specification and regulation of all possible renewable sources as such, including renewable hydrogen. Otherwise, in case a constitutional complaint is filed, even the existence of unconstitutionality caused by omission could be established as described above.

The European Union has recently published a Hydrogen Strategy and started to prepare the relevant regulations. It would be expedient for Hungary to participate in this EU legislative process and to start the development of domestic regulations on hydrogen as soon as possible.

Preserving the environment for future generations, as a constitutional principle, obliges the state, and as a reflection of that, sustainable budgetary management and the definition of a 'sustainable financial source' can be important milestones for laying the foundations of the hydrogen economy and for the effective implementation of pilot projects.

Based on the above analysis, it can be declared concerning hydrogen that the future has started.

[61] Act CLI of 2011 on the Constitutional Court.
[62] Kovács & Pozsár-Szentmiklósy 2018.

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