

THE JOURNEY TO CLEAN ENERGY

*A FleishmanHillard overview of
national hydrogen strategies*

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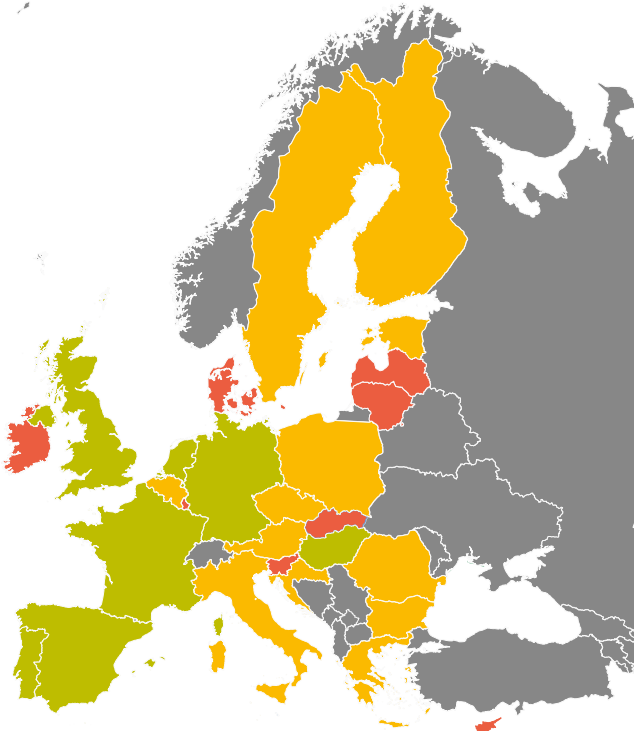
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In March 2020 the European Union announced its ambitious target to become climate neutral by 2050, and hydrogen will be an indispensable means for the decarbonization of the Member States' economies. It is fair to say that hydrogen has really been gaining momentum over the past few years, with countries issuing national roadmaps and strategies for its increased deployment. Currently, many envision hydrogen as one of the best alternatives to substitute fossil fuels, especially in hard-to-decarbonize sectors such as heavy industry and transport.



Later in the same year, in July, the European Commission adopted a hydrogen strategy for a climate neutral Europe, highlighting the essential role of hydrogen in decarbonizing the industry, transport, power generation and heating sectors.² Over the next 30 years, the Commission intends to gradually increase hydrogen production throughout Europe. Hydrogen also appeared in the recently published “Fit for 55” Package, e.g. the proposal for the revision of the Renewable Energy Directive included a target of 50% for green hydrogen use in industry. Finally, the Commission identified hydrogen as an investment priority in its post-COVID recovery plan “Next Generation EU”.

While some Member States already had hydrogen strategies before 2020, the publication of the EU hydrogen strategy provided an extra boost. As indicated in the map (see: Page 8) over half of European countries have either already published their strategies or are currently in the process of developing them. Accordingly, FleishmanHillard EU has prepared the present report to help assess the current degree of readiness and ambition of hydrogen utilization across Europe. To this purpose, it will analyze the current state of play and the key objectives for hydrogen deployment set in national strategies.

¹ European Commission, “Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 (European Climate Law)” (2020) <<https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588581905912&uri=CELEX:52020PC0080>>.

² European Commission, “A hydrogen strategy for a climate-neutral Europe” (2020) <https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf>.

Introduction

The report divides the countries in three sections, (1) **Frontrunners**, (2) **Developers** and (3) **Laggards**. This reflects the status of national hydrogen strategies and does not necessarily indicate the level of maturity of hydrogen technology within countries. Accordingly, some of the states included in the “Developers” and “Laggards” sections may already have wide deployment of hydrogen projects but lack national frameworks. As the report shows, hydrogen-specific legislation is absent in almost all Member States, while in others, the unsuitability of the existing legal framework obstructs hydrogen deployment. Therefore, the report provides a useful overview of the status quo, in preparation of upcoming hydrogen-specific laws.

The report coincides with the [upcoming] publication of the Hydrogen and Gas Market Decarbonization package expected on 14 December 2021.³ While it is likely to stir debates among the stakeholders, the package, together with the EU Hydrogen Strategy and national efforts will hopefully clarify the future path for the production and deployment of hydrogen in Europe.

Betting on Green: Renewable Hydrogen as the End-Goal

While hydrogen has numerous applications in the energy sector, it is not an energy source, but an energy carrier. This means that hydrogen must be extracted from other sources. Depending on the energy source and the extraction process, there are several types of hydrogen, not all of which are equally suitable to achieve decarbonization. Within the context of EU hydrogen production, grey, blue, and green hydrogen play the most important roles.

According to recent estimations, 96% of hydrogen produced in the EU is the so-called ‘grey hydrogen’, namely hydrogen generated from fossil fuels. The downside of grey hydrogen is in the large volumes of CO₂ emitted during the process (1 kg grey hydrogen = 9 kg CO₂ emissions). One way to remedy the situation is through capturing emissions generated from the steam reforming process and storing them underground. Where this is done, the hydrogen produced is referred to as ‘blue hydrogen’, which is considered a low-carbon hydrogen type. Nevertheless, while CO₂ emissions are lower with blue hydrogen, it does lead to the release of ‘fugitive methane’ resulting from leaks. This important drawback may potentially be remedied in the near future with the Commission’s proposal for a regulation containing binding rules on methane leak detection and repair in the energy sector.⁴ If adopted, the regulation could significantly reduce the carbon footprint of blue hydrogen production. Finally, ‘green hydrogen’ refers to hydrogen produced from renewable energy sources via electrolysis. However, due to the high costs associated with the process and the lack of required infrastructure, green hydrogen currently amounts to only 1% of all hydrogen produced.

Nevertheless, it is the deployment of green hydrogen that constitutes the main priority of the EU’s Hydrogen Strategy. The document highlights renewable hydrogen as an essential means of decarbonizing the economy and creating sustainable growth. The current roadmap envisions production of up to 1 million tons of renewable hydrogen by 2024 and up to 10 million tons by 2030 with large-scale deployment across the hard-to-decarbonize sectors. Concurrently, the EU views blue hydrogen as a transitional path required to support the scale-up of green hydrogen and meet the growing hydrogen demand. Importantly, both green and blue hydrogen are considered ‘clean’ hydrogen types.

Alternatively, the United Kingdom, which also aims at climate neutrality by 2050, placed a high bid on blue hydrogen, highlighting that both types have an important role to play. It remains to be seen which path the rest of EU Member States will follow. For now,

Hydrogen also appeared in the recently published “Fit for 55” Package, e.g. the proposal for the revision of the Renewable Energy Directive included a target of 50% for green hydrogen use in industry. Finally, the Commission identified hydrogen as an investment priority in its post-COVID recovery plan “Next Generation EU”.

however, it is apparent that more government support is required if the EU is to achieve deep decarbonization. This means that those countries that have not yet announced their hydrogen plans need to do so soon while the frontrunners need to focus on the adoption of hydrogen-specific legislation.

With this report, FleishmanHillard EU wants to provide a concise overview of the national hydrogen strategies of the EU Member States and the UK in this critical time for hydrogen development in Europe. The report will be revised every three months in line with the most recent political developments and reader feedback. Do not hesitate to reach out to the FH Energy and Transport team to further discuss the state of play of hydrogen and other cross-cutting policy developments in Europe.



³ Tentative agendas for forthcoming Commission meetings SEC(2021)2387
[https://ec.europa.eu/transparency/documents-register/detail?ref=SEC\(2021\)2387&lang=en](https://ec.europa.eu/transparency/documents-register/detail?ref=SEC(2021)2387&lang=en)
⁴ European Commission, “Climate change – new rules to prevent methane leakage in the energy sector” (2021) https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en

THE FRONTRUNNERS

This section provides an overview of the European countries, which have a fairly developed national hydrogen strategies to date. Out of the seven countries included in the section, France stands out as having one of the most developed hydrogen legal frameworks in Europe (i.e. the Ordinance on Hydrogen). On the other hand, while an official Hydrogen Strategy has yet to become part of the Dutch legislation, the Netherlands accounts for the highest number of large-scale hydrogen projects and pilots currently in operation.

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1. The Current Status of Hydrogen Deployment

Similar to Austria, France is pursuing the objective of becoming one of the world's leaders in hydrogen deployment.¹ The Government started preparations of a "plan for storage of renewable energies using decarbonized hydrogen" already in 2015 pursuant to Law No. 2015-992. As a result, the Minister for Energy announced the Multiannual Energy Program (hereinafter, PPE) in 2018, which will be addressed in detail below.

France has one of the most developed hydrogen legal frameworks in the EU.² The majority of present legal measures govern the deployment of hydrogen in the mobility sector with the 2019 Mobility Orientation Act providing a framework for refueling stations for private vehicles, buses, and ships. The process of hydrogen injection into the gas grid is regulated by the Energy Regulator and falls within the scope of the Energy Code.

2. National Hydrogen Strategy and Future Developments

The PPE pursues three primary objectives:

- Increasing the share of green hydrogen for industrial use.
- Hydrogen deployment in the mobility sector.
- Stabilization of energy networks via hydrogen operationalization.³

In 2019, the plan was complemented by a target of 10% of low-carbon hydrogen by 2023 and between 20 and 40% by 2030. Moreover, substantial financial support is envisioned for the hydrogen sector, as stipulated in the Multiannual Energy Program for 2019-2023 and 2024-2028. As such,

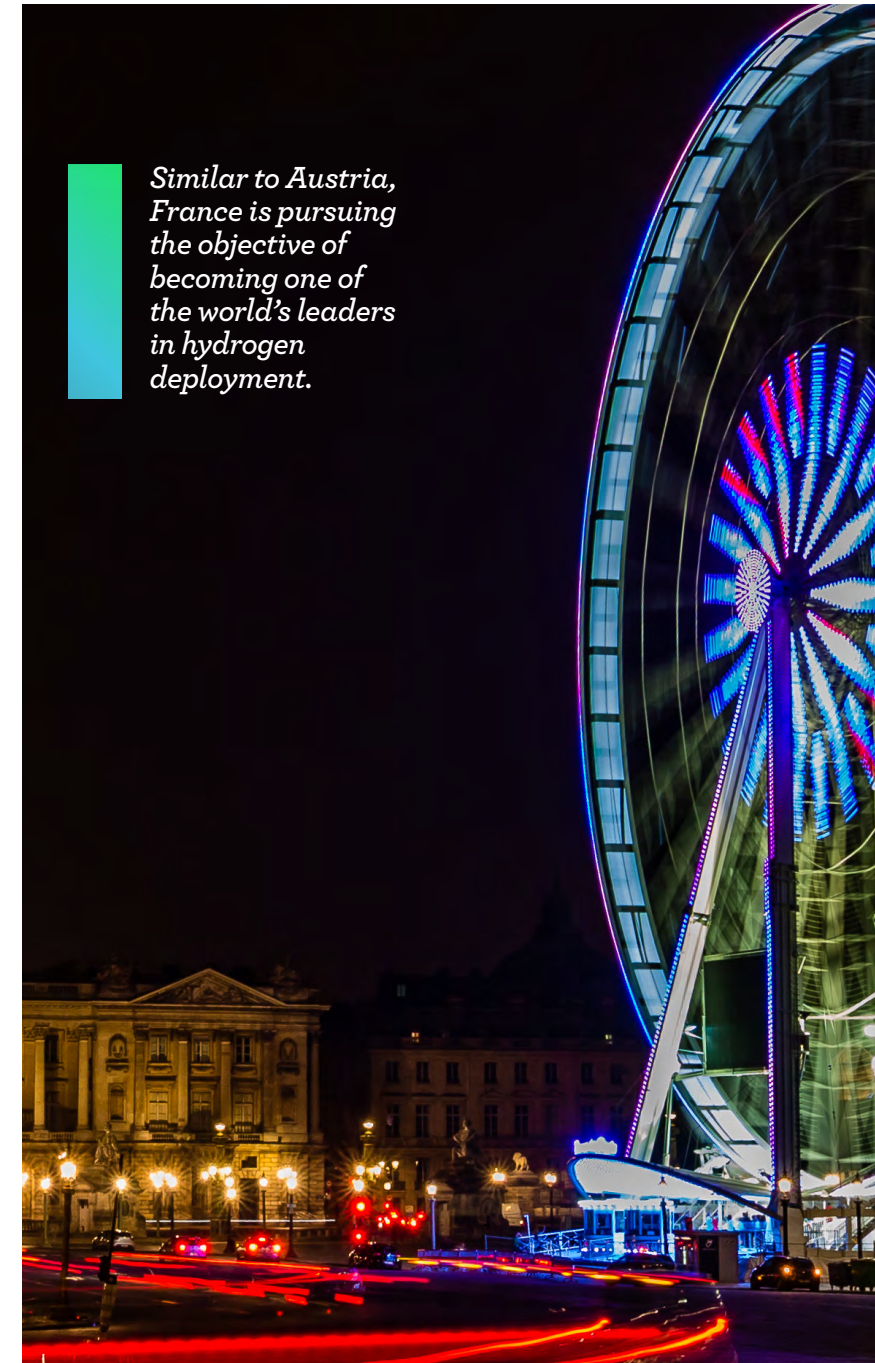
50 million EUR is to be invested in hydrogen on an annual basis. Furthermore, targets were set for hydrogen use in power-to-gas installations. These include the goal of 1-10 MW by the end of 2023 and 10-100 MW by the end of 2028. A less ambitious target was included regarding the development of hydrogen refueling infrastructure, with 100 charging stations to be in operation by 2023 and 400-1000 stations by the end of 2028. With regard to hydrogen storage, no short-term goals were established, as the "storage of large amounts of electricity in the form of hydrogen in order to manage renewable energy intermittency should not be required before circa 2050".

In February 2021, a draft Ordinance on Hydrogen was published addressing the following points:

- Taxonomy of hydrogen, categorizing it into renewable, low-carbon and fossil on the basis of production methods and GHGs emitted as a result.
- Proposed governmental support schemes for low- and zero-carbon production, setting out the framework for such measures (with carbon capture and storage excluded from support schemes).
- Guarantees of origin and certification regime for green or low-carbon hydrogen in line with the 2018 Renewable Energy Directive.
- Regulation requirements for the injection of hydrogen and its transportation via the gas grid with a long-term view of building a hydrogen market and ensuring energy security.⁴

The Ordinance is expected to come into force in the first quarter of 2022.

Similar to Austria, France is pursuing the objective of becoming one of the world's leaders in hydrogen deployment.



¹ CMS Expert Guides, "Hydrogen Law and Regulation in France" (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/france>>.

² WFW, "The French Hydrogen Strategy" (2021) <<https://www.wfw.com/articles/the-french-hydrogen-strategy/>>.

³ HSF Energy Notes, "Recent developments in the French hydrogen sector: the draft hydrogen ordinance" (2021) <<https://hsfnotes.com/energy/2021/02/12/recent-developments-in-the-french-hydrogen-sector-the-draft-hydrogen-ordinance/>>.

⁴ Ibid.





1. The Current Status of Hydrogen Deployment

The development of the German hydrogen market is still considered to be at its early stages.¹ Hydrogen is utilized primarily in the industry sector, in particular, in the production of chemicals. Nevertheless, the Government has been investing significant amounts in the hydrogen sector.²

Germany lacks a comprehensive legal framework to the extent that the application of gas legislation to hydrogen remains unclear.² Together with the ongoing debate surrounding CCS, this issue is expected to be addressed alongside the implementation of the National Hydrogen Strategy.³ Accordingly, in February 2021 the Government presented a draft for amending the Energy Act. The definition of “gas” under the current version of the Act only includes green hydrogen produced from electrolysis, thus effectively excluding blue hydrogen from its scope.

2. National Hydrogen Strategy and Future Developments

The National Hydrogen Strategy for Germany was announced in June 2020.⁴ It is a comprehensive plan aimed primarily at increasing the role of green hydrogen—the only type of hydrogen recognized as “sustainable in the long term”—in the energy transition process.

The Strategy identifies 13 goals and ambitions, which can be summarized as following:

- Increase the production of green hydrogen to 14 TWh by 2030 and to 19 TWh no later than by 2040 to meet the growing demand. This is planned to be done through raising the capacity of onshore and offshore renewable energy generation plants.
- Establishing a competitive domestic market for the production and use of hydrogen. This goal is to be supported by improving wind and solar technology and taxing fossil fuels in transport and heating.
- Fostering the transition to hydrogen in the industrial sector. This will be done primarily by providing financial support for electrolyzers and launching hydrogen pilot projects.
- Increasing the share of hydrogen-based vehicles, including in aviation and navigation in the long-term.
- Utilizing hydrogen to decarbonize the heating sector. Up to EUR 700 million is to be made available for achieving the objective in 2020-2024.
- Appointing a National Hydrogen Council consisting of 26 experts from various fields. The Council is to support the Government through legislative proposals and recommendations.⁵

With EUR 700 million invested in 2016 and up to EUR 1.4 billion on an annual basis from 2017 onwards. Another EUR 7 billion was made available for “speeding up the market rollout of hydrogen technology”



¹ CMS Expert Guides, “Hydrogen Law and Regulation in Germany” (2021) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/germany>>.

² Ibid.

³ Clean Energy Wire, “Quest for climate neutrality puts CCS back on the table in Germany” (2020) <<https://www.cleanenergywire.org/factsheets/quest-climate-neutrality-puts-ccs-back-table-germany>>.

⁴ Federal Ministry for Economic Affairs and Energy, “National Hydrogen Strategy for Germany” (2020) <<https://www.bmwi.de/Redaktion/EN/Publikationen/Energie/the-national-hydrogen-strategy.html>>.

⁵ Clean Energy Wire, “Germany’s National Hydrogen Strategy” (2020) <<https://www.cleanenergywire.org/factsheets/germanys-national-hydrogen-strategy>>.





1. The Current Status of Hydrogen Deployment

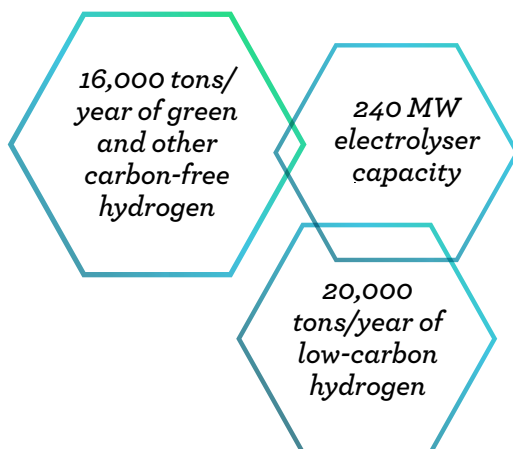
Hungary has an ambitious agenda for the development of green hydrogen from electricity produced from renewable sources. It also has plans for deployment of blended hydrogen in a variety of sectors. Moreover, Hungary is considering a roll-out of hydrogen storage projects in areas of depleted gas fields.

The Hungarian TSO FGSZ is currently in the process of reviewing the rules and requirements for natural gas transportation in order to establish a safe level of hydrogen that can be injected into the grid.¹

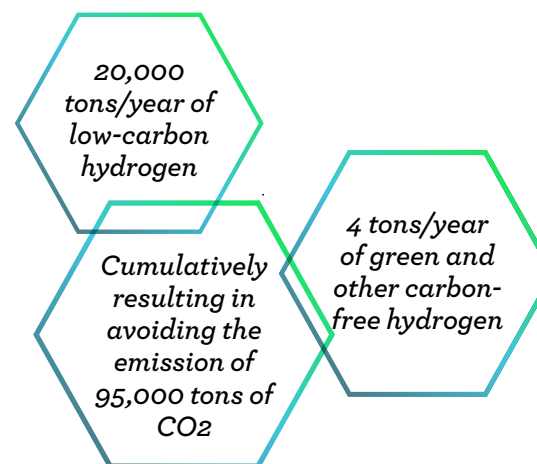
2. National Hydrogen Strategy and Future Developments

The National Hydrogen Strategy was announced in May 2021.² It sets a number of priority objectives for 2030:

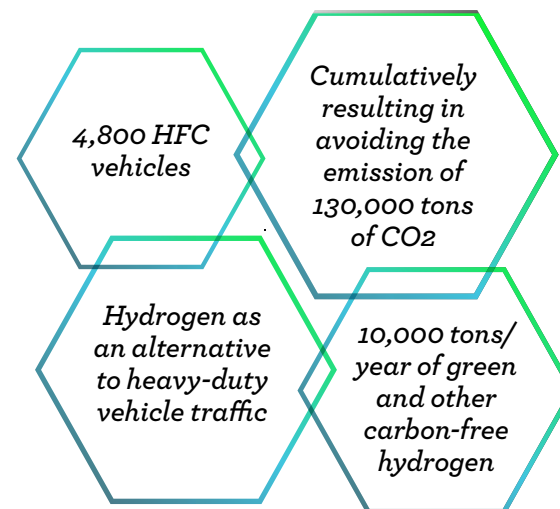
Large-scale production of low- and zero-carbon hydrogen



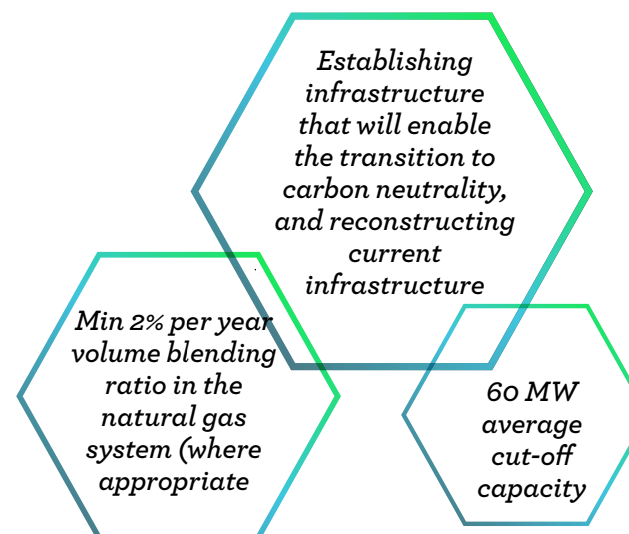
Decarbonization of industrial consumption



Green transport



Electricity and natural gas support infrastructure



¹ European Commission, "Hungary: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans" (2020) <https://www.fch.europa.eu/sites/default/files/file_attach/Brochure%20FCH%20Hungary%20%28ID%209473092%29.pdf>

² Hungarian Government, "Hungary's National Hydrogen Strategy: Strategy for the introduction of clean hydrogen and hydrogen technologies to the domestic market and for establishing background infrastructure for the hydrogen industry" (2021) <<https://cdn.kormany.hu/uploads/document/a/a2/a2b/a2b2b7ed5179b17694659b8f050ba9648e75a0bf.pdf>>

THE NETHERLANDS



1. The Current Status of Hydrogen Deployment

The Netherlands is rightly considered one of the leaders in hydrogen deployment in the EU. A significant number of large-scale projects and pilots are currently in operation, with more in development.¹ In 2018, the Dutch TSO Gasunie started the operation of the first public hydrogen pipeline (a former natural gas pipeline) Yara-Dow.² Additionally, from 2019 the 1 MW Hystock plant converts solar energy into hydrogen via electrolysis. The Groningen area (the so-called Dutch 'Hydrogen Valley') hosts a hydrogen value chain from production to end-use.³ Moreover, the Port of Rotterdam together with the state company EBN and Gasunie are developing a large-scale "Porthos" carbon storage project in the North Sea which will allow the Netherlands to increase production of blue hydrogen.⁴ Finally, hydrogen-refueling stations are currently in development in the North of the country.



So far, there is no hydrogen-specific legislation, although the process has been initiated.⁵ The Dutch hydrogen sector is regulated on the basis

of gas-related legislation and other energy laws. In particular, the Gas Act governs the licensing process for hydrogen transportation. The injection of hydrogen into the gas grid is regulated by the Gas Quality Decree.

2. National Hydrogen Strategy and Future Developments

In June 2019, the Dutch Government published the Climate Agreement, which included specific targets for hydrogen deployment in 2030 and 2050. Five principal areas of focus have been identified:

- 1) A carbon-free feedstock for the process industry.
- 2) Carbon-free carriers for high temperature heat for the process industry.
- 3) Controllable carbon-free capacity, energy storage for prolonged periods and energy transport over longer distances.
- 4) Mobility, especially regarding passenger transport ahead of 2025; heavy road transport and shipping for the long-term (2030); committing battery electric transport to hydrogen; special focus on the transition from grey to green hydrogen.
- 5) Build an environment for sustainable buildings and districts.⁶

The Agreement explicitly indicated green hydrogen as the primary area of focus. Collectively, the objective for green hydrogen was set to achieve an electrolysis capacity of over 800 MW and 15 kilotons from biogenic fuels by 2025. In the long run, the Netherlands

¹ CMS Expert Guides, "Hydrogen Law and Regulation in the Netherlands" (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/netherlands>>

² Gasunie, "Gasunie hydrogen pipeline from Dow to Yara brought into operation" (2018) <<https://www.gasunie.nl/en/news/gasunie-hydrogen-pipeline-from-dow-to-yara-brought-into-operation>>

³ CMS Expert Guides, "Hydrogen Law and Regulation in the Netherlands" (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/netherlands>>

⁴ Porthos, "CO2 reduction through storage beneath the North Sea" <<https://www.porthosco2.nl/en/>>

⁵ CMS Expert Guides, "Hydrogen Law and Regulation in the Netherlands" (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/netherlands>>

⁶ Government of the Netherlands, "Climate Agreement" (2019) <<https://www.government.nl/documents/reports/2019/06/28/climate-agreement>>



The Port of Rotterdam together with the state company EBN and Gasunie are developing a large-scale "Porthos" carbon storage project in the North Sea which will allow the Netherlands to increase production of blue hydrogen".

NETHERLANDS continued



aims to reach a situation where the hydrogen demand will be met solely by green hydrogen. Nevertheless, the Agreement also recognized the temporary need in blue hydrogen as a means of meeting the demand of the emerging global hydrogen market, which is predicted to include both green and blue hydrogen. Importantly, blue hydrogen deployment must not impede the growth of the green one.

The Agreement presupposes the initiation of a Hydrogen Program. The main focus of the Program is on upscaling of the green hydrogen production. Accordingly, a reduction of 65% on the capex of electrolyzers is set to be realized through upscaling by 2030 from EUR 100 million per 100 MW to EUR 35 million per 100 MW. As a result, the electrolysis capacity is expected to reach 3-4 GW by 2030. A particular focus is placed on the offshore wind energy sector as the primary source for energy needed for green hydrogen production. The Program also focuses on the development of hydrogen infrastructure. As such, 50 refueling stations, 15,000 fuel cell vehicles, and 3,000 heavy-duty vehicles are to be in operation by 2025; 300,000 fuel cell vehicles to be in operation by 2030.

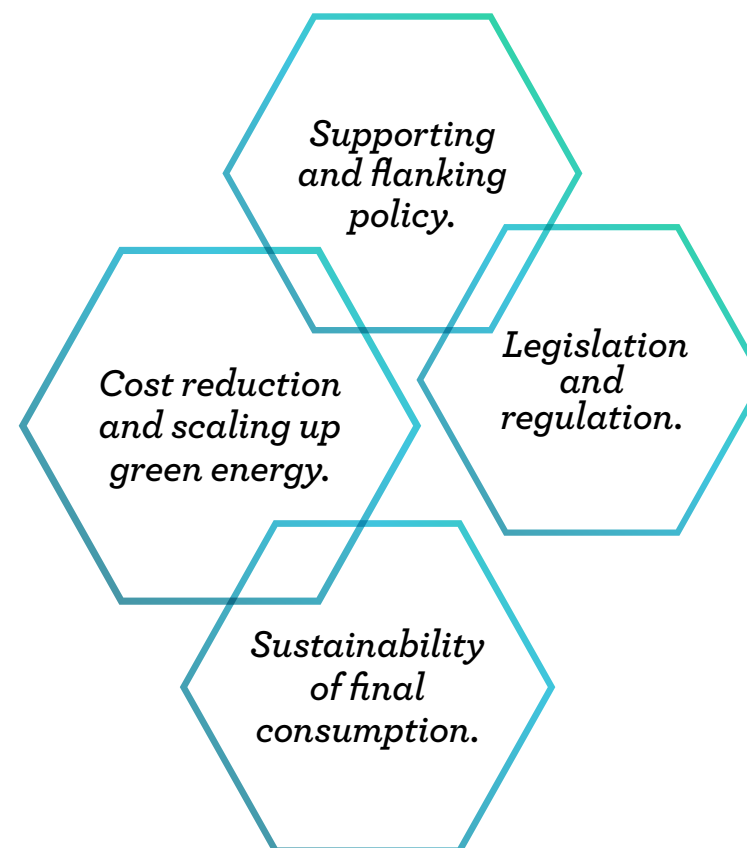
The development presupposed under the Program will be implemented in 3 phases:

- 1) 2019-2021: preparatory phase.
- 2) 2022-2025: scaling up to 500 MW of established electrolysis capacity (if possible); development of the demand for hydrogen; development of regional infrastructure, and the connection of clusters.
- 3) 2026-2030: scaling up to 3-4 GW of established electrolysis capacity.

These objectives were reiterated in the letter titled "Government Strategy on Hydrogen" issued in April of 2020.⁷ The letter explains the increased focus on hydrogen deployment, stating that without it the Netherlands will not be able to meet the project demand for zero-carbon gases in 2050. The letter also identified large electrolysis facilities and carbon capture and storage as the primary methods of hydrogen production. However, the focus will ultimately be placed on creating a clean hydrogen supply chain.

The Integrated Plan sets the target of 32GWh of hydrogen-fueled vehicles by 2030. Moreover, hydrogen refueling stations with a total installed capacity of 20 MW are envisioned for 2030 along with significant investments of 3.5 million EUR in hydrogen projects.

With regard to the policy agenda, 4 pillars have been identified:



⁷ Government of the Netherlands, "Government Strategy on Hydrogen" (2020) <<https://www.government.nl/documents/publications/2020/04/06/government-strategy-on-hydrogen>>.



1. The Current Status of Hydrogen Deployment

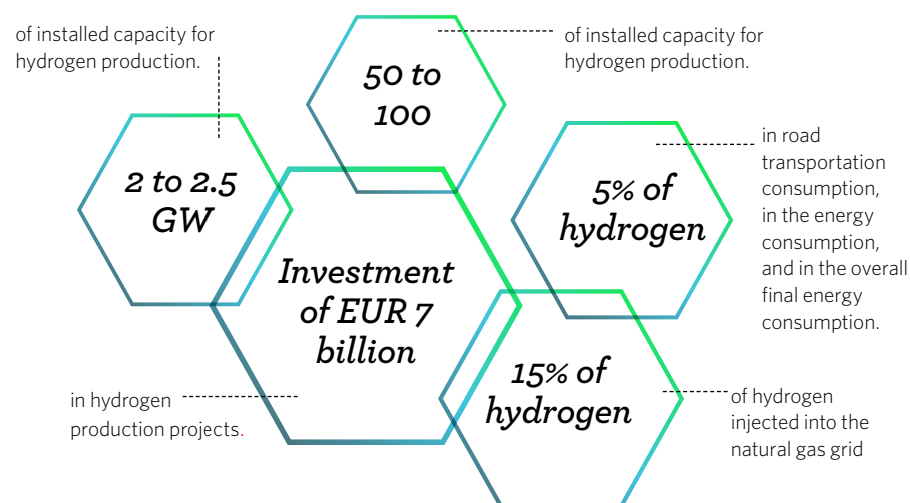
There are several small- and large-scale hydrogen projects in operation in Portugal. Some of them focus exclusively on the decarbonization of industry and energy generation. Among the most prominent is the “Green Flamingo” project, envisioned to create a hydrogen solar power plant, and Synthetic Fuel for Aviation that aims at increasing the use of green hydrogen from PV in production of alternative aviation fuels.¹

Hydrogen is envisioned to play a key role in aiding the attainment of the 2030 GHG emissions reduction goal, even though for now the utilization of low-carbon hydrogen is relatively low.

Several national laws regulate the hydrogen sector; however, no uniform law on hydrogen is in place to this day.² The Government is expected to introduce separate sections on hydrogen by amending Decree laws on transportation, storage, and reception of gases.

2. National Hydrogen Strategy and Future Developments

Portugal’s National Strategy for Hydrogen was announced in May 2020 and comprises a number of objectives to be achieved by 2030:



¹ DW, “Green Flamingo: Portugal hopes to export green hydrogen to EU” (2020) <<https://www.dw.com/en/green-flamingo-portugal-hopes-to-export-green-hydrogen-to-eu/a-55673203>>.
² CMS Expert Guides, “Hydrogen Law and Regulation in Portugal” (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/portugal>>.



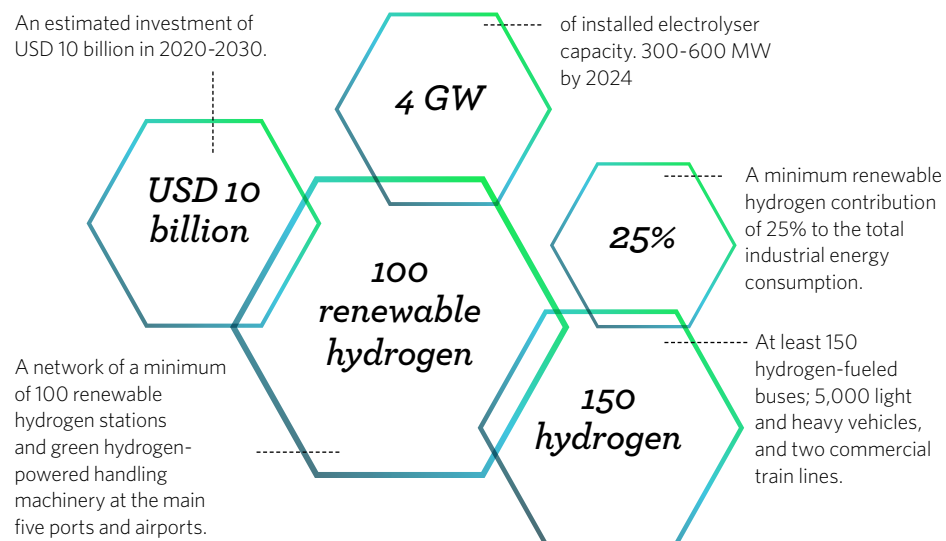
1. The Current Status of Hydrogen Deployment

The essential role of hydrogen has been recognized in Spain’s National Energy and Climate Plan, with hydrogen deployment prognosed to expand due to the increase in the country’s energy production from renewables.¹ Spain currently consumes an estimated of 500,000 tons of hydrogen annually, all of which is fossil fuel based. However, large pilots for green hydrogen productions are in development.

No hydrogen-specific legislation exists in Spain at the moment; however, this is expected to change in the coming future. The injection of hydrogen into the gas network is regulated by the PD-01 Protocol, which sets technical and safety criteria with a reference to the European UNE-EN 16726 standard. The operation of hydrogen plants is subjected to a permitting procedure regulated on a regional level.

2. National Hydrogen Strategy and Future Developments

In 2020, the Hydrogen Roadmap: A Commitment to Renewable Hydrogen was adopted.² The following objectives for 2030 are included:



¹ CMS Expert Guides, “Hydrogen Law and Regulation in Spain” (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/spain>>.
² Ministry for the Ecological Transition and the Demographic Challenge, “Hoja de Ruta del Hidrógeno” (2020) <<https://www.miteco.gob.es/es/ministerio/hoja-de-ruta-del-hidrogeno-renovable.aspx>>.

THE UNITED KINGDOM



1. The Current Status of Hydrogen Deployment

The UK started using hydrogen as early as the mid-18th century, and hydrogen has been playing a key role in the British economy. Today, most of the hydrogen produced in the UK is used in chemicals and refineries.¹ Hydrogen is also used as a fuel in the transport sector, albeit considerably less.

While the predominant amount of hydrogen in the UK is produced from fossil fuels (i.e., grey hydrogen), a number of low-carbon hydrogen projects are in development across the country.

There is little hydrogen-specific legislation in the UK at the moment, which means that general gas laws regulate hydrogen production and deployment.² In particular, the definition of “gas” under the 1986 Gas Act includes hydrogen. The Gas Act also stipulates requirements that must be fulfilled in order to obtain a license for supply, shipping or transportation of hydrogen. Moreover, the licensee must comply with various energy codes.

The process of injecting hydrogen into the gas grid is regulated by the Gas Safety (Management) Regulations 1996. Finally, a number of health and safety regulations apply.

2. National Hydrogen Strategy and Future Developments

The UK is the latest European country to publish a national hydrogen strategy. Published in August 2021, the UK Hydrogen Strategy identifies hydrogen as an essential asset in achieving energy transition and becoming net zero by 2050.³ Notably, in contrast with the 2020 EU Hydrogen Strategy that is largely focused on green hydrogen, UK opted for a broader term such as “low-carbon hydrogen”. While the emissions standard for what constitutes “low-carbon hydrogen” is not yet decided upon, as the public consultation will remain open until the end of October, the Strategy make it clear that both green and blue hydrogen have a key role to play in phasing out fossil fuels. However, steam reforming combined with CCS and renewables-powered electrolysis will not be the only hydrogen production methods. The Strategy also listed several additional methods, among which electrolysis powered by nuclear energy.

¹ CMS Expert Guides, “Hydrogen Law and Regulation in the UK” (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/united-kingdom>>.

² Ibid.

³ HM Government, “UK Hydrogen Strategy” (2021) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf>.



The UK is planning to deploy hydrogen in decarbonizing a number of sectors, including the industry, the power sector, and transportation. Importantly and once again in contrast with the rest of Europe, the UK envisions hydrogen to play a role in bringing down emissions from heating building, with the Strategy suggesting that hydrogen demand for heat in buildings could be up to 45TWh by 2035.

The UK Strategy sets the following objectives for 2030:

- Decarbonization of existing UK hydrogen supply through CCUS and/or supplemented by electrolytic hydrogen injection
- Lower cost of hydrogen production driven by learning from early projects, more mature markets, and technology innovation.
- End-to-end hydrogen system with a diverse range of users across different sectors.
- Increased public awareness and acceptance among consumers.
- Promotion of UK economic growth and opportunities, including jobs and investment opportunities.

Over £4 billion of investment is planned to be unlocked throughout the 2020s

- Emissions reduction under Carbon Budgets 4 and 5 while driving decarbonization towards Carbon Budget 6 and net zero.
- Preparation for a ramp up beyond 2030 on a pathway to net zero, with requisite hydrogen infrastructure and technologies as well as regulatory and market frameworks in place.
- Policy development based on evidence from literature and data collected from project deployment.



THE DEVELOPERS

Countries such as Belgium and Poland have been included in “The Developers” group as the hydrogen technologies they possess present a good level of maturity; yet these states currently lack a comprehensive hydrogen-specific legal framework. A common thread unifying these countries is the focus on hydrogen used primarily in the transportation sector, with countries such as Finland setting ambitious targets of purchasing a minimum of 250,000 hydrogen-powered vehicles by 2030.

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1. The Current Status of Hydrogen Deployment

Austria relies on hydrogen as one of the energy sources contributing to an increase in the overall national share of renewables in final energy consumption and to comply with its obligations under European legislation.¹ In 2019 the Government presented a climate protection package, announcing the ambition to become the “the world’s number one hydrogen nation”.² Austria’s main priority lies in increasing green hydrogen production levels and developing public and private refueling infrastructure.

In 2019 the Austrian Government presented a climate protection package, announcing his government’s ambition to become the “the world’s number one hydrogen nation”.

While hydrogen falls outside of the scope of the 2011 Gas Industry Act, there are several legal acts that must be considered in the process of constructing and operating a hydrogen plant. These include the 2000 Environmental Impact Assessment Act and the Austrian Trade Act. Nonetheless, there is currently no hydrogen-specific legal framework in Austria. For this reason, in 2019 the Austrian government launched a Hydrogen Initiative. As part of the initiative, the legal framework was planned to be amended with the introduction of the Renewable Expansion Act. However, the process has been delayed due to parliamentary elections. Therefore, hydrogen development continues to rely on existing gas legislation. Moreover, where national laws are insufficient, EU law applies directly.

There is a number of large-scale hydrogen initiatives, such as UpHy I and II (focused on green hydrogen for mobility and industry), H2Pioneer (green hydrogen in the light sector), Renewable Gasfield (green hydrogen from polymer electrolysis production), and HyTruck (emissions-free fuels for commercial vehicles) operating in the country.³ In addition, hydrogen research and deployment is largely supported by the Austrian private sector.

2. National Hydrogen Strategy and Future Developments

It was announced that the Austrian Hydrogen Strategy would be published at the end of 2020.⁴ The Strategy was to focus on several objectives. Firstly, development of hydrogen technology for the economic and transport sectors was to be prioritized to achieve Kurz’s ambition of becoming the number one hydrogen nation. Secondly, more investments were planned to be awarded to the Hydrogen Center Austria to support research and innovation. However, the process seems to have been delayed, as no document has been made available. Moreover, no news announcements regarding the publication of the 2020 Strategy are to be found.

¹ CMS Expert Guides, “Hydrogen Law and Regulation in Austria” (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/austria>>.

² H2 International, “Austria as hydrogen nation No. 1” (2019) <<https://www.h2-international.com/2019/10/13/austria-as-hydrogen-nation-no-1/>>.

³ Energy Innovation Austria, “UpHy I & II” <<https://www.energy-innovation-austria.at/article/uphy-iii-2/?lang=en>>; WIVA P&G, “H2Pioneer” <<https://www.wiva.at/v2/portfolio-item/h2pioneer-pave-the-way-for-green-hydrogen-for-early-adopters-in-the-light-industry/?lang=en>>; WIVA P&G, “Renewable Gasfield” <<https://www.wiva.at/v2/portfolio-item/renewable-gasfield/?lang=en>>.

⁴ CMS Expert Guides, “Hydrogen Law and Regulation in Austria” (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/austria>>.



1. The Current Status of Hydrogen Deployment

The primary focus of hydrogen deployment in Belgium lies with the transport sector, including the development of hydrogen-fueled vehicles and refueling stations. As such, Belgium has one of the highest maturity levels for hydrogen technology, with first projects starting operation already in 2009.¹ The use of hydrogen as a “large scale renewable energy storage solution” has also proven economically viable. The demonstration project Don Quichote stored large quantities of renewable energy, thus proving market readiness for hydrogen utilization in road transportation, grid balancing and other areas.² On 18 October 2021, the Flemish Government has signed a Memorandum of Understanding with the European Investment Bank, which will help identify hydrogen projects in the region that could be eligible for financial support.³

Different national laws govern hydrogen deployment, albeit for now mostly regarding its safety or transportation. Moreover, a permitting system exists for hydrogen projects, such as storage and conversion. Additionally, hydrogen transportation via pipelines falls under the scope of the Royal Decree of 14 May 2002, although no injection of hydrogen into the natural gas network has been conducted so far. Finally, regional laws of Flanders, Wallonia and Brussels govern the licensing process. However, Belgium lacks a comprehensive Hydrogen-specific legal framework, which contributes to the uncertainty in hydrogen operationalization.

2. National Hydrogen Strategy and Future Developments

While a number of hydrogen projects are operating throughout Belgium, no national strategy has been announced to this day. Nevertheless, in December 2020 the Hydrogen Industry Cluster presented a Hydrogen Strategy for the Flanders region for years 2025-2030.⁴ Some of the main objectives emphasized in the document include the development of large-scale electrolysis projects (for green hydrogen production), offsetting the production of grey hydrogen through carbon capture and through its gradual replacement with renewable sources, as well as focusing on small-scale local hydrogen production. For 2025, the Strategy envisions 200 MW installed capacity producing 15 kilotons of green hydrogen on an annual basis, and 500 MW with a production of 35 kilotons for 2030 via large-scale electrolysis. With regard to the second objective, the Strategy stipulates an initiation of CCS in 2025 with the decarbonization being scaled-up by 2030. Finally, 5 to 10 local hydrogen sites with a total capacity of 20 MW producing 1.5 kilotons of green hydrogen a year are envisioned for 2025. The number is deemed to increase to 10 to 20 sites with a total capacity of 50 MW in 2030.

¹ WaterstofNet, “Hydrogen in the Flanders – Netherlands region” <https://www.waterstofnet.eu/_asset/public/WaterstofNet_brochure_ENG.pdf>.

² Don Quichote, “Wind Energy, Hydrogen, Forklifts and Smart Grid at a Large Logistic Centre of Colruyt Group (in Halle, near Brussels)” <<https://www.don-quichote.eu/>>.

³ European Investment Bank, “Belgium: EIB signs memorandum of understanding on Hydrogen with Flanders” (2021) <<https://www.eib.org/en/press/all/2021-340-eib-signs-memorandum-of-understanding-on-hydrogen-with-flanders>>.

⁴ Waterstof Industrie Cluster, “A Flemish Hydrogen Strategy 2025-2030”, (2020) <https://www.waterstofnet.eu/_asset/public/WVIC/2020-12-7-Flemish-Hydrogen-Strategy-Hydrogen-Industry-Cluster.pdf>.



1. The Current Status of Hydrogen Deployment

Bulgaria recognizes hydrogen as a potential area for future development; however, there is currently a limited number of projects operating in the country. Those already in place are primarily within the electricity and transportation sector. Moreover, Bulgarian hydrogen remains fossil fuel-based, as it is produced by Lukoil in oil refineries. While hydrogen operationalization is expected to increase by 2030 through the deployment of the "Power to X" technology, green hydrogen remains expensive. Therefore, significant investments are needed before national producers start experiencing cost reductions associated with technology maturing.

Hydrogen-specific legal framework is extremely limited in Bulgaria. Therefore, until a comprehensive specific legislation is developed, general energy laws apply, such as the Energy Act, the Energy from Renewable Sources Act, and the Spatial Development Act.

2. National Hydrogen Strategy and Future Developments

Bulgaria does not have a hydrogen-specific national strategy. However, the development of hydrogen projects in transport and power generation have been included in the Energy and Climate Integrated Plan of the Republic of Bulgaria for the period of 2021-2030.¹ The Integrated Plan sets the target of 32GWh of hydrogen-fueled vehicles by 2030. Moreover, hydrogen refueling stations with a total installed capacity of 20 MW are envisioned for 2030 along with significant investments of 3.5 million EUR in hydrogen projects.

The Integrated Plan sets the target of 32GWh of hydrogen-fueled vehicles by 2030. Moreover, hydrogen refueling stations with a total installed capacity of 20 MW are envisioned for 2030 along with significant investments of 3.5 million EUR in hydrogen projects.

¹ Ministry of Energy, Ministry of the Environment and Water, "Integrated Energy and Climate Plan of the Republic of Bulgaria 2021-2030" (2019) <https://ec.europa.eu/energy/sites/ener/files/documents/bg_final_necp_main_en.pdf>.



1. The Current Status of Hydrogen Deployment

According to the NECP submitted to the European Commission in 2019, Croatia is primarily focused on the development of hydrogen projects in the transportation sector, while its operationalization in industry remains limited.¹ Croatia also envisions hydrogen integration in its energy system.

While there is no hydrogen-specific legal framework in Croatia to this day, the country has been reported to be in development of a national program for hydrogen market development.² Hydrogen is explicitly included within the scope of the definition of alternative fuels in the Law on the Deployment of Alternative Fuels Infrastructure. This creates beneficial conditions for future hydrogen utilization. Moreover, existing energy laws, such as the Energy Act, the Regulation of Energy Activities, and the Gas Market Act apply.

2. National Hydrogen Strategy and Future Developments

In March 2021, Croatia initiated preparations of the National Hydrogen Strategy for 2050. The Strategy is envisioned to contain a long-term plan for the development and deployment of hydrogen in light of the EU's 2050 carbon neutrality goal. The primary objective of the strategy is decarbonization of hydrogen production and its gradual replacement of fossil fuels.

Some of the targets to be included in the National Hydrogen Strategy can be predicted to align with Croatia's NECP. The latter contained several concrete targets. First of all, a goal of 3.5% of electric or hydrogen-powered vehicles was set for 2030. Moreover, development of the alternative fuel infrastructure was indicated as one of the focal points. Finally, the Law on the Deployment of Alternative Fuels Infrastructure is envisioned to be expanded to include alternative fuels in navigation.

¹ Ministry of Environment and Energy, "Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030" (2019) <https://ec.europa.eu/energy/sites/default/files/documents/hr_final_necp_main_en.pdf>.

² European Commission, "Croatia: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans" (2020) <https://www.fch.europa.eu/sites/default/files/file_attach/Brochure%20FCH%20Croatia%20%28ID%209473034%29.pdf>; Euractiv, "Low hanging fruit: Eastern EU states eye existing gas network for hydrogen" (2021) <<https://www.euractiv.com/section/energy/news/low-hanging-fruit-eastern-eu-states-eye-existing-gas-network-for-hydrogen/>>.



1. The Current Status of Hydrogen Deployment

The primary focus on hydrogen currently lies with the Czech industry and its transportation sector.¹ With regard to the latter, a number of small-scale initiatives exist on national and local levels.

There is no hydrogen-specific legislation in the Czech Republic, which means that the production, transportation, utilization, and storage of hydrogen is regulated within the framework of existing laws.² These include the Energy Act, the Chemical Act, and the Act on Protection of Public Health. Notably, the 2017 amendment to the Act on Fuel Substances recognized hydrogen as an alternative fuel. Furthermore, several legislative acts regulating the transport sector explicitly refer to hydrogen.

2. National Hydrogen Strategy and Future Developments

No national hydrogen strategy exists in the Czech Republic. Instead, hydrogen-related objectives are included in the National Action Plan for Clean Mobility adopted in 2015 and amended in 2019.³ The Plan identifies the deployment of hydrogen-fueled public transport and the development of refueling infrastructure as priorities within the mobility sector. Regarding the latter, 2-5 public hydrogen refueling stations are planned to be put into operation already in 2025. In order to attain the mobility objective, the following supporting measures are identified:

- Ensuring compliance with the requirements of Directive 2014/94/EU concerning standards for hydrogen refueling stations.
- Relieving hydrogen-powered vehicles from road taxes.
- Eliminating obstacles in the area of hydrogen-powered vehicles servicing.
- Investing in research and development and increasing the number of Hydrogen-specific pilot projects.

Furthermore, connecting to the neighboring German hydrogen network is under consideration.

¹ CMS Expert Guides, "Hydrogen Law and Regulation in the Czech Republic" (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/czech-republic>>
² Ibid.
³ Ministry of Industry and Trade, "National Action Plan for Clean Mobility (NAP CM)" (2019) <<https://www.eafo.eu/sites/default/files/npl/1%20CZECH%20REPUBLIC%20NPF.en.pdf>>



1. The Current Status of Hydrogen Deployment

In 2018, Estonia joined the Hydrogen Initiative considering "the use of hydrogen in different economic sectors allows it to move towards a low-carbon economy in the most efficient way".¹ A Hydrogen Work Group was initiated by the Ministry of Environment to analyze the prospects of hydrogen deployment; particular focus was placed on the transport sector. Moreover, increasing the share of green hydrogen produced via electrolysis is contemplated for the purpose of decarbonizing the electricity sector.

While there is no hydrogen-specific legal framework in Estonia, the Hydrogen Working Group is designing a roadmap that will likely include specific policy objectives.² The lack of a regulatory framework for hydrogen has been identified as one of the major impediments to green hydrogen deployment. This is foreseen to be partially remedied

with the upcoming revision of the EU gas market rules aimed at facilitating hydrogen deployment. As Estonia's Natural Gas Act implements the EU's Third Gas Package, the country is likely to transpose the revised gas rules in the Act as well.

2. National Hydrogen Strategy and Future Developments

On 27 October 2020, the Parliament of Estonia delivered a Proposal to the Government for the development of a Hydrogen Strategy.³ The Strategy to cover a variety of sectors, such as transport, energy production, and buildings. Moreover, it will address the entire value chain, from production to end use.

Increasing the share of green hydrogen produced via electrolysis is contemplated for the purpose of decarbonizing the electricity sector.

¹ Estonia's Communication to the European Commission under Article 3(1) of Regulation (EU) No 2012/2018, "Estonia's 2030 National Energy and Climate Plan (NECP 2030)" (2019) <https://ec.europa.eu/energy/sites/default/files/documents/ee_final_necp_main_en.pdf>
² European Commission, "Estonia: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans" (2020) <https://www.fch.europa.eu/sites/default/files/file_attach/Brochure%20FCH%20Estonia%20%28ID%209496897%29.pdf>
³ Next Generation Energy Technology, "Estonian Hydrogen Strategy" (2020) <<http://h2est.ee/eng/estonian-hydrogen-strategy/>>



1. The Current Status of Hydrogen Deployment

Finland aims at becoming carbon neutral already by 2035 and carbon negative by 2050.¹ Large-scale deployment of hydrogen technology is incorporated within these national plans.

The current hydrogen production level in Finland is at 4.7-5 TWh, yet less than 1% of this hydrogen is produced via electrolysis. 99% of it comes out of refineries that also generate 80% of demand for hydrogen.

The remaining 20% is generated by the chemical industry. As such, compared to other Member States, hydrogen-powered transport system is substantially underdeveloped. The Government plans to remedy this by purchasing a minimum of 250,000 hydrogen-powered vehicles by 2030 as stipulated in the Government Report on Medium-term Climate Change Policy Plan for 2030.²

Finland currently lacks a comprehensive hydrogen-specific legal framework. Moreover, no specific targets for hydrogen deployment were included in its NECP. According to the Commission's assessment, there are also "no technology-specific policies to promote fuel cell vehicles and hydrogen refueling stations infrastructure". However, several policy instruments, such as car taxes and carbon pricing, create an incentive for hydrogen utilization.

Additionally, the Finnish government is discussing a new law, which extends the current Finnish Guarantees of Origin legislation to include hydrogen. This will simplify the process of identifying hydrogen's level of sustainability. The law was scheduled to come into force by summer 2021, but lawmakers will continue to discuss the draft law in autumn. In August 2021, P2X Solutions—a Finnish forerunner of Power-to-X technology—announced its intention to build the country's first green hydrogen production plant by 2024.³

2. National Hydrogen Strategy and Future Developments

There is no national hydrogen strategy. In order to promote hydrogen development, the Finnish government appointed a working group to provide a report on energy system integration, the promotion of the hydrogen economy and Power-to-X technologies by 30 June 2021.⁴ This report should feed into the government's next climate and energy strategy, which will be presented to Parliament in autumn of 2021.

Moreover, a National Hydrogen Roadmap for Finland was commissioned by Business Finland and was delivered in 2020.⁵ The Roadmap contains a list of suggestions for each part of the hydrogen value chain. These, however, lack specific targets and focus primarily on research, development, and innovation.

¹ Ministry of the Environment, "Government's climate policy: carbon-neutral Finland by 2035" <<https://ym.fi/en/climate-neutral-finland-2035>>

² Ministry of the Environment, "Government Report on Medium-term Climate Change Policy Plan for 2030 Towards Climate-Smart Day-to-Day Living" (2017) <https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/80769/YMre_21en_2017.pdf?sequence=1>

³ FuelCells Works, "First Green Hydrogen Production Plant in Harjavalta Finland" (2021) <<https://fuelcellsworks.com/news/first-green-hydrogen-production-plant-in-harjavalta-finland/>>

⁴ Ministry of Economic Affairs and Employment, "Working group to explore possibilities to promote energy sector integration" (2020) <<https://valtioneuvosto.fi/en/-/1410877/working-group-to-explore-possibilities-to-promote-energy-sector-integration>>

⁵ Business Finland, "National Hydrogen Roadmap guides Finland towards carbon neutrality" (2020) <<https://www.businessfinland.fi/en/whats-new/news/cision-releases/2020/national-hydrogen-roadmap-guides-finland-towards-carbon-neutrality>>



1. The Current Status of Hydrogen Deployment

While the Greek Government indicated its intention to deploy hydrogen in the future, no projects are expected until early 2022.¹ The main focus will be placed on decarbonization and energy storage.

Greece lacks a legal framework for hydrogen. Law 4439/2016 dealing with the development of alternative fuel infrastructures is a national translation of Directive 2014/94/EU.

2. National Hydrogen Strategy and Future Developments

At present, there is no National Hydrogen Strategy in Greece. However, in December 2020 it was announced that a special Committee will be assembled to produce a draft Strategy Plan for the promotion of technologies and applications of hydrogen and other RES gases.² The Committee will design:

- A Roadmap for the development and utilization of hydrogen and other RES gases.
- Policy proposals for the energy sector.
- Estimated costs for the operationalization of hydrogen and other RES gases.

The Plan was originally expected in September 2021, but no document has been published yet.

¹ WFW, "Hydrogen in Greece" (2021) <<https://www.wfw.com/articles/hydrogen-in-greece/>>
² Ibid.



1. The Current Status of Hydrogen Deployment

Italy set itself the target of reducing national GHG emissions levels by 33% by 2030 under the Effort Sharing Regulation. As such, hydrogen deployment has been identified as one of the key instruments to reach the set target. So far, only a small share of hydrogen produced in Italy is low- or zero-carbon. However, this number is projected to increase in the upcoming years with the decrease of costs of renewable energy and electrolysis.

The Italian hydrogen framework is fragmented, which renders the commencement of new projects more difficult.¹ In particular, the Italian environmental regulator does not differentiate between hydrogen production through reforming and hydrogen production through electrolysis. As a result, certain land use prohibitions apply to both processes irrespective of the production method. The only hydrogen-specific piece of legislation is the Ministerial Decree on “Technical rules of fire prevention for design, construction, and operation of hydrogen distribution facilities for automotive vehicles”. Other aspects of the hydrogen sector are governed predominantly by gas and fossil fuel legislation.

2. National Hydrogen Strategy and Future Developments

In June 2021 the Italian Ministry of Economic Development announced the publication of the National Hydrogen Strategy Preliminary Guidelines. The Guidelines set the vision for hydrogen deployment until 2050. As such, 5 GW of electrolysis capacity is to be installed by 2030 to meet the 2% of hydrogen penetration in the final energy demand. The demand is set at 20% by 2050. The Guidelines presuppose substantial investment (both national and European) in the years 2020-2030 reaching up to EUR 10 billion. Three models of green hydrogen production are identified:

- 1) Complete on-site production.
- 2) On-site production with renewable electricity transportation.
- 3) Centralized production with hydrogen transportation.

Moreover, the creation of hydrogen valleys and industrial clusters are envisioned. The final version of the Strategy is expected in 2021.²

¹ CMS Expert Guides, “Hydrogen Law and Regulation in Italy” (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/italy>>.

² IEA, “National Hydrogen Strategy Preliminary Guidelines” (2021) <<https://www.iea.org/policies/13087-national-hydrogen-strategy-preliminary-guidelines>>.



1. The Current Status of Hydrogen Deployment

Poland is the fifth largest producer of hydrogen worldwide, accounting for 14% of Europe’s hydrogen.¹ However, the development of hydrogen projects is currently limited in the Member State. Nevertheless, several generation, transportation, and storage projects are in the development stage. The focus of decarbonization is on the transport sector and electricity storage.

Currently, no hydrogen-specific laws are in force in Poland.² Those provisions that apply to hydrogen do so primarily with regard to the transport sector within the framework of the Act on Electromobility and Alternative Fuels. Accordingly, the rest of the activities are regulated by general energy legislation. For instance, the injection of hydrogen into the pipeline is done in accordance with the same procedures that govern gaseous fuels under the Energy Law Act. However, the new legal framework for hydrogen is expected to come into force in 2021 and will include an Act on Hydrogen.

2. National Hydrogen Strategy and Future Developments

The draft Polish National Hydrogen Strategy was published in January 2021. It sets out 6 primary objectives, namely:

- 1) Implementation of hydrogen technology in the energy sector.
- 2) Use of hydrogen as an alternative fuel in transport (for low-emissions mobility).
- 3) Low-emissions hydrogen in hard to decarbonize industry sectors.
- 4) New installations to increase the production share of low- and zero-emissions hydrogen.
- 5) Safe and efficient transportation of hydrogen.
- 6) Implementation of a stable regulatory framework to support the attainment of the targets listed above (i.e. the Act on Hydrogen).³

¹ CMS Expert Guides, “Hydrogen Law and Regulation in Poland” (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/poland>>.

² Ibid.

³ IEA, “Polish Hydrogen Strategy” (2021) <<https://www.iea.org/policies/12730-polish-hydrogen-strategy>>.

⁴ Service of the Republic of Poland, “Rozpoczęły się konsultacje publiczne projektu „Polskiej Strategii Wodorowej”” (2021) <<https://www.gov.pl/web/klimat/rozpoczely-sie-konsultacje-publiczne-projektu-polskiej-strategii-wodorowej>>.

Poland is the fifth largest producer of hydrogen worldwide, accounting for 14% of Europe’s hydrogen.

The primary objectives are supported by 40 actions in the three main sectors: energy, transport and industry. Moreover, specific targets include:

- 2 GW installed electrolyser capacity by 2030.
- 500 Polish-manufactured hydrogen fuel cell buses by 2025.
- 32 hydrogen-refueling stations in operation by 2025.
- PLN 1 billion of state support for the development of hydrogen technology.

The draft Hydrogen Strategy is currently undergoing public consultation. At the same time, the draft will be reviewed by the Council of Ministers, which is expected to adopt the Strategy in 2021.⁴



ROMANIA



1. The Current Status of Hydrogen Deployment

The deployment of hydrogen remains limited in Romania, with the gas being mainly utilized in refineries.¹ So far, Romania only produces fossil fuel-based hydrogen. However, it indicated in its 2020 NECP that the implementation of a number of pilot projects in the electricity sector is under consideration.

Romania does not have any hydrogen-specific legislation.² Following the amendment of the Energy Law in July 2020, the regulatory framework for hydrogen will be established by the energy regulator, ANRE. This includes technical and commercial requirements regarding the operation of a hydrogen terminal. Discussions are currently ongoing regarding the need to amend the existing legislation and adopt rules that would incentivize decarbonization.

2. National Hydrogen Strategy and Future Developments

In April 2021 it was announced that Romania is to draft its national hydrogen strategy.³



¹ CMS Expert Guides, "Hydrogen Law and Regulation in Romania" (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/romania>>.

² Ibid.

³ Energetika, "Romania to draft national hydrogen strategy - government official" (2021) <<https://www.energetika.net/en/novice/articles/romania-to-draft-national-hydrogen-strategy-government-off>>.

SWEDEN



1. The Current Status of Hydrogen Deployment

Sweden set the target of reaching net-zero GHG emissions by 2045 at the latest, which is one of the main drivers of the development of hydrogen technology.¹ A large share of Sweden's electricity is generated from renewable sources, which creates beneficial conditions for expanding the deployment of green hydrogen.

Sweden lacks the comprehensive legal framework for hydrogen deployment.² No technology-specific policies promoting hydrogen-fueled transport exist either.

The deployment of hydrogen-based technology is expected "to be driven by the market".³ Market instruments, such as car taxes and carbon pricing are used to incentivize low-carbon hydrogen utilization and have proven effective, with Sweden recently delivering world's first fossil-fuel free steel, produced with hydrogen.⁴

2. National Hydrogen Strategy and Future Developments

The Swedish Energy Agency was scheduled to produce a national strategy by November 2021.⁵ Moreover, Fossil Free Sweden—a governmental initiative—published a hydrogen strategy that is focused achieving major milestones in the industries where hydrogen can be deployed most efficiently.⁶

Sweden set the target of reaching net-zero GHG emissions by 2045 at the latest, which is one of the main drivers of the development of hydrogen technology.

¹ Ministry of the Environment and Energy, "The Swedish climate policy framework" (2021) <<https://www.government.se/495f60/contentassets/883ae8e123bc4e42aa8d59296ebe0478/the-swedish-climate-policy-framework.pdf>>.

² European Commission, "Sweden: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans" (2020) <https://www.fch.europa.eu/sites/default/files/inline_attachments/Brochure%20FCH%20Sweden%20ID%209474490.pdf>.

³ Ibid.

⁴ The Guardian, "Green Steel: Swedish company ships first batch without using coal" (2021) <<https://www.theguardian.com/science/2021/aug/19/green-steel-swedish-company-ships-first-batch-made-without-using-coal>>.

⁵ ZEHTC, "New National Hydrogen Strategy" (2021) <<https://www.zehtc.org/new-national-hydrogen-strategy/>>.

⁶ Fossilfritt Sverige, "Hydrogen Strategy" <<https://fossilfritt.sverige.se/en/strategies/hydrogen/>>.

THE LAGGARDS

This category regroups all EU Member States in which hydrogen-specific legislation is either absent or in its embryonic stage. The countries included in the section differ significantly in their approach to the use of hydrogen. For instance, despite still lacking a national strategy, Denmark considers hydrogen essential to meet its greenhouse gas reduction goals. In contrast, for the Republic of Cyprus hydrogen deployment is not considered a priority and no hydrogen projects have been included in its National Energy and Climate Plan for 2030.

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1. The Current Status of Hydrogen Deployment

The Republic of Cyprus is not currently focusing on hydrogen deployment and did not include hydrogen projects in its NECP for 2030.¹ Moreover, the absence of the gas network complicates its utilization. No agenda for creating Hydrogen-specific infrastructure exists to this day. There are also no plans to invest in research and innovation and no intention to develop hydrogen-based technology even for 2050. No national association operates in the field of hydrogen development.

According to the Commission, the creation of a Hydrogen-specific legal framework is currently not envisioned in Cyprus.²

2. National Hydrogen Strategy and Future Developments

There is currently no strategy for hydrogen and no plans to develop a roadmap in the nearest future.

¹ "Cyprus' Integrated National Energy and Climate Plan under the Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action" (2020) <https://ec.europa.eu/energy/sites/default/files/documents/cv_final_necp_main_en.pdf>.
² European Commission, "Cyprus: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans" (2020) <https://www.fch.europa.eu/sites/default/files/attach/Brochure%20FCH%20Cyprus%20_LowRes%20%28ID%209496949%29.pdf>.



1. The Current Status of Hydrogen Deployment

Among the EU Member States, Denmark has one of the most ambitious plans for greenhouse gas reduction, aiming at cutting 70% by 2030 and reaching net-zero in 2050.¹ Utilization of hydrogen is considered essential for achieving these objectives.

Despite its ambitious plans, Denmark still lacks a comprehensive hydrogen-specific legal framework.² However, hydrogen refueling infrastructure is included within the scope of the Executive Order on Requirements for Technical Specifications for Publicly Available Infrastructure for Alternative Fuels.

There is currently a network of 10 hydrogen-refueling stations in Denmark. However, according to Denmark's NECP, the transport sector remains less of a priority with little market demand for hydrogen-powered vehicles envisioned before 2025. Ambitious plans have been set for the deployment of the "Power-to-X" technology with nearly EUR 67 million of private and public funding being invested in the hydrogen sector.³ Notably, the Danish government plans to adopt a strategy on carbon capture, usage & storage and on Power-to-X technology at the end of 2021. This strategy will give direction to the development of the Danish hydrogen market. Finally, two energy island projects have been approved this year, with some of the generated renewable energy being used for green hydrogen production.⁴

2. National Hydrogen Strategy and Future Developments

While a large number of projects receive financial support, Denmark does not have a national strategy for hydrogen.

The Danish government plans to adopt a strategy on carbon capture, usage & storage and on Power-to-X technology at the end of 2021.

¹ Retsinformation, "Climate Law" (2020) <<https://www.retsinformation.dk/eli/lt/2020/965>>.
² European Commission, "Denmark: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans" (2020) <<https://www.fch.europa.eu/sites/default/files/attach/Brochure%20FCH%20Denmark%20%28ID%209473036%29.pdf>>.
³ "Climate Action and Low Carbon Development (Amendment) Act 2021" (2021) <<https://data.oireachtas.ie/ie/oireachtas/act/2021/32/eng/enacted/a3221.pdf>>.
⁴ Iterreg Europe, "Renewable Energy in Ireland 2019 Report" (2019) <https://www.iterregeurope.eu/news-and-events/news/5265/renewable-energy-in-ireland-2019-report/?no_cache=1&chash=6c4eb4bb73a6a790f3c5a64928d1b35a>.



1. The Current Status of Hydrogen Deployment

In July 2021 Ireland enacted an ambitious Climate Action and Low Carbon Development Act that set the GHG emissions reduction target for 2030 at 51% relative to 2018 levels. Moreover, Ireland aims to reach climate neutrality by 2050. These targets will require considerable structural changes in the energy sector, with clean hydrogen serving as a complimentary solution to wind power—the country's main source of renewable energy.¹

There are two pathways for hydrogen deployment currently under consideration. The first one focuses on carbon capture and storage with hydrogen produced primarily from natural gas. The second one is carbon-free, presupposing hydrogen production through electrolysis of water. However, this option is more costly.

Ireland did not indicate any specific objectives in its NECP submitted to the Commission.

There is no comprehensive hydrogen-specific legal framework in Ireland.²

2. National Hydrogen Strategy and Future Developments

There is no National Strategy for Hydrogen in Ireland. However, the Commission suggested using the Hydrogen Roadmap for Irish Transport 2020-2030 (produced by a transport association) as a starting point.³

¹ European Commission, "Ireland: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans" (2020) <<https://www.fch.europa.eu/sites/default/files/attach/Brochure%20FCH%20Ireland%20%28ID%209473093%29.pdf>>.
² Hydrogen Mobility Ireland, "Narrative Summary: A Hydrogen Roadmap for Irish Transport, 2020-2030" (2019) <https://hydrogenireland.org/wp-content/uploads/2019/10/HMI_narrative_summary_final_Oc3rd2019.pdf>.
³ Ibid.

LATVIA



1. The Current Status of Hydrogen Deployment

According to its NECP, Latvia views hydrogen as a “future alternative fuel to replace petroleum products”.¹ The primary focus lies in the transport sector, with the first hydrogen-refueling station in operation in Riga since 2016. Latvian vision for hydrogen deployment in transport is long-term and includes plans for the development of hydrogen infrastructure. Moreover, innovation is prioritized and is to be achieved via the implementation of the national R&D&I Smart Specialization Strategy in the period between 2021 and 2027. Furthermore, Latvia continues coordination efforts with the neighboring Baltic countries. Despite all that, no specific objectives were included in the 2019 NECP.

A comprehensive legal framework remains absent in Latvia.² Hydrogen is listed as an alternative fuel under national law and its purity requirements are governed by the Standardisation Law.

2. National Hydrogen Strategy and Future Developments

No hydrogen strategy has been developed in Latvia so far.

LITHUANIA



1. The Current Status of Hydrogen Deployment

So far, Lithuania is mainly considering hydrogen deployment from the perspective of R&D&I. No specific targets have been included in the NECP submitted to the Commission.¹

The Commission did not identify a comprehensive legal framework for the deployment of hydrogen in Lithuania.² In March 2021, the Law on Alternative fuels was passed with the aimed at facilitating hydrogen and biomethane in coming future. The Law includes the objective of having at least 5% of both gases in the final energy consumption mix in transport by 2030.

2. National Hydrogen Strategy and Future Developments

No national strategy has been developed in Lithuania to this day. Nevertheless, a national study was initiated in 2021 by the Ministry of Energy to prepare National Hydrogen Development Guidelines.³ The development of the Guidelines was commissioned to the energy transmission group EPSO-G in view that the transportation of green hydrogen will be conducted with the use of the national gas grid.

¹ “National Energy and Climate Action Plan for of the Republic of Lithuania for 2021-2030” (2020) <https://ec.europa.eu/energy/sites/ener/files/documents/lt_final_necp_main_en.pdf>

² European Commission, “Lithuania: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans” (2020) <https://www.fch.europa.eu/sites/default/files/file_attach/Brochure%20FCH%20Lithuania%20%28ID%209473351%29.pdf>

³ Ministry of Energy of the Republic of Lithuania, “Ministry of Energy takes the lead in preparing national hydrogen development guidelines” (2021) <<https://enmin.lrv.lt/en/news/ministry-of-energy-takes-the-lead-in-preparing-national-hydrogen-development-guidelines>>

LUXEMBOURG



1. The Current Status of Hydrogen Deployment

Luxembourg set the target of 50-55% GHG emissions reduction for 2030 and hydrogen is seen as a key tool to achieve the national energy transition. The special focus is put on the mobility sector, the industry and on energy storage. Another important consideration involves using existing gas infrastructure for green hydrogen supply. Moreover, the deployment of hydrogen is considered in the conversion of military vehicles and the development of “hydrogen driven fleets”.¹

Nevertheless, despite the ambitious plans, no comprehensive legal framework exists in place.²

2. National Hydrogen Strategy and Future Developments

There is presently no national hydrogen strategy.

The deployment of hydrogen is considered in the conversion of military vehicles and the development of “hydrogen driven fleets.”

¹ IEA, “Luxembourg 2020: Energy Policy Review” (2020) <https://iea.blob.core.windows.net/assets/8875d562-756c-414c-bc7e-51c115b1a38c/Luxembourg_2020_Energy_Policy_Review.pdf>

² European Commission, “Luxembourg: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans” (2020) <https://www.fch.europa.eu/sites/default/files/file_attach/Brochure%20FCH%20Luxembourg%20%28ID%209473030%29.pdf>

¹ Cabinet of Ministers, “Latvia’s National Energy and Climate Plan 2021-2030” (2020) <https://ec.europa.eu/energy/sites/ener/files/documents/lt_final_necp_main_en.pdf>

² European Commission, “Latvia: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans” (2020) <https://www.fch.europa.eu/sites/default/files/file_attach/Brochure%20FCH%20Latvia%20%28ID%209473352%29.pdf>

MALTA



1. The Current Status of Hydrogen Deployment

There are three focal points for Malta when it comes to hydrogen deployment according to its NECP: gas infrastructure, decarbonization of the transport sector, and green hydrogen production.¹ Malta also considers hydrogen strategically necessary for ensuring the security of energy supply. However, no specific objectives were included in the NECP.

No comprehensive legal framework regulating hydrogen deployment exists in Malta. So far, hydrogen has only been considered within the scope of the National Transport Strategy. However, “as the cost of the infrastructure is greatly disproportionate to current demand and considering the limited range on the island as well as the highest energy efficiency of battery electric vehicles” electro mobility is currently prioritized over the installment of hydrogen refueling network.²

2. National Hydrogen Strategy and Future Developments

There is no national strategy for hydrogen in Malta; moreover, no plans to develop one in the nearest future have been announced.

¹ Malta's 2030 National Energy and Climate Plan" (2019) <https://ec.europa.eu/energy/sites/default/files/documents/mt_final_necp_main_en.pdf>
² European Alternative Fuels Observatory, "Malta" <<https://www.eafo.eu/content/malta>>

SLOVAKIA



1. The Current Status of Hydrogen Deployment

In recent years, Slovakia has been expressing interest in increasing the number of hydrogen mobility projects and developing the necessary infrastructure.¹ The interest is supported by the country's private sector. So far, no hydrogen-powered vehicles or refueling infrastructure are in operation in Slovakia.² Hydrogen is produced by chemical plants and is used to meet domestic needs. Additionally, Slovakia is considering low-carbon hydrogen production from nuclear energy.

There is no hydrogen-specific legislation in Slovakia. Instead, the hydrogen value chain is governed by national laws on renewable energy and natural gases. Some of the most relevant laws include the Act No. 309/2009 Coll. on the Promotion of Renewable Energy Sources and Highly Efficient Cogeneration, the Energy Act No. 251/2012 Coll. as well as the Act No. 250/2012 Coll. on Regulation in Network Industries.

2. National Hydrogen Strategy and Future Developments

There is currently no national strategy on hydrogen in Slovakia.

¹ CMS Expert Guides, "Hydrogen Law and Regulation in Slovakia" (2020) <<https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/slovakia>>
² Ibid.

SLOVENIA



1. The Current Status of Hydrogen Deployment

According to its NECP, Slovenia views hydrogen as a potential contributor to the overall share of renewable electricity generated, as well as a method of ensuring security of supply and achieving decarbonization.¹ According to its estimations, around 7% of fuel consumption can be met by hydrogen in 2040. To achieve this, Slovenia intends to develop a market for renewable hydrogen, which will be supported by a guarantees of origin scheme.

So far, no comprehensive legal framework regulates the deployment of hydrogen in Slovenia.²

2. National Hydrogen Strategy and Future Developments

There is no national hydrogen strategy in Slovenia at present.



¹ Republic of Slovenia, "Integrated National Energy and Climate Plan of the Republic of Slovenia" (2020) <https://ec.europa.eu/energy/sites/default/files/documents/si_final_necp_main_en.pdf>
² European Commission, "Slovenia: Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans" (2020) <https://www.fch.europa.eu/sites/default/files/file_attach/Brochure%20FCH%20Slovenia%20%28ID%209474178%29.pdf>



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