

Regulatory Treatment of Power-to-Gas

“European Green Deal” Regulatory White Paper series (paper #2)

relevant to the European Commission’s Hydrogen and Energy System Integration Strategies

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Introduction

Europe’s energy National Regulatory Authorities (NRAs), represented by ACER and CEER¹, welcome the European Commission’s Energy System Integration and Hydrogen Strategies² that aim to link all the areas of the energy system and to exploit the synergies between them. In this context, power-to-gas technologies, by generating gas(es) from electricity, are considered pivotal for the hydrogen strategy³, as they are at the interface between the electricity and gas vectors (also including hydrogen and biomethane), allowing a better coupling of the European Union’s (EU) gas and electricity sectors (both in terms of their markets and infrastructure)⁴. This link becomes increasingly important considering the EU’s long-term objective to decarbonise and to have largely renewable-based electricity generation (RES).

From a technical point of view, power-to-gas installations are electrolyzers that convert electricity to gas (hydrogen or, with subsequent methanation, synthetic methane). They may be used for different purposes and provide different services. For example, the synthetic and renewable gases which are produced may be used for gas congestion management or for storage and flexibility, as stated in the European Commission’s Hydrogen Strategy: "...playing a role in balancing a renewables-based electricity system by transforming electricity into hydrogen when renewable electricity is abundant and cheap and by providing flexibility"⁵. That being said, power-to-gas technologies are still far from being economically viable; indeed, to become so they need a significant increase in production efficiency, the development of demand for renewable gases and a large amount of inexpensive electricity⁶, which require a large deployment of RES. However, electricity is still largely generated with conventional high-carbon sources, having a significant CO₂ footprint⁷.

¹ ACER is the European Union Agency for the Cooperation of Energy Regulators, see www.acer.europa.eu. CEER is the Council of European Energy Regulators which is the European association of energy national regulatory authorities, see www.ceer.eu.

² European Commission Communication on Powering a Climate-Neutral Economy: An EU Strategy for Energy System Integration, COM/2020/299 final; European Commission Communication on a Hydrogen Strategy for a Climate-Neutral Europe, COM/2020/301 final.

³ The Commission’s hydrogen strategy considers that, in the short and medium term, other forms of low-carbon hydrogen are also needed, such as fossil-based hydrogen production with carbon capture and storage or usage.

⁴ See Frontier Economics et al., Potentials of sector coupling for decarbonisation - Assessing regulatory barriers in linking the gas and electricity sectors in the EU - Intermediate report, study for the European Commission, 2019.

⁵ p. 6

⁶ The International Energy Agency (*The Future of Hydrogen*, 2019) estimated that, to be economically viable, an electrolyser would need to operate between 3000 and 5000 hours annually with low-cost electricity to reach sufficient economy of scale.

⁷ IFPEN/SINTEP (*Hydrogen for Europe*, 2019) evaluated the average carbon content of electricity on the European grid at 296kgCO₂/MWh, and the resulting carbon content of hydrogen produced through electrolysis is 393gCO₂/kWh. Hydrogen

The future development of these technologies raises questions about their regulatory treatment. National Regulatory Authorities (NRAs) have a technology-neutral approach: the goal of regulators is not to decide on the best technology to be developed in order to achieve the climate goals set by policy-makers. Rather, the goal is to eliminate barriers and define regulatory conditions that would allow the most cost-effective solutions to be developed. With respect to power-to-gas installations, the regulatory framework should allow for the efficient development and use of those installations, which should be done by the market, as compared with other installations and technologies providing similar services. Thus, the regulatory treatment for all installations should be fair and the market should select the most efficient solutions.

This White Paper builds on the “ACER/CEER: The Bridge Beyond 2025 Conclusions Paper”⁸. It focuses on the link between the electricity and gas sectors (for the purposes of this paper, the gas sector includes hydrogen). It does not assess the link with other sectors, such as transport or heating. Other aspects of the European Commission’s Hydrogen Strategy are covered in other ACER/CEER papers, in particular: the planning and development of gas and electricity infrastructure⁹, and the regulation of hydrogen infrastructure¹⁰.

produced through methane reforming without CCS has a carbon content of 285gCO₂/kWh (IRENA, *Hydrogen: a renewable perspective*, 2019).

⁸ ACER-CEER, *The Bridge Beyond 2025 Conclusions Paper*, 19 November 2019.

⁹ ACER-CEER *Position on Revision of the Trans-European Energy Networks Regulation (TEN-E) and Infrastructure Governance*, 19 June 2020.

¹⁰ ACER-CEER “European Green Deal” *Regulatory White Paper #1 “When and How to Regulate Hydrogen Networks?”*, 9 February 2021.

Overview of Regulators' Key Recommendations

When addressing the regulation of power-to-gas installations, ACER and CEER recommend consideration of the following issues:

- 1. Revisit the current set of definitions for major activities in the context of integrated gas and electricity sectors**
 - a. In the context of integrated gas and electricity sectors, where market development and competition will be cross-sectoral, electricity and gas definitions should be revisited with respect to the use of the respective networks.
 - b. In particular, the definition of 'energy storage' in the 2019 Electricity Directive¹¹ should be amended as it now includes power-to-gas installations although, in themselves, such installations are not energy storage facilities (even if they may be pivotal to support energy storage). When defining power-to-gas, it is important to distinguish between installations that are connected to the electricity network only (such as in-site generation for industrial purposes) and those that are connected to both the electricity and gas networks.
- 2. Consider investment and management of power-to-gas installations as market-based activities which are open to competition among market players**
 - c. Investment and management of power-to-gas installations should be market-based and open to competition among market players. This is needed in order to establish a level playing field with other activities through which similar services could be provided.
 - d. Transmission and distribution system operators (TSOs/DSOs) should as a rule be precluded from investing in and running such installations (as is currently the case).
- 3. Allow involvement of system operators in the development and operation of power-to-gas installations only in exceptional cases**
 - e. By way of derogation, TSOs/DSOs may invest in power-to-gas installations only if this is necessary to guarantee secure, reliable and efficient network operations and if no other market party is willing to carry out the investment. This derogation must follow a step-wise approach and be carried out under clear and limited conditions defined by NRAs (e.g. limitations in scope, scale and time), after it has been proven that the market is not willing to invest in such installations and foreseeing a procedure to transfer such installations back to a market-based regime once the derogation expires.
- 4. Include power-to-gas installations and their suitable locations in system needs analysis**
 - f. Gas and electricity network operators should consider the development of power-to-gas installations in their network development planning and provide locational information to potential investors.
- 5. Define cost-reflective network tariffs, which should be applied to comparable activities across the electricity and gas sectors in a technologically-neutral way**
 - g. Network tariffs should not be used to subsidise technologies, activities or users and should provide a level playing field for comparable activities in the context of an integrated energy system.
- 6. Avoid distortive effects of taxes and levies on the integrated energy system**
 - h. Taxes and levies should not hinder energy system integration nor support specific technologies. To this end, regulators welcome the European Commission's proposal to review the Energy Taxation Directive.

7. Ensure traceability of renewable energy throughout the integrated energy system

- i. Definitions and criteria for sustainable gases should be set unambiguously in order to monitor whether the gases coming from power-to-gas installations are environmentally sustainable, considering the carbon emissions associated with the overall production process and allowing for an economic valorisation (e.g. Guarantees of Origin).
- j. The use of renewable energy should be traceable across the whole value chain.

1. Revisit the current set of definitions for major activities in the context of integrated gas and electricity sectors

From a legal point of view, the EU legislation does not define power-to-gas installations. However, Electricity Directive (EU) 2019/944 includes power-to-gas activities under the definition of 'energy storage' in the electricity system¹² (EU legislation does not have a definition for gas storage in terms of hydrogen or synthetic methane). Nevertheless, power-to-gas installations are not in themselves storage installations, although they may be pivotal to support energy storage¹³. Hence, the definition of electricity storage might be modified in order to better clarify its application to power-to-gas.

Furthermore, in the context of an integrated energy system, there may be a need to rethink the definitions of various activities. In the current framework, regulation of the gas and electricity sectors is done separately, utilising a silo perspective, and the definitions of the activities using one network do not consider their impact on the other network. However, assuming that the gas and electricity sectors will become fully integrated (with market development and competition becoming cross-sectoral), regulation of the two sectors should be done in a more coordinated way, considering cross-sectoral impacts. In this context, the framework of current definitions could be revisited with respect to the use of the networks, properly including all activities in the gas and electricity sectors and thereby ensuring that comparable activities are treated in a technologically-neutral way.

In particular, regarding power-to-gas, it is important to distinguish between installations that are connected to the electricity network only (such as on-site generation for industrial purposes¹⁴) and those that are connected to both the electricity and the gas networks. In the former case, power-to-gas installations can be considered as electricity users. In the latter case, they can be considered as integrating elements between the gas and electricity sectors that enable "*operating of the energy system "as a whole", across multiple energy carriers, infrastructures and consumption sectors*" as formulated in the European Commission's Energy System Integration Strategy¹⁵. These initial considerations should be further developed by policy-makers. It is important to ensure a consistent overall body of definitions across relevant gas and electricity regulation and to avoid overlaps between the different definitions.

¹¹ Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast)

¹² Article 2 of Directive (EU) 2019/944 defines energy storage as: "in the electricity system, deferring the final use of electricity to a moment later than when it was generated, or the conversion of electrical energy into a form of energy which can be stored, the storing of such energy, and the subsequent reconversion of such energy into electrical energy or use as another energy carrier".

¹³ Power-to-gas installations may constitute the first step in a process to store electricity (the next step would be to use a power generator) or to store gas fuels (the next step would be to use a gas fuel storage facility).

¹⁴ In the first phase of the European Commission's Hydrogen Strategy, the focus of hydrogen production will be for industrial consumption.

¹⁵ p. 1

2. Consider investment and management of power-to-gas installations as market-based activities which are open to competition of market players

Investment in and management of power-to-gas installations are market-based activities open to competition among market players. Gas and electricity TSOs/DSOs should be precluded from investing and running such installations, as is currently the case¹⁶.

In order to ensure transparency and market integrity, which are needed for competition to work effectively, hydrogen should be considered a wholesale energy product, just like electricity or methane, once there are sufficient options for trading and transport. The reason is twofold; Firstly, conversion and storage decisions will be taken according to market-based principles, which will require a price signal for the commodity. Secondly, the principles of REMIT¹⁷ should also apply to hydrogen produced by power-to-gas installations to ensure monitoring against market abuse.

3. Allow involvement of network operators in the development and operation of power-to-gas installations only in exceptional cases

The role of network operators (both in the electricity and gas sectors) should, in principle, be limited to providing network access and transmission and distribution services. TSOs/DSOs may be allowed to invest in power-to-gas installations only in exceptional cases and following the approval of the NRA. This must follow a step-wise approach and be carried out under clear and limited conditions defined by NRAs (e.g. limitation in scope, scale and time): (i) it must be proven that such installations are needed for secure, reliable and efficient network operation; (ii) a process has been opened for market parties to express their interest to make such an investment and, after a reasonable period of time, no such interest has been expressed by market parties; (iii) there should be a procedure for transferring such installations back to a market-based regime; and (iv) the recovery of the costs of power-to-gas installations should consider the needs and/or benefits of such installations for each group of network users across the gas or electricity sectors. Moreover, the system operator should have no interest in the commodity itself (it shall not sell gas in the markets) and NRAs could take into account the level of unbundling in the derogation decision.

Articles 36 and 54 of Directive (EU) 2019/994 introduce the possibility for electricity network operators to invest in power-to-gas installations under clear and limited conditions, in the context of the involvement of electricity network operators in energy storage activities. Given that in Recommendation #1 of this paper we propose to remove power-to-gas from the definition of energy storage, it is suggested to keep this possibility by adding such provisions specifically for power-to-gas in the Electricity Directive.

Such a derogation could be mirrored for gas TSOs/DSOs, with additional restrictions to be considered such as requiring investments to be done through a separate, but related, entity. Care would need to be taken not to allow TSO/DSO-operated installations to foreclose the market for the services these installations provide and not to allow them to have any interest in the commodity itself. This would likely include requirements for regulated third-party access for all installations developed by TSOs or DSOs.¹⁸

¹⁶ The Electricity Directive (EU) 2019/944 prohibits electricity TSOs/DSOs from developing energy storage activities which are defined in a broad way that also covers power-to-gas installations. Since, to a certain extent, hydrogen can be safely blended into the gas infrastructure, hydrogen production can be considered to be subject to the rules of Directive 2009/73/EC (the Gas Directive); Hence, gas TSOs/DSOs cannot be directly involved in hydrogen production activities.

¹⁷ Regulation (EU) 1227/2011 on wholesale energy market integrity and transparency.

¹⁸ The involvement of the TSO/DSO could also be justified in case of testing innovative aspects of power-to-gas that the market is not yet able to value. Such projects should be small-scale initiatives (first-of-a-kind or small-scale pilots), with a view to generating new information in the public interest and where there is no risk of a material impact on the market.

4. Include power-to-gas installations and their suitable locations in system needs analysis

In the context of an integrated energy system, it could be necessary to locate power-to-gas installations at specific points of the regulated electricity or gas networks, also taking into consideration that, as the network is a scarce resource, the location of power-to-gas installations may create difficulties of access for other investors with the same or other technologies. If the market is not able to provide an efficient locational signal, there is a need for an entity with the technical competence, such as the system operators, to define the best location and size of the installations¹⁹. This does not imply that TSOs/DSOs should invest in power-to-gas, as, for example, competitive tenders could be used. The TSOs/DSOs would have a role in defining the location and size of the investments, under supervision of the NRA.

Against this background, gas and electricity system operators should consider the possible development of power-to-gas installations in their network development planning based on a comparison of the costs/benefits of a power-to-gas investment against competing options. This analysis should be supported by a cross-sectoral CBA methodology²⁰ taking into consideration long-term values. System operators should be subject to an open data obligation. This would provide locational information to potential investors, e.g. by providing indications of the best geographical areas for the energy system where power-to-gas installations could be installed.

Electricity and gas system operators need to cooperate closely in this context. The planning exercise can cover several aspects, including alleviation of congestion, as well as coherence with other technical aspects such as economies of scale of power-to-gas installations or the location of hydrogen or synthetic gas consumption areas. The planning exercise could also include other developments of decentralised energy production, like biomethane. This may be relevant in particular in cases where system operators procure services from market parties.

5. Define cost-reflective network tariffs, which should be applied to comparable activities across the electricity and gas sectors in a technologically-neutral way

Network tariffs should be cost-reflective and non-discriminatory. Network tariffs should not be used to subsidise technologies, activities or users; any subsidisation (which is under the responsibility of policymakers and not of NRAs) should be done with dedicated instruments outside the regulation of network access. In the context of sector integration, power-to-gas installations may compete with other installations both in the electricity and gas sectors for providing similar services. In order to allow a level playing field, the tariffication principles should be applied to comparable activities (in particular, storage and conversion activities) across the electricity and gas sectors in a technologically-neutral way and should be based on the principle of charging for the network services by properly considering the potential offsetting effect and the overall cost impact on the networks. Increasing compatibility between the gas and electricity tariffication frameworks could be carefully considered, taking into account the impact it would have on the whole system. A gradual and stepwise approach is advisable. As a starting point, ACER and CEER intend to carry out a comparison of the tariff regulatory frameworks in place, which will also include power-to-gas installations and their competitors. This comparison will also consider the results of the ACER best practice reports on electricity transmission and distribution tariff methodologies pursuant to Article 18(9) of Regulation 2019/943.

¹⁹ This may happen when it is not possible for the market to internalise all the benefits of renewable energy and storage (for example because the electricity price is not sufficiently differentiated geographically). If this is the case, there is information asymmetry, i.e. the TSO/DSO has knowledge systems that the market does not have and that knowledge is considered necessary for an efficient development of these installations from a systemic point of view.

²⁰ E.g. based on a forward-looking perspective that puts due attention to networks expansion, development of renewable generation capacity, the development of cross-border capacity and project lead times for developing power-to-gas installations.

6. Avoid distortive effects of taxes and levies in the integrated energy system

Similar to network tariffs, taxes and levies should not distort the integration of the energy system. Article 18(1) of the EU Electricity Regulation 2019/943 stipulates that network charges shall not include unrelated costs supporting unrelated policy objectives. A similar provision should be extended to the gas sector.

It appears appropriate to also revise and harmonise the current frameworks for energy-based taxes and levies applied to similar activities that pertain to the users of one of more regulated networks, in order to avoid favouring some network users while potentially double charging others. In order to reduce distortions, tax and levies may be moved to the general taxation framework. In this regard, regulators welcome the European Commission's proposal to review the Energy Taxation Directive in order to align and harmonise the taxation of energy products and electricity with EU environment and climate policies, in particular, regarding storage and hydrogen production.

7. Ensure traceability of renewable energy throughout the integrated energy system

Definitions and criteria for sustainable gases should be set unambiguously in order to monitor whether the gases coming from power-to-gas installations are environmentally sustainable, thereby allowing their economic valorisation (for example, through a Guarantees of Origin system). Indeed, as the Hydrogen Strategy points out, power-to-gas installations will only produce renewable hydrogen if the electricity stems from renewable sources. In particular, it is important to improve the often used "colour labelling" of hydrogen production, and to set criteria to define the carbon emissions associated to the overall production process. The use of renewable energy should also be traceable across the whole value chain (also through the existing instruments in Directive (EU) 2018/2001).

Relevant ACER/CEER Papers

1	European Energy Regulators' Overview Paper, "The Bridge Beyond 2025 Conclusions Paper" , 19 November 2019
2	ACER-CEER Position Paper on Revision of the Trans-European Energy Networks Regulation (TEN-E) and Infrastructure Governance , 19 June 2020
3	ACER-CEER "European Green Deal" Regulatory White Paper #1 "When and How to Regulate Hydrogen Networks?" , 9 February 2021