

Background Paper on Possible Regulation of Hydrogen Networks

HYDROGEN: TECHNOLOGIES, MARKETS, REGULATION, PAN-EUROPEAN COOPERATION WEBINAR SERIES

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1. Scope of our work

The scope of our study was to review and meta-analyse a whole range of papers regarding the regulatory aspects of hydrogen networks in the EU



- Our key findings and recommendation arise from the review and meta-analysis of material related to the injection of hydrogen into the grid and do not represent the Consultant's opinion on potential resulting debates on the matter.
- Our analysis does not intend to prioritize possible actions, but to list them, so that could be addressed by the hydrogen future market players.
- Focus areas and the whole content of our study is not a matter of importance ranking, but a matter of depicting the future of hydrogen energy sector, following the best example of natural gas with a proven success on the European market or other equally successful regulatory models (i.e. regulation on telecommunications.).
- In no case, a regulated or a non-regulated hydrogen network option is exclusively suggested, but alternative options for both of them are highlighted.

2. Objective and key outcomes

Hydrogen currently accounts for ~1% of Europe's energy consumption, 96% of which is produced from natural gas, emitting significant amounts of CO2 emissions in the process

Objective



Need of assessing the energy transition aspects relevant to gas infrastructure, primarily the regulatory ones, but also technical and economic ones, in support of achieving the EU's energy and climate policy objectives

Key Outcome



Identification of possible energy transition regulatory solutions to address the gaps and areas for improvement needed to allow the introduction of hydrogen to gas transmission, distribution, storage and regasification facilities.

3. Grid Infrastructure and hydrogen networks

The EU's energy sector is undergoing structural change, targeting areas ranging from sources of primary energy to energy transportation infrastructure, regulations and prices.

Challenges

Significant cost-effective decarbonization through an integrated sectoral approach

Improving energy efficiency to reduce energy losses

Storing large quantities of energy and transporting energy over long distances

Energy system integration

Natural Gas Infrastructure

Transfer energy over long distances at low cost and low energy losses

High cross-border energy transmission capacities

Flexibility for meeting supply-demand and fairly large seasonal energy storage capacities

Serving of a large portion of the EU territory and public acceptance

Hydrogen

- Injected in the form of a blend into the natural gas grid
 - Currently, in the majority of the Member States, injection of H₂ in the gas transmission network is not applicable.
 - Nevertheless, many of the NRAs report that their Hydrogen strategy is underway
- Used to produce synthetic methane for injection into the natural gas grid
- Injected directly into a dedicated hydrogen grid

3. Grid Infrastructure and hydrogen networks

The emergence of new gases, like hydrogen, poses challenges for the gas infrastructure in its present form, from a technical, economical and system-level standpoint.

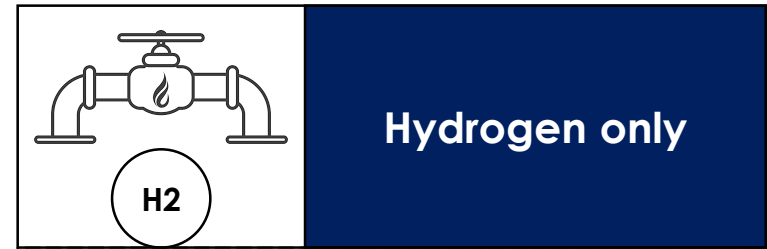


Blending hydrogen and methane

A likely configuration in the short to medium term, as per the EU Hydrogen Strategy, is one that can accommodate an increasing share of hydrogen in the grid,

- as green hydrogen produced from electrolysis through renewable generated electricity,
- as low carbon hydrogen (blue) from reforming of natural gas with Carbon Capture, Utilization, and Storage (CCUS) technologies (transition to clean energy).

This configuration is based on acceptable thresholds of hydrogen and methane.



Hydrogen only

Hydrogen can be acquired through a range of sources and processes, e.g. from renewable electricity via electrolysis or imported hydrogen (also at a small scale from methane via pyrolysis).

Hydrogen has distinctly different characteristics from natural gas (calorific value, flow properties, density, flame speed, flame combustion properties, heat characteristics and interaction with the grid).

Although blending hydrogen and methane can slightly change these characteristics, a pure hydrogen-ready grid, would translate into different technical considerations in each grid component.

4. EU existing Policy/Regulatory Framework and European Strategies


Fundamental legal and administrative barriers might hinder the injection of hydrogen into the gas grid in the EU, with the main hurdle being the lack of a framework for grid injection requirements.

- The EU legislative framework is well established when it comes to natural gas and its infrastructure.
- At the heart of the EU framework for gas, lies the Third Gas Directive and its associated regulations.
- A number of the EU legal acts are also relevant to the deployment of hydrogen, either directly (e.g. renewable gas deployment including hydrogen) or indirectly (e.g. safety, environmental, transport law, etc.).
- Current legislation must be adapted and further developed to address the treatment of hydrogen and the injection of hydrogen into gas networks.

Number	Title	Date
1.	DIRECTIVE (EU) 2019/692 amending Directive 2009/73/EC concerning common rules for the internal market in natural gas.	April 17, 2019
2.	Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources (RED II)	December 2018
3.	COMMISSION REGULATION (EU) 2017/460 establishing a network code on harmonized transmission tariff structures for gas.	March 16, 2017
4.	COMMISSION REGULATION (EU) 2015/703 establishing a network code on interoperability and data exchange rules.	April 13, 2015
5.	COUNCIL REGULATION (EU) No 559/2014 establishing the Fuel Cells and Hydrogen 2 Joint Undertaking; - The Fuel Cells and Hydrogen Joint Undertaking (FCH JU)	May 6, 2014
6.	Directive 2009/73/EC concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC.	July 13, 2009
7.	REGULATION (EC) No 715/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on conditions for access to the natural gas transmission networks and repealing regulation EC 1775/2005.	July 13, 2009
8.	Regulation (EC) No 942/2019 of the European Parliament and of the Council establishing an Agency for the Cooperation of Energy Regulators	July 13, 2009

The Dutch government has recognized that a solid regulatory framework is the key for the development of the hydrogen economy.

On 30th March 2020, the Dutch Minister for Economy and Climate published a vision and action plan for hydrogen to 2050.



In the “State Vision for the Development of Markets for the Energy Transition”, dated on 22nd June 2020, the Dutch Minister of Economic Affairs and Climate Policy stated that the transition of the natural gas infrastructure to green gas and low carbon hydrogen is one of the main policy issues

- The Dutch government recognizing its role in the development of the hydrogen infrastructure will review the conditions under which the existing gas grid could be used for the transport and distribution of hydrogen and the role of the network operators in the hydrogen chain.
- The national and regional network operators and companies will be involved in this process.
- Connections with Germany and other neighboring countries and capacities required are also taken into consideration during the investigation, as H2 deployment makes much more sense if applied at a trans-European level, as opposed to segmented national boundaries.
- Laws and regulations for the deployment of the existing gas network is anticipated in the near-term.

4. EU existing Policy/Regulatory Framework and European Strategies

The Federal Government of Germany approved the “National Hydrogen Strategy” on 10th June 2020, which aims at the enhancement of the domestic hydrogen’s production and its utilization

**National
Hydrogen
Strategy**

- Enhancement of gas transport infrastructure including the revision and the development of the regulatory framework and the technical requirements for the gas infrastructure, the examination of the compatibility of existing gas infrastructure, the needs for upgraded gas infrastructure and/or the development of new dedicated hydrogen networks

Action plan

- A total of approximately 38 measures are being developed to support the first phase of the Strategy including the market ramp-up and the well-functioning of the domestic market by 2023
- The aforementioned actions require the preparation and the development of the essential regulatory basis for the construction and the expansion of the hydrogen infrastructure expected to be ready in the near term

5. Review and meta-analysis

A review of 21 key papers has been carried out to identify all material whose primary focus is the regulatory aspects of hydrogen networks in the EU

The review sought to identify material related to the regulatory aspects of the accelerated refurbishment of the existing energy infrastructure and the development of new ones, relevant to hydrogen injection.

Assessment Areas

- 1 The acknowledgement of infrastructure adaptation costs incurred by the network and gas facilities operators, specifically with respect to transmission, distribution, storage and liquefied gas facilities
- 2 The time horizon of the regulatory period
- 3 Evaluation of infrastructure investments
- 4 The benefits expected from the adaptations in developing a hydrogen network
- 5 Market, economic and financial terms and conditions to be accounted by regulators for hydrogen
- 6 New technologies and products with a focus on those who address cross border barriers, for hydrogen handling

Gap Analysis - Acknowledgement of infrastructure adaptation costs

Current State

- Absence of hydrogen network development planning
- Inadequate technology specific regulations
- Uncoordinated infrastructure planning between hydrogen and natural gas/electricity sectors

Future State

- Dynamic regulatory approach for H2 regulation for the transition phase
- Clear infrastructure investment plans for hydrogen – coordination with the natural gas and electricity sector
- Distinction between mixed gas networks and dedicated hydrogen networks
- Definition of roles amongst TSOs, DSOs, etc.
- NRAs being aware of infrastructure adaptation and/or new investment costs

Action Steps

- Network planning (DSOs & TSOs cooperation)
- Ownership of hydrogen storage facilities – clearer definition of roles (in some EU MS ownership unbundled network operators are allowed to own storage facilities)
- In case of the identified need for regulation, incentive regulation for network operators and all market participants supporting innovation & R&D. Cost reflectivity should be respected by separate accounting of costs and separate tariffs, thus helping to avoid cross-subsidisation between natural gas and hydrogen.
- Support schemes for refurbishment of existing infrastructure and new pipelines, in cases that network owners cannot accomplish it by their own, resulting to high tariffs
- NRAs to be aware of investment and adaptation costs under proper consultation

Gap Analysis - The time horizon of the regulatory period

Current State

- Three-phase development plan foreseen in the EU hydrogen strategy
- No EU harmonised hydrogen blending limits targets and quotas and thus, no harmonized regulation to inject H2 into the existing grid

Future State

- Development of infrastructure by specific target years (2030, 2050) to realize decarbonization goals in parallel with market development

Action Steps

- Clear regulatory phases and milestones, in cases of regulated hydrogen networks
- Assessment of infrastructure needs for mixed gas networks (transition phase) and dedicated hydrogen networks)
- Set specific H2 blending quotas by specific target years, eventually leading to harmonization of regulation across the EU
- Regulatory sandboxes at EU level with the supervision of NRAs at national level to develop R&D and pilots in the medium term (in order to avoid price and access discrimination and help to set an investment framework that attracts networks operators)
- Planning and regulation of medium-range backbone transmission infrastructure

Gap Analysis - The benefits expected from the adaptations in developing a hydrogen network

Current State

- Current methods applied, e.g. CBA
- Inhomogeneity in CBA methodologies or other appraisal method used

Future State

- Optimal investment decisions with respect to infrastructure development
- Regulatory framework to address the benefits, apart from the risks

Action Steps

- Introduction of a Hydrogen Network Code and Network Tariff Regulation, at least blending hydrogen, in case of regulated hydrogen networks with a clear regulation on revenues and tariffs methodology at EU level , by also making certain that hydrogen is not included in the natural gas revenue and tariff regulation, in order to avoid cross-subsidisation for hydrogen by natural gas users
- ACER to be authorized to issue binding CBA guidelines
- Sustainability benefits to be factored in CBA and full assessment of decarbonization effects to be considered in decommissioning and repurposing of infrastructure
- PCIs (CBA appraisal) to include hydrogen projects

Gap Analysis - Market, economic and financial terms and conditions

Current State

- Lack of framework particularly for dedicated hydrogen networks (Licensing and registration issues, e.g. lack of provisions, Unclear P2G legal status, Unclear future role of TSOs)
- Institutional and structural issues

Future State

- Effective competition in the market, with high levels of liquidity
- Sustainable and transparent market

Action Steps

- Clear framework for licensing of hydrogen facilities
- Clear role of NRAs regarding hydrogen
- Monitoring of hydrogen production facilities and hydrogen production, in terms of volumes and other parameters
- Participation of hydrogen producers in balancing, maybe in a more distant future
- Storage and Linepack Regulation
- Revision of gas market legislation
- The unbundling of TSOs/DSOs must be respected. Provisions for TSOs/DSOs to invest in projects such as P2G until market mature enough. If no interest is expressed by market parties/investors, TSOs/DSOs should be generally avoided, even in cases of insufficient interest in P2G investment by market participants. However, careful assessment must be made for pilot projects and other exceptional circumstances where an investment could be carried out by TSOs/DSOs and under close supervision of NRAs.

Gap Analysis - New technologies and products

Current State

- Immaturity of relevant technologies
- Some projects already address cross-border barriers, creating a hydrogen backbone
- Lack of common gas quality standards at large
- Low interconnection capacity level in certain areas

Future State

- Single European market with unhindered flows and interconnections
- Prospects for unified hydrogen market

Action Steps

- Definition of hydrogen and hydrogen facilities, as well as clear definitions for renewable and low carbon gases
- Hydrogen standards (including Safety standards for hydrogen and blending limits, gas quality measurements)
- EU-wide Guarantees of Origin (GO)/certificates system (addressing cross-border barriers)
- Fuel Mix disclosure obligations on suppliers

7. Recommendations

Recommendations aim for creating a framework that supports and enhances the uptake of clean hydrogen, while promoting its role as a facilitator of sectoral integration.

- There is a need for clear definitions for renewable and low carbon gases. The recast RED includes a taxonomy of hydrogen, yet it focuses on the transport sector and not on the use of hydrogen in other important sectors, e.g. industry. Clarity is required also on the legal status of energy storage in particular with respect to power-to-gas (P2G).
- The recast EU RED (2018/2001/EU) extends the scope of Guarantees of Origins to cover hydrogen and mandates European Standard Organizations to review the standard EN 16325, which specifies the requirements for GOs. There is a need of coordination between countries to agree on a common methodology for tracing and certifying hydrogen production.
- Common gas quality standards should be agreed upon and adopted by Member States.
- Following the time planning of the EU Hydrogen Strategy, an assessment of infrastructure needs for mixed and dedicated hydrogen networks should be conducted, for the medium- and long-term.
- A hydrogen market design, in line with the electricity and gas markets would help realize the full potential of hydrogen towards decarbonization.

Thank you for your time

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