Chapter 3

2019 EU and National Policies Report

September 2020

FUEL CELLS AND HYDROGEN OBSERVATORY

This report is based on data gathered as part of the Fuel Cells and Hydrogen Observatory as at 31 December 2019. The authors believe that this information comes from reliable sources, but do not guarantee the accuracy or completion of this information. The Observatory and information gathered within it will continue to be revised. These revisions will take place annually and can also be done on a case by case basis. As a result, the information used as of writing of this report might differ from the changing data in the Observatory.

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This report was prepared for the Fuel Cells and Hydrogen 2 Joint Undertaking as part of the Fuel Cells and Hydrogen Observatory. Copies of this document can be downloaded from https://www.fchobservatory.eu/

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1. Executive Summary

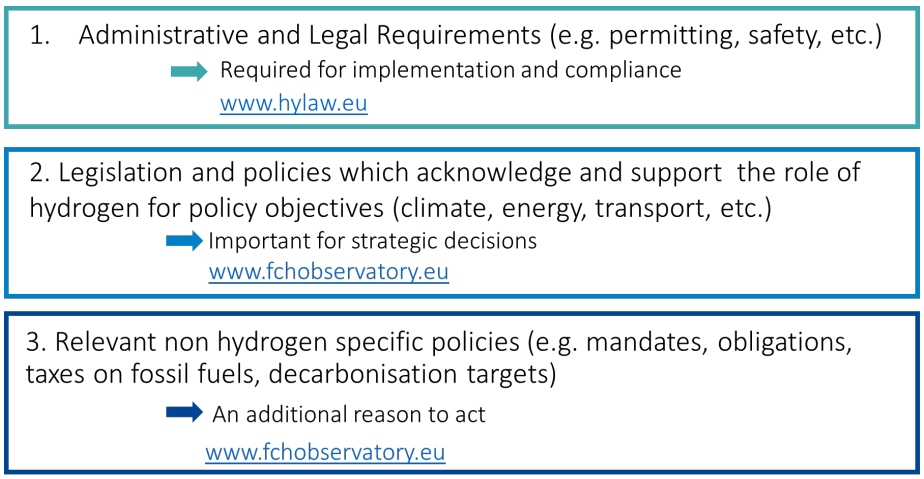
1.1. Material and Geographical Scope

Purpose:	The policy module of the FCHO presents an overview of EU and national policies across various hydrogen and fuel cell related sectors. It provides a snapshot of the current state of hydrogen legislation and policy.
Scope:	While FCHO covers 38 entities around the world, due to the completeness of the data at the moment of writing, this report covers 29 entities. The report reflects data collected January 2019 – December 2019.
Key Findings:	Hydrogen policies are relatively commonplace among European countries, but with large differences between member states. EU hydrogen leaders do not lag behind global outliers such as South Korea or Japan.

The section of the Fuel Cells and Hydrogen Observatory (FCHO) on "Policy, Regulation, Codes" provides users with a comprehensive overview of ***the most relevant policies at EU, national or regional level that directly or indirectly affect the development and deployment of the hydrogen technologies*** *under the scope of the Observatory.*

While many legislative and non-legislative acts have a certain relevance for hydrogen technologies, the FCHO has chosen to focus on those policies that impact on the business case for FCH technologies, meaning that they are ***relevant to decision makers*** *when deciding whether to apply (or not) an FCH solution in a particular field. Legal and administrative requirements which have to be complied with by project developers when implementing hydrogen solutions are already covered comprehensively by other sources[1] and are not covered by the FCHO.*

Figure 1: Material scope of the FCHO Policy Module



At EU level, the FCHO covers all relevant legislative (Regulations and Directives) and non-legislative (Institutional Communications) policies pursued by the EU with a strong impact on hydrogen technologies.

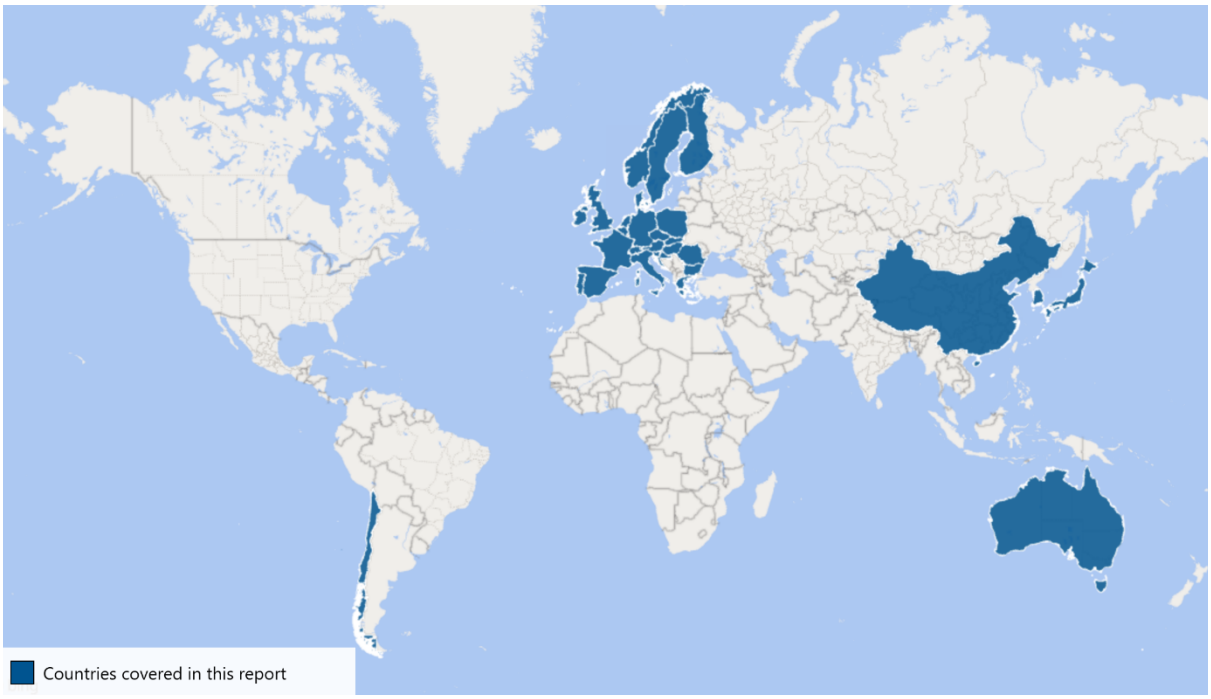
[1] www.hylaw.eu

Table 1: EU policies covered by the FCHO

Legislative measures (in force)	*Non-legislative policies (or planned legislative measures)*
Renewable Energy Directive	*EU Green Deal*
CO2 emission performance standards for new passenger cars and light-duty vehicles	*European Climate Law*
CO2 emission performance standards for new heavy-duty vehicles	*Energy Policy (including the Smart Integration Package)*
Alternative Fuel Infrastructure Directive	*Industrial Policy and Green Growth*
EU Emission Trading System (ETS)	*ETS Innovation Fund*
Public Procurement rules for clean vehicles	*Taxation, and Sustainable Finance (including R&D)*

At national and regional level, the FCHO covers 38 entities comprised of 37 countries and one sub-national unit, the State of California. The entities have been chosen to cover the EU, EEA, as well as other hydrogen outliers such as South Korea, Japan, China, and others. As of writing of this report in April 2020, the FCH Observatory received complete responses from 29 out of the 38 entities.[2] As a result, the data included in this report covers these 29 countries, 24 of which are members of the EU/EEA/UK. The FCH Observatory team will seek to complete its database to cover all 38 entities. The geographical coverage of this report is available in Figure 2, below.

Figure 2: Geographical coverage of this report for national policies



This report analyses the main policies enacted at EU, as well as national or regional level which affect the deployment of fuel cell and hydrogen technologies.

[2] The entities yet to be completed include California, Canada, Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta, and Morocco.

EU policies have been structured around 3 main areas of impact:

- *Hydrogen production*
- *Hydrogen distribution*[3]
- *End-use sectors*[4]

As they generally provide more operational support and incentives than EU policies, national policies have been organized in the following categories: (i) fuel cell electric vehicles, (ii) stationary power, (iii) hydrogen as a fuel and hydrogen refuelling infrastructure, (iv) hydrogen and the gas grid, (v) hydrogen in industry, and (vi) general questions.

1.2. Main findings

***At EU level**, with the announcement of the EU Green Deal in December 2019, the framework of policies tackling the hydrogen industry is profoundly changing. Thought as the EU's 'new growth strategy', the Green Deal is a high-level political strategy which aims at carbon neutrality in the EU by 2050. To achieve this objective to be enshrined in the European Climate Law, the Green Deal encompasses all sectors of the economy. It includes a broad legislative reviewing process of already-existing policies and a series of new legislative and non-legislative acts. The Green Deal should therefore be understood as the "umbrella" policy, for the various relevant sectors in the hydrogen industry, being transport, energy, and other fields (such as taxation and sustainable finance).*

The unprecedented uncertainties brought about by the COVID-19 crisis (and subsequent economic recovery package) will, no doubt, fundamentally change the policy landscape in the years to come. However, early political messages have confirmed that the EU Green Deal will remain the path forward and will represent the backbone of the industrial and economic policies pursued by the EU.

This report briefly presents the main policies which are relevant at EU level, while the FCHO itself goes deeper into how each policy impacts hydrogen in the different areas of the value chain.

***At national level**, given the stage of the clean hydrogen industry, there are large discrepancies between the adoption rates of various policies among different countries. The outliers in having adopted the most hydrogen friendly policies in Europe are the Netherlands, Finland, Austria, and Germany.*

Policies supporting utilization of hydrogen in transport through fuel cell electric vehicles (FCEVs) are the most common from all sectors. 27 out of the 29 countries included in this survey have at least one policy supporting FCEVs with 23 of them having three or more policies in place.[5] *22 out of the 24 EU/EEA/UK countries have at least one FCEV supporting policy in place. France and Austria have the largest number of subsidy policies supporting FCEVs with six financial and non-economic incentives in place while Croatia and Portugal are the only two countries with no FCEV supporting policies. The most common policies are registration tax benefits and purchase subsidies.*

Policies supporting hydrogen as a fuel and hydrogen refuelling infrastructure are also quite common with 24 out of 29 countries having at least one policy in place and 10 countries having three or more policies. Among EU/EEA/UK, 21 out of 24 countries have at least one policy with Germany, Netherlands, and Italy having adopted four different policies. These are capex support, mandates, permitting rules, and other policies. The most common refuelling infrastructure policies include permitting guidelines in 15 countries and capex support in 14 countries.

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[3] Further broken down into (i) 'large scale storage', (ii) 'hydrogen in the gas grid', (iii) 'transport and storage in liquid carriers', (iv) 'transport by road, ship, etc.', and (iv) 'HRS for multiple applications'.

[4] Further broken down into (i) 'transport' ('road transport', 'maritime', 'aviation', and 'trains'), 'heat and power' ('stationary fuel cells' and 'hydrogen burners and turbines'), and 'energy intensive industry'.

[5] The full list of the 29 covered countries is in Table 10 in the Annex.

Policies supporting stationary power are less common with only 13 out of the 29 countries having at least one policy in place. Among EU/EEA/UK, 12 out of 24 countries have at least one policy while only Japan possesses stationary power policies from among the external countries. The leaders are Germany with four different policies, United Kingdom with three followed by Bulgaria, Finland, Italy, Netherlands, and Slovenia with two policies in place each. The most common stationary power policy is capex support that is available in eight countries followed by feed-in tariffs in five countries and tax incentives in four countries.

Various policies supporting injection of hydrogen into the current gas grid are also less common. While 13 countries, (including 11 EU/EEA/UK) allow hydrogen producers that inject hydrogen into the gas grid to access electricity at or below the wholesale market price, only Austria, Australia, and Finland currently offer capex subsidies for their renewable or low-carbon hydrogen production plants. Feed-in premiums are even rarer with only the Netherlands and its new Stimulering Duurzame Energietransitie (SDE++) policy allowing hydrogen projects to apply for feed-in premiums for producing hydrogen from electrolysis.[6] These projects have to clear a level of 300 EUR per ton of avoided CO2 and it is unclear whether any hydrogen projects will be able to reach this level. Lastly, as of April 2020, no country those surveyed currently has a legal quota for renewable hydrogen in its gas mix.

While hydrogen is widely used in industrial applications, policies supporting the introduction of renewable sourced hydrogen are less common. Low-carbon hydrogen demonstration subsidies are the most common form of support, being available in 13 countries. (12 in EU/EEA/UK). Capex subsidies for renewable/low carbon hydrogen production used in industry for non-demonstration projects are in effect in Austria, Belgium, Bulgaria, Finland, and Netherlands.

Hydrogen roadmaps and strategies are relatively commonplace. Among the surveyed countries, 13 out of 29 have some type of hydrogen strategy[7]. This is further broken down in Figure 16.

[6] SDE++ is an "Incentive Scheme for Sustainable Energy Transition".

[7] 10 countries (France, Germany, Netherlands, Norway, Portugal, and Spain is EU/EEA/UK and Australia, China, Japan, South Korea) out of the 29 surveyed have standalone regional or national hydrogen strategy while in 3, Bulgaria, Czech Republic, and Greece, hydrogen strategies are a part of a bigger energy, climate, or mobility plans.

2. EU Policies and Regulations

This report provides users with a comprehensive overview of the most relevant policies at EU level that directly or indirectly affect the development and deployment of the hydrogen technologies covered by the Fuel Cells and Hydrogen Observatory (FCHO). This report presents an overview of those EU policies.

This report analyses a total of 13 policies, both of legislative and non-legislative content and enacted at EU level. Legislative content typically involves a Directive (e.g. Renewable Energy Directive) or a Regulation (e.g. Regulation setting CO2 emission performance standards for new passenger cars and light-duty vehicles). In contrast, non-legislative content typically involves a high-level political strategy, roadmap or communication.

The policies covered are presented in the table below.

Table 2: EU Policies covered by the FCHO

Legislative measures (in force)	*Non-legislative policies (or planned legislative measures)*
Renewable Energy Directive	*EU Green Deal*
CO2 emission performance standards for new passenger cars and light-duty vehicles	*European Climate Law*
CO2 emission performance standards for new heavy-duty vehicles	*Energy Policy (including the Smart Integration Package)*
Alternative Fuel Infrastructure Directive	*Industrial Policy and Green Growth*
EU Emission Trading System (ETS)	*ETS Innovation Fund*
Public Procurement rules for clean vehicles	*Taxation, and Sustainable Finance (including R&D)*

The FCHO structures these polices based on the various value chain levels and applications of the hydrogen and fuel cell industry. Those are broken down into three main categories:

1. Hydrogen Production

2. Hydrogen Distribution

- *Large scale storage*
- *Hydrogen in the gas grid*
- *Transport and storage in liquid carriers*
- *Transport by road, ship, etc.*
- *HRS for multiple applications*

3. Hydrogen End-Uses

- *Transport*
  - *Road transport*
  - *Maritime*
  - *Aviation*
  - *Trains*
- *Heat and Power*
  - *Stationary fuel cells*
  - *Hydrogen burners and turbines*
- *Energy Intensive Industry*

*In the **transport** sector, all policies covered by this analysis – aside from the Energy Policy – have a potential impact on hydrogen and fuel cell application development and could foster their scaling up*

and deployment. In road transport, both regulations setting CO2 emission performance standards for new passenger cars and light-duty vehicles and for new heavy-duty vehicles contribute to promoting low-carbon mobility, by making standards stricter and emission reduction targets more ambitious and by including a precise timeframe for this decade. The Clean Vehicle Directive, which sets public procurement rules for clean vehicles, and the Alternative Fuel Infrastructure Directive, which establishes a common framework for alternative fuels deployment, go down the same path. In maritime transport, the EU ETS could expand its scope in order to control and help reduce greenhouse gas emission from the sector, if political statements in that regard are to become law. The ETS Innovation Fund is intended to redirect revenues from ETS allowance auctioning into industry demonstration projects for innovative low-carbon technologies. In the aviation sector, the ETS is already implemented and plans are to reduce the number of free allowances allocated to airlines. The Renewable Energy Directive, which sets a 14% renewables target for transport, is expected to affect all levels of the transport sector. Overall, these policies will impact mobility and transport, with the main objective of reducing greenhouse gas emissions. Hydrogen and fuel cell technologies have a major opportunity to benefit from this change, thanks to the potential of their applications at many levels of the transport sector and thanks to the various forms of legal incentives and funding support deployed in this framework.

*In the **energy** sector, most policies covered by the analysis will have an impact on hydrogen deployment and could also support its scale up. The Renewable Energy Directive sets a 32% target share of renewable energy in the EU's gross final energy consumption by 2030 (the target share is set to be revised upwards). National contributions towards this target are determined by Member States, within integrated national energy and climate plans (NECPs) in accordance with Regulation (EU) 2018/1999. (The Governance Regulation) and other acts (e.g. Effort Sharing Regulation). Hydrogen can help Member States meet their respective targets by reducing average emissions from the gas system, by helping to integrate more renewable energy in transport and industrial sectors, and by acting as a grid balancing instrument through energy storage (increasingly needed with renewables deployment). Indeed, the Commission repeatedly mentioned hydrogen as one of the most popular forms of energy storage. Increased demand in green hydrogen and scaling up could help curbing production costs. The ETS, which covers around 45% of the EU's greenhouse gas emissions, has the objective to contribute to reducing overall CO2 emissions by 40% by 2030 compared to 1990 levels (i.e. a 43% reduction by 2030 compared to 2005 levels). Considering the current upwards revision of EU-level CO2 emission reduction targets, ETS contribution to emission reduction objectives could be boosted further. This could especially help deploy hydrogen in the activities whose emissions are covered by the ETS, such as energy-intensive industries or aviation. The Innovation Fund should, here too, be a useful support tool to fund innovative projects in low-carbon technologies. The highly expected fourth Gas Package or Smart Sector Integration Package will shape new opportunities for hydrogen deployment. This new framework will aim at developing clean alternative gas technologies and at enabling sector integration, both levels where hydrogen has great potential. Hydrogen will also have a role to play in the futureproofing of already-existing natural gas infrastructure. The Commission plans to announce a Strategy on smart sector integration by end of 2020.*

*Other policies are expected to have **cross-cutting impacts** on the hydrogen industry. These include the Commission's new Industrial Strategy. It launched the Clean Hydrogen Alliance and it plans the revision of state aid rules, notably for Important Projects of Common European Interest (IPCEI), two key landmarks to foster the uptake in the production and deployment of clean hydrogen technologies.*

*Finally, the **Energy Taxation Directive**, which is under review, aims to shift the tax burden from labour to pollution. Clean hydrogen should be positively impacted from the change, as low-carbon technologies could benefit from financial incentives compared to more highly taxed fossil fuels. Similarly, the*

*Commission plans to channel **financial flows** to low-carbon investments and review **taxonomy** for this purpose. Hydrogen will thereby benefit from extra funding means, not to mention the €1 trillion Sustainable Europe Investment Plan, the investment pillar of the Green Deal, and the alignment of further investment tools like Horizon Europe with Green Deal objectives.*

3. National Incentives and Policies

3.1. Methodology

National respondents

Because of the diverse scope of the policies monitored, no single authority could provide the data required for the Observatory. As a result, ***data collection at the national level*** *has been done by* ***an extensive team of national contributors****. Their unique knowledge, expertise, and language skills ensured an efficient data collection process. Contributors include governmental organizations such as national energy agencies, national hydrogen associations, research centres, and ministries.*

Verification

Respondents' answers have been verified and revised by Hydrogen Europe to ensure both consistency and factual correctness of provided answers. Given the changing nature of policies, all ***answers will be revised*** *on an annual basis.*

Technical background

The data collection process has been implemented, from a technical perspective with the support of the consortia's technological partner, Inycom. Drupal questionnaires and data storage in a SQL database format were used. The platform's interface is complemented with Tableau for automatic creation of maps and other visualizations.

Content

The National Policies part of the Observatory module on "Policy, Regulation, Codes)" provides users with a comprehensive overview of the most relevant policies on national or regional level that directly or indirectly affect the development and deployment of the hydrogen technologies covered by the Observatory.

Questions are organized around six major chapters described in the table below.

Table 3: Categories of national policies covered by the Fuel Cells and Hydrogen Observatory

Sector	Explanation of context
1. Fuel cell electric vehicles	Policies that may prevent or support FCEVs and/or the substitution of conventional vehicles with zero-emission solutions
2. Stationary power	Policies that may prevent or support the deployment of stationary fuel cells and/or the substitution of grid electricity / gas with heat and power produced from fuel cells
3. Hydrogen as a fuel and hydrogen refuelling Infrastructure	Policies that may prevent or support hydrogen as a fuel / hydrogen refuelling stations and/or the substitution of fossil fuels with hydrogen
4. Hydrogen and the gas grid	Policies that may prevent or support the substitution of natural gas by hydrogen (distinction between grey, green or blue whenever relevant)
5. Hydrogen in the industry	Policies that may prevent or support the introduction of hydrogen in industrial processes, substituting conventional methods/fossil fuels (e.g. H_2 as a reducing agent in steel production)
6. General questions	Strategy and planning policies such as hydrogen roadmaps as well as various renewable electricity subsidy policies

This report presents an analytical overview of the currently gathered national policies data structured around the six above-mentioned chapters. This report is not exhaustive and it does not address all the questions included in the Observatory. Each chapter provides an introduction into the sector and

presents preliminary results based on gathered data. It focuses on key insights in each chapter that provide informational value about the proliferation and scale of policies impacting the various hydrogen sectors.

3.2. Geographical Coverage

The geographical coverage of the National Policies part of the FCH Observatory includes ***38 entities.*** *These 38 entities are comprised of 37 countries and one sub-national unit, the State of California.*

As of writing of this report in April 2020, the FCH Observatory received complete responses from 29 out of the 38 entities.[8] As a result, the data included in this report covers these 29 countries, 24 of which are members of the EU/EEA/UK. Figure 3 outlines both the countries covered in this report as well as countries/entities that covered by the Observatory's online portal.

Since the hydrogen sector is developing with different objectives around the world due to countries' different demands, policies adopted to support its further development also differ widely. In view of these developments, it is important to cover not only EU members, but also other major economies focused on hydrogen development.[9]

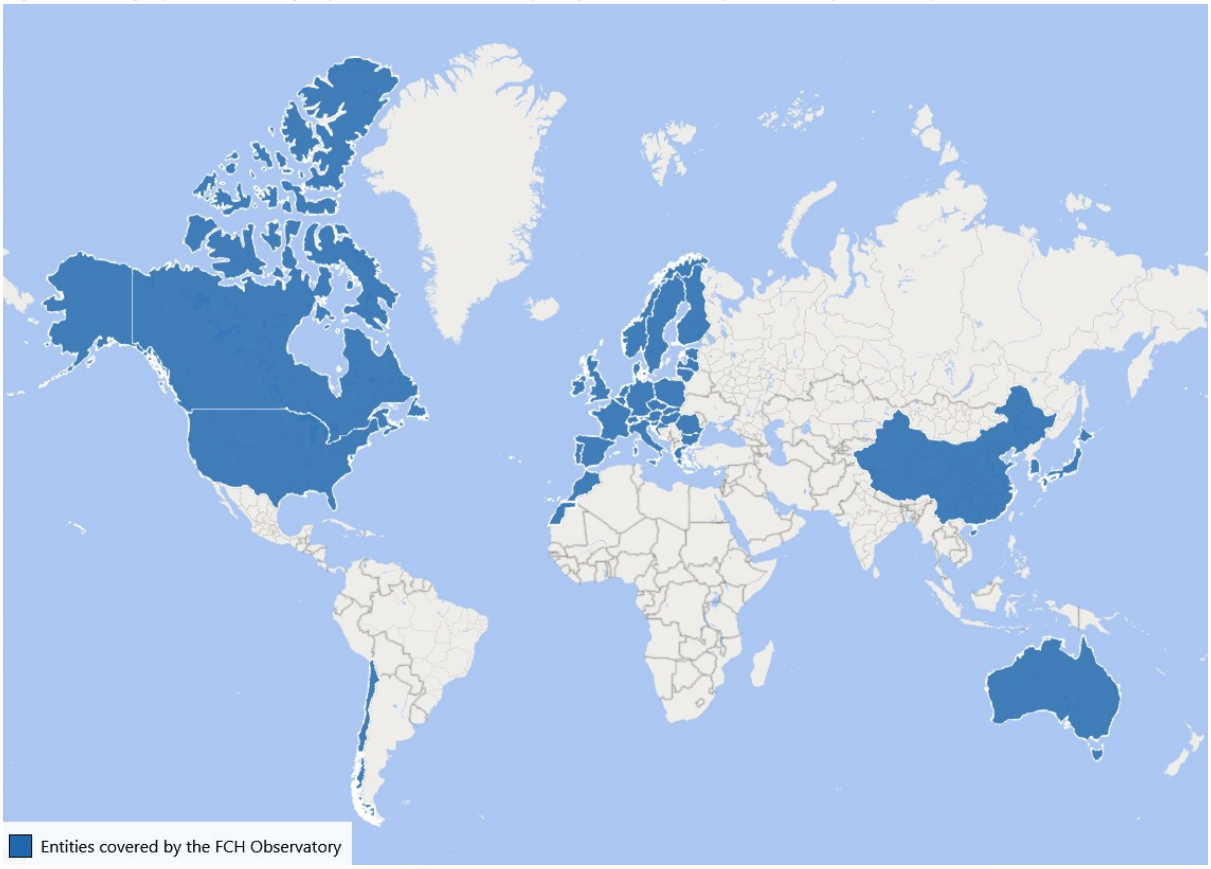
We are confident that a more global policy coverage will:

- *Allow for a more comprehensive analytical and comparative work given the inclusion of major economies.*
- *Increase the utilization and importance of FCH Observatory around the world.*

[8] The entities yet to be completed include California, Canada, Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta, and Morocco.

[9] Major non-EU/EEA hydrogen economies already being tracked include Australia, Chile, China, Japan, and South Korea.

Figure 3: Geographical coverage of the Fuel Cells and Hydrogen Observatory in terms of national policies[10]



3.3. Fuel Cell Electric Vehicles

The chapter covering policies on Fuel Cell Electric Vehicles covers questions related to different means of FCEV support via six different policy categories.

Table 4: Main questions answered in the FCEV chapter

Fuel cell electric vehicles chapter questions (selection)
Is there a purchase subsidy offered to FCEVs?
Are there any registration tax benefits offered to FCEVs
Are there any ownership tax benefits offered to FCEVs
Are there any company tax benefits offered to FCEVs
Are there other financial benefits and/or subsidies offered to FCEVs?
Are there any non-economic benefits / incentives applicable to FCEV's?
What subsidies, financial, or non-economic benefits are available to BEVs?
Is there a national/regional plan on hydrogen for mobility in place?

The questionnaire sought to answer whether policies are in place, their economic value (in EUR or as % of the vehicle cost or tax due), which modes of transport they apply to (heavy duty vehicles, passenger cars, boats etc.), and any other relevant details about the policy.

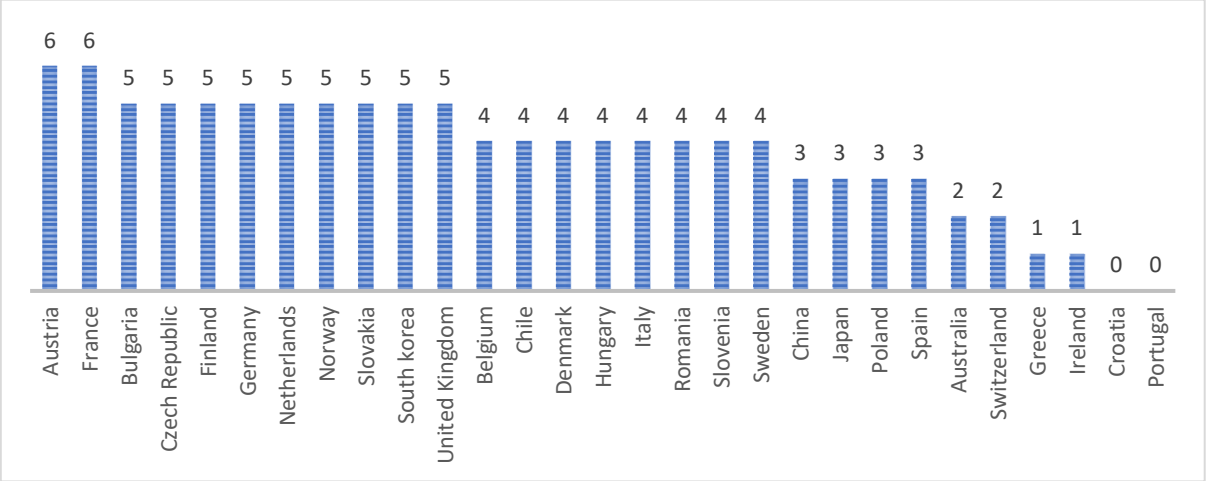
[10] Information for the United States of America is represented by California.

*Policies for FCEVs are widespread among the surveyed countries. **27 out of the 29 countries** included in this survey have **at least one policy supporting FCEVs** with **23 of them having three or more policies** in place. In comparison, there are also 27 countries with BEV policies such as purchase subsidies, registration tax, ownership tax benefit, and company tax benefit. For EU/EEA/UK, 22 out of 24 have at least one policy and 19 countries have three or more FCEV policies.*

*As evident in Figure 4, **France and Austria** have the **largest number of policies supporting FCEV** vehicles with all six financial and non-economic incentives in place. Countries with five policy categories include Bulgaria, Czech Republic, Finland, Germany, Netherlands, Norway, Slovakia, South Korea, and United Kingdom.*

*On the other end of the spectrum, **Croatia and Portugal** are the only two countries with **no FCEV supporting policies** even though both of those countries have at least some BEV support policy in place. In Portugal's case, BEV support includes exemption from circulation tax, purchase subsidy, deductible VAT for companies as well as some non-economic benefits such as access to bus lanes, free parking, and free circulation in some downtown areas.*

Figure 4: Number of FCEV policies adopted by country

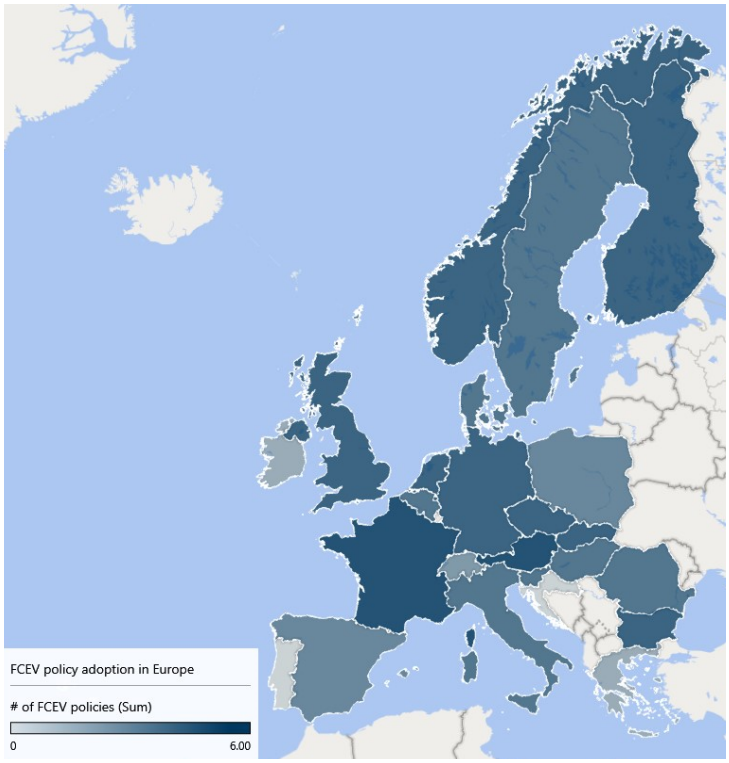


While various FCEV and BEV policies have been adopted across Europe, they are not on the same footing. BEV policies continue to be more common. There are 10 EU/EEA/UK countries in which there is a BEV policy that excludes FCEVs.[11] Some of the examples that exclude FCEVs are Slovakia's purchase subsidies and accelerated depreciation policies applicable only for PHEVs and BEVs.

An analysis of FCEV policies in Europe in Figure 5 does not conclude any geographical distinction in regards to FCEV policy adoption with all regions being represented among both the most and least supportive.

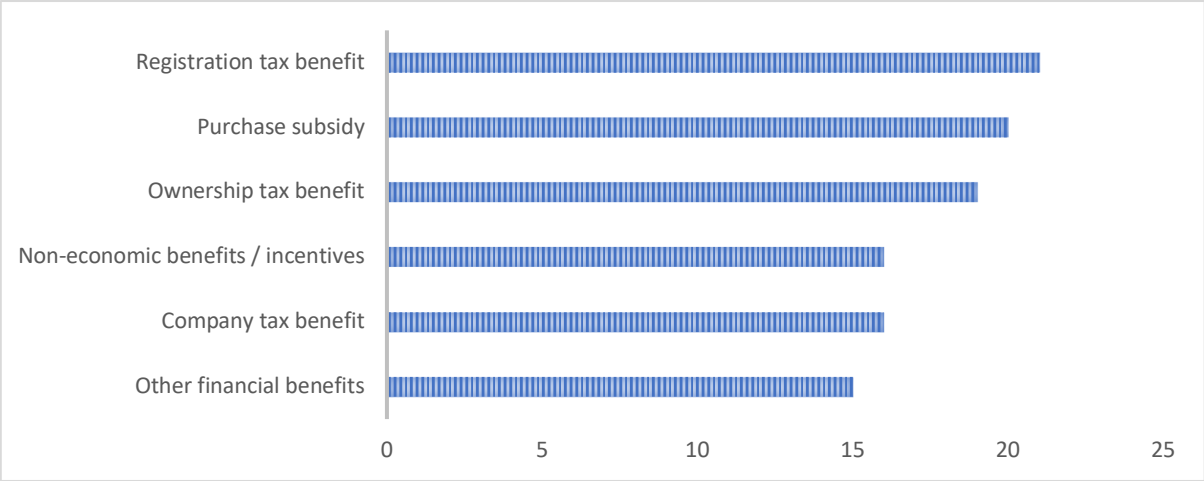
[11] Countries in which there is at least one policy intended to promote electric mobility that excludes FCEVs: Croatia, Finland, Germany, Hungary, Ireland, Italy, Netherlands, Portugal, Slovakia, Sweden.

Figure 5: Intensity of FCEV policy adoption in Europe



Considering all applications and modes of transport, the ***most commonly implemented policy is registration tax benefit*** *being offered in* ***21 out of 29*** *countries, followed by purchase subsidies in 20 countries, and ownership tax benefits in 19 countries.*[12]

Figure 6: Number of countries that adopted one of the six measured FCEV policies



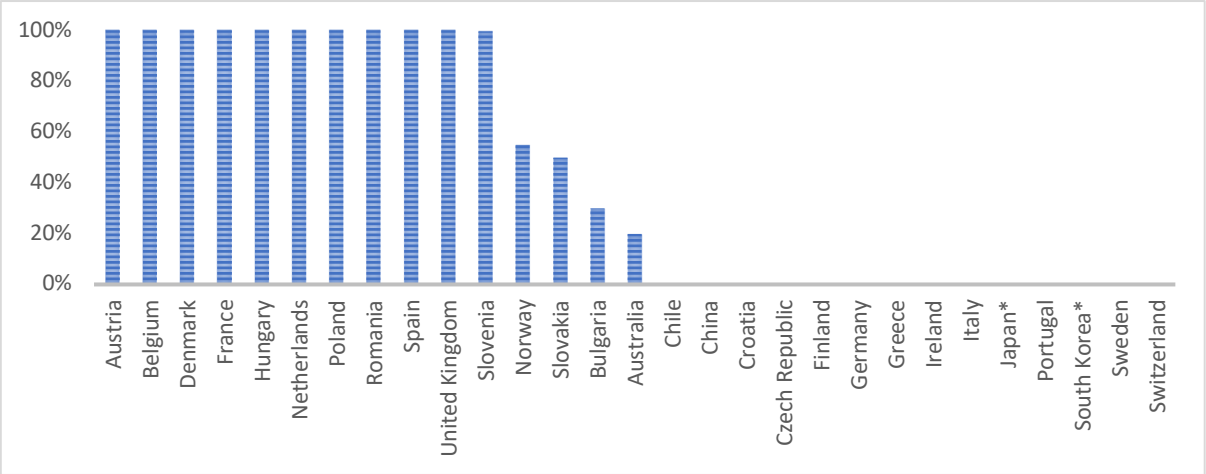
The structure and scale of the provided policy support varies widely among countries. Some countries use absolute values while others use percentages, but most of them limit their policy support up to a specific amount, especially in the case of purchase subsidies.

For passenger cars, registration tax benefit is the most common policy with 17 countries providing at least some registration tax benefit and 13 countries providing more than 50%. In comparison, 19

[12] Registration tax benefits are present in 17, purchase subsidies in 16, and ownership tax benefits in 15 out of the 24 EU/EEA/UK countries measured in this report.

*countries provide registration tax benefits for battery electric vehicles. The two countries with registration tax benefits for battery and not fuel cell passenger cars are Chile and Ireland. Figure 5 below provides an overview of registration tax benefit values for passenger FCEVs. Countries with * have policies with absolute values or other representations that cannot be displayed in Figure 7.*[13]

Figure 7: Overview of % values of registration tax benefits across covered countries



The second most common FCEV support policy are ***purchase subsidies****. They are among the most common and well-known policy instruments for supporting emerging technologies as they decrease the capital investment and bridge the gap between the established and emerging technology.*

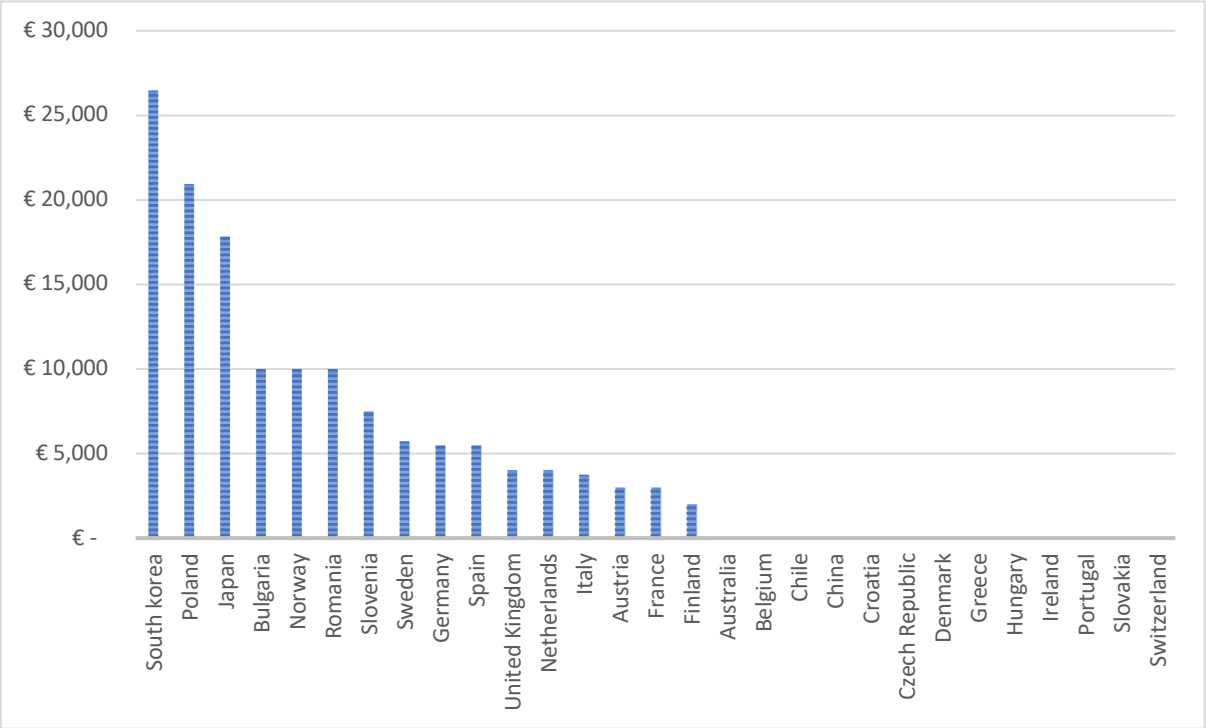
20 countries out of the 29 countries *that are a part of this report currently have* ***purchase subsidies for FCEVs.***[14] *Out of those 29, 23 have policies to support BEVs. Nineteen countries have purchase subsidies for both BEVs and FCEVs. Countries* ***with BEV and not FCEV purchase subsidies include Croatia, Hungary, Ireland, and Portugal.***

Countries with current subsidies for internal combustion engine include Australia, Czech Republic, Finland, Japan, Slovenia, and Sweden – all of which also have BEV and FCEV purchase subsidies in place.

The most common applications for ***FCEV purchase subsidies*** *include* ***passenger cars in 17 countries, light duty vehicles in 11 countries, buses and coaches in 11 countries, heavy duty vehicles in six countries****, and motorcycles and scooters in five countries. Non-road mobile machinery is only supported in Austria and the Netherlands. Trains, light rail, boats, and planes are included in purchase subsidy support schemes only in the Netherlands. Figure 8 presents values of purchase subsidies for FCEV passenger cars.*

[13] South Korea provides up to 5,095 EUR registration tax exemption. Japan also has registration tax benefit in place, but its value has yet to be determined.
[14] 16 out of 24 for EU/EEA/UK.

Figure 8: Overview of purchase subsidies across covered countries



The third most common policy are ***ownership tax benefits*** *being present in 19 countries. Belgium, France, Germany, and Romania have a 100 % tax exemption. Slovakia provides 50% reduction of the annual tax. Finland's benefits amount to ~150 EUR annually, UK's to 166 EUR, South Korea's to 100 EUR, Hungary's 60-110 EUR, Czechia's 20- 60 EUR, and Slovenia's 22-565 EUR.*

With hydrogen vehicle fleets being promoted to replace the current fleets of ICE vehicles, more than half of the surveyed countries provide company tax benefits for passenger cars. Slovenia offers 40% reduction of the vehicle's tax base. The Netherlands provide 36% of the tax amount. Germany provides 100% tax benefit on FCEV purchases. Belgium provides tax benefit in the amount of at least 1,310 EUR while Austria provides up to 6,667 EUR company tax benefit for FCEV purchases. Hungary's company tax benefits amount to between 840-1,680 EUR/ year.

Lastly, 15 countries currently provide ***other economic benefits*** *which include not having to pay for tolls in the Czech Republic or a reduction of the tax that an employee has to pay for using an employer-owned car in Sweden.*

16 countries also provide ***non-economic benefits*** *such as free parking in Bulgaria, Czech Republic, Denmark, France, Hungary, Norway, Poland, and Spain. Another common benefit is free access to restricted zones and exemptions from driving bans in Chile, France, Germany, Poland, and Spain which is especially relevant for light and heavy-duty trucks that will have to contend with these bans or restrictions in upcoming years.*

3.4. Stationary Power

The stationary power chapter covers policy support for stationary fuel cells providing electricity and/or heat.

Table 5: Main questions answered in the stationary power chapter

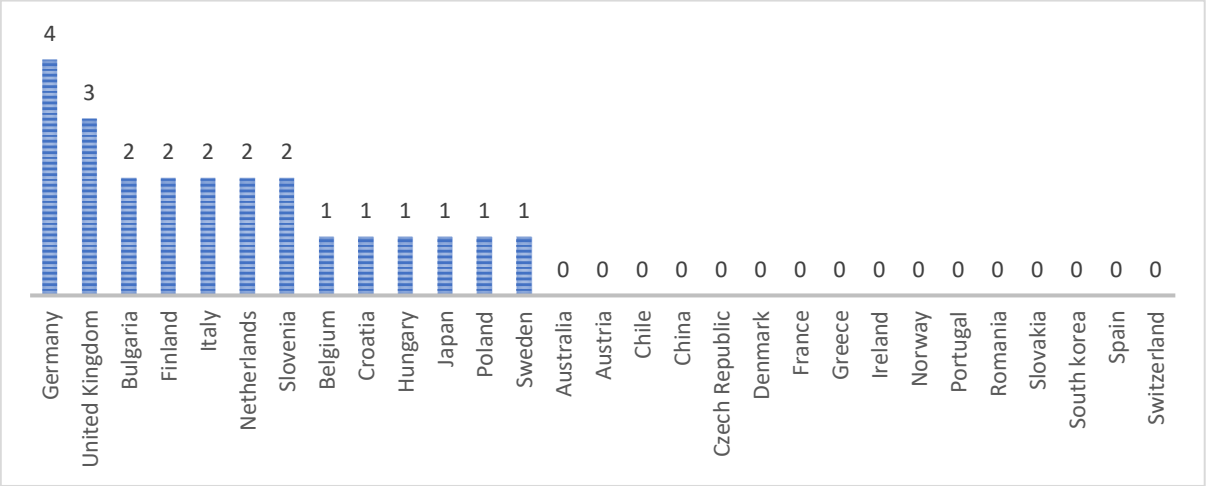
Stationary power chapter questions (selection)
Is there a purchase (capex) support offered to stationary fuel cell applications?
Are there feed-in tariffs for electricity generated by stationary fuel cell applications?
Are there feed-in premiums for electricity generated by stationary fuel cell applications?
Do quota obligation and certificate schemes exist for electricity generated by stationary fuel cell applications?
Do tax incentives exist that might support the deployment of stationary fuel cell applications?
Are there any other policies (e.g. incentives or obligations) that support or inhibit the replacement of conventional stationary power applications with stationary fuel cells?

The questionnaire sought to answer whether the policies are in place, their economic value (in EUR or as % of the investment or tax due), which applications they apply to (CHP, non-CHP, gensets), and any other relevant details about the policy.

The chapter also explores whether similar support mechanisms are available for conventional stationary power application.

Policy support for stationary power is less common compared to FCEV subsidies. Only ***13 out of the 29 countries*** *included in the report have at least one policy in place.*[15] *The* ***leaders are Germany with four different policies***, ***United Kingdom with three*** *followed by Bulgaria, Finland, Italy, Netherlands, and Slovenia with two policies in place each.*

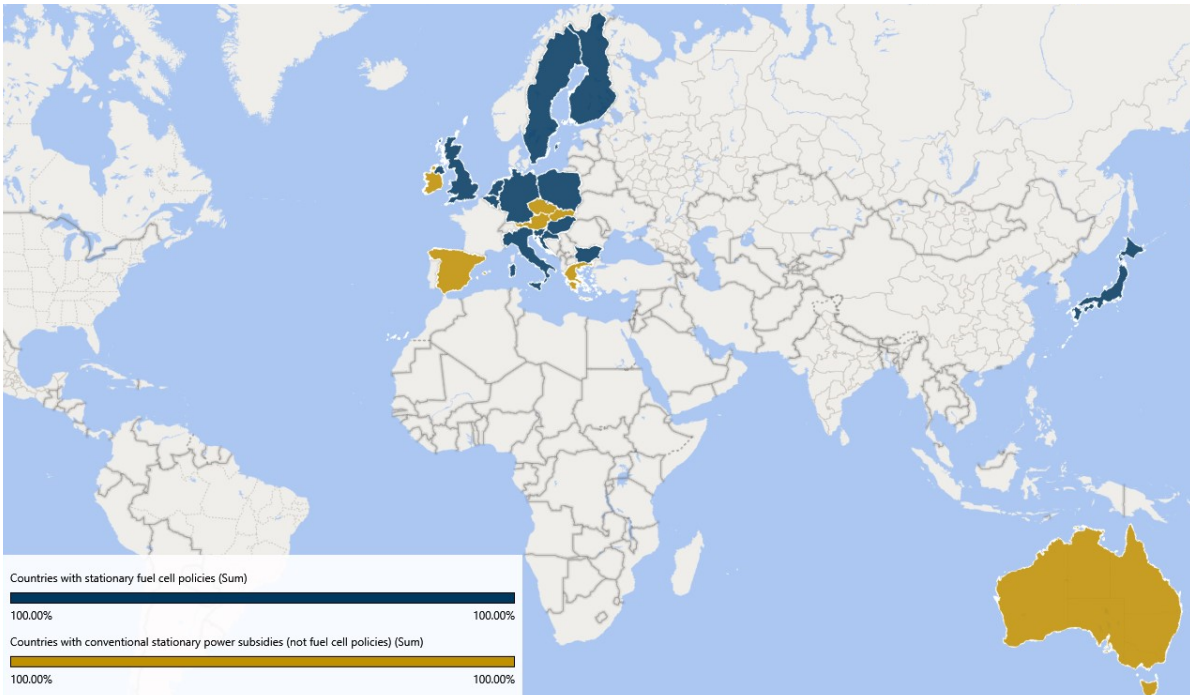
Figure 9: Number of stationary fuel cell policies adopted by country



As evidenced by Figure 9, there is no clear geographical distinction that would help explain the number of adopted policies in the surveyed countries. Figure 10 shows ***7 countries,*** *in yellow,* ***with subsidies for conventional stationary power applications*** *that lack stationary fuel cell subsidies.*

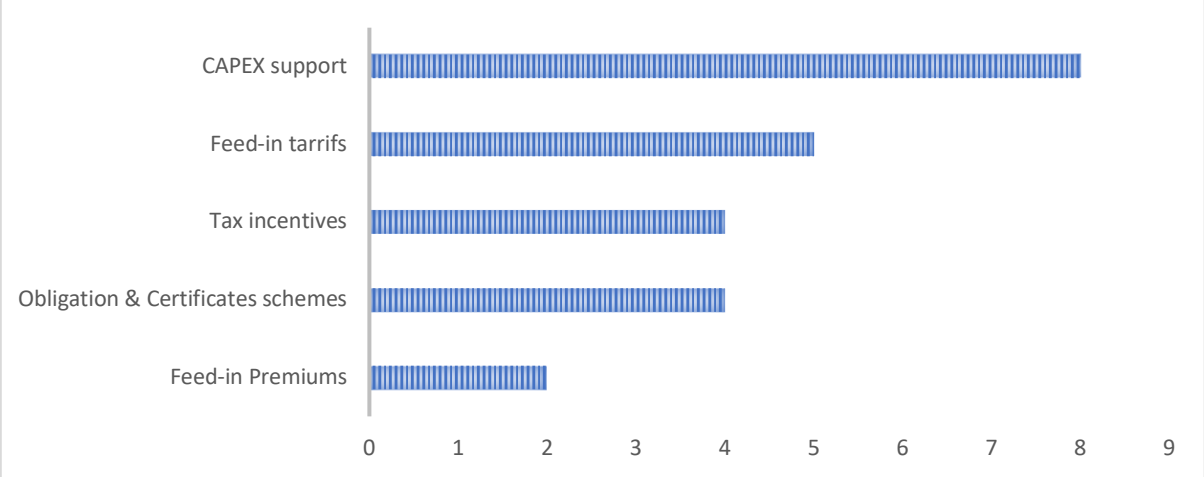
[15] For EU/EEA/UK, it is 12 out of 24 countries.

Figure 10: Geographical coverage of stationary fuel cell and conventional stationary power subsidies



According to Figure 11, the ***most common*** *stationary power policy is* ***capex support that is available in eight countries*** *followed by feed-in tariffs in five countries and tax incentives in four countries.*

Figure 11: Number of countries that adopted one of the six measured stationary power policies



Capex subsidies are some of the most common and well-known policy instruments. They decrease the necessary capital investment and shrink or eliminate the difference between the established and emerging technology.

Eight countries out of the 29 *that are a part of this report currently have* ***capex subsidies for stationary fuel cell power applications****. These include Belgium, Bulgaria, Finland, Germany, Italy, Japan, Netherlands, and United Kingdom. Out of those 29,* ***six have capex support policies for conventional stationary power technologies, but not fuel cell technologies****. These include Austria, Greece, Ireland, Poland, Slovakia, and Slovenia.*

The most common applications for stationary power subsidies include ***combined heat and power in eight countries, other non-CHP stationary power applications in four countries (Bulgaria, Finland, Netherlands, and the United Kingdom), and genset capex subsidies only in the Netherlands.***

3.5. Hydrogen as Fuel and Hydrogen Refuelling Infrastructure

The hydrogen as fuel and hydrogen refuelling infrastructure chapter covers various policy instruments used to promote the build-up of refuelling infrastructure and the use of hydrogen as a fuel.

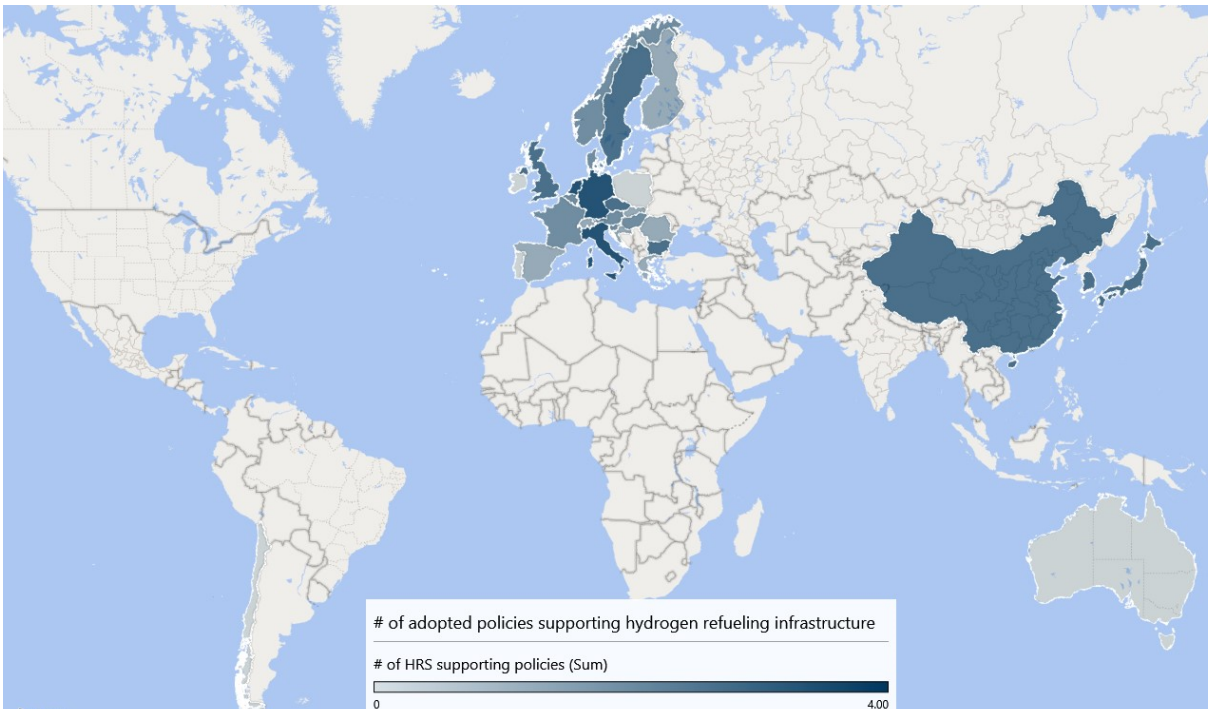
Table 4: Main questions answered in the hydrogen as fuel and hydrogen refuelling infrastructure chapter

Hydrogen as fuel and hydrogen refuelling infrastructure chapter questions (selection)
Is there any capex support offered for HRSs in your country?
Is H2 used as fuel taxed in your country?
Are there any mandates / obligations in place requiring the construction of HRSs?
Are there clear rules or guidelines in place that cover permitting of HRS?
Are there any other policies (e.g. incentives or obligations) that support or inhibit the development of HRS in your country?

The questionnaire sought to answer whether the policies are in place, their economic value and any other relevant details about the policy.

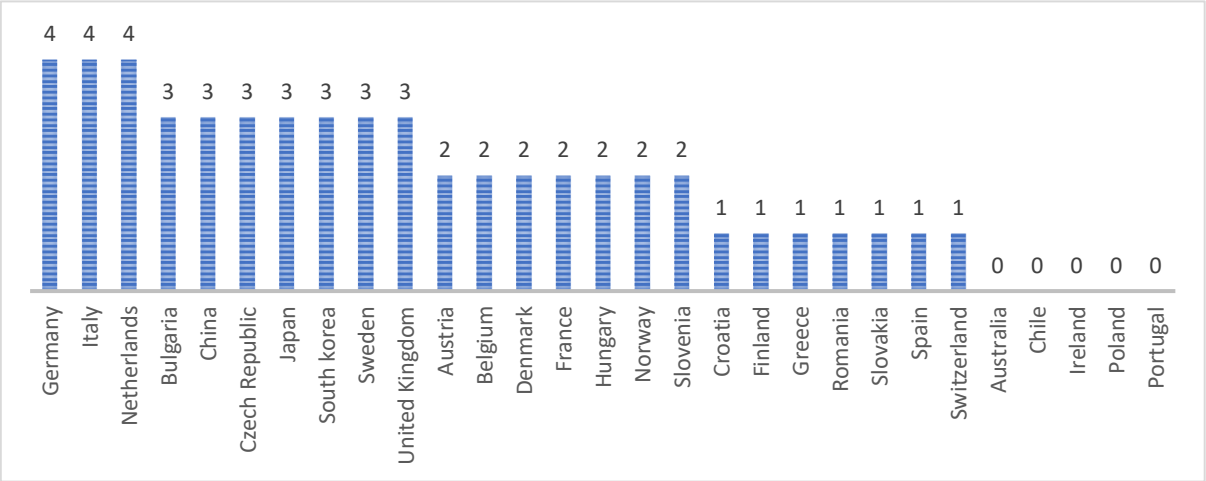
Figure 12 and Figure 13 provide an overview of countries with the most and least ambitious refuelling support policies with ***Germany, Netherlands, and Italy*** *having* ***adopted four different policies****. These are* ***capex support, mandates, permitting rules, and other policies****.*

Figure 12: Geographical coverage and intensity of subsidies for hydrogen refuelling infrastructure



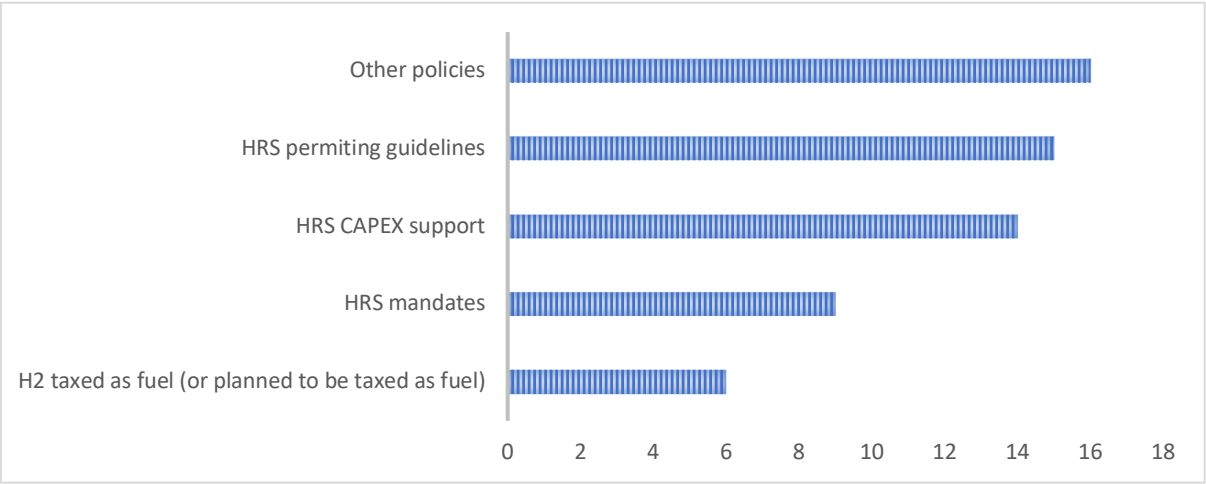
Seven countries have at least three policies in place *including Bulgaria, China, Czech Republic, Japan, South Korea, Sweden, and the United Kingdom.*

Figure 13: Number of hydrogen refuelling infrastructure policies adopted by country



*The **most common refuelling infrastructure policies** include **permitting guidelines in 15 countries, capex support in 14 countries**, and other types of supporting policies in 16 countries.*[16]

Figure 14: Number of countries that have adopted one of the five measured hydrogen as a fuel and refuelling infrastructure policies



*Only **three countries tax hydrogen as fuel** (Hungary, Poland, and Slovenia) and **three countries are planning to do so** (Bulgaria, France, and the United Kingdom). Hungary taxes hydrogen fuel as natural gas while Poland taxes it at 0.04 EUR/kg. Bulgaria, France, and the United Kingdom are planning to introduce hydrogen fuel taxes in the mid-to-long term. This is the least common policy in this category.*

*The **other policies provided by survey respondents cover a wide range of government and industry initiatives.** In addition to capex support, Bulgaria provides grants from the Ministry of Environment for development of HRS infrastructure. In Germany, companies created an industry initiative, H2 MOBILITY, whose primary task is the establishment of a nationwide infrastructure for hydrogen mobility. In the Czech Republic, the new revision of the National Action Plan for Clean Mobility is expected to recommend allocation of further funds to support HRS development. Currently, the Swedish government policy requires fuel stations that sell over 1000 m^3 of petrol or diesel to provide at least one alternative fuel.*

[16] Permitting guidelines are present in 13, capex support in 11, and other policies in 14 out of the 24 EU/EEA/UK countries measured in this report.

This requirement is currently most commonly satisfied with E85, but could also incentivize HRS deployment in the future.

3.6. Hydrogen and the Gas Grid

The injection of hydrogen from renewable sources in the natural gas network could enhance the transport and storage capacities of the existing gas infrastructure for indirect electricity transport, energy storage, and meeting decarbonization targets. This chapter covers policies that may support or prevent the substitution of natural gas by hydrogen.

Table 6: Main questions answered in the hydrogen and the gas grid chapter

Hydrogen and the gas grid chapter questions (selection)
Is there any feed-in tariff for hydrogen when injected into the Gas Grid?
Is there a feed-in premium for hydrogen when injected into the Gas Grid?*
Is any quota system in place for renewable content of the gas mix in the gas grid?
Is there any capex subsidy for renewable/low-carbon hydrogen production plants when the produced hydrogen is subsequently injected into the gas grid?
Is there any exemption from or reduction of certain electricity price components for the electricity used for production of renewable/low-carbon hydrogen when the produced hydrogen is subsequently injected into the gas grid?
In your country, would renewable/low-carbon hydrogen production plants be able to access electricity at or below wholesale market price?
Are there any exemptions from or reduction of gas network fees and tariffs?
Is there any policy on the allocation of gas grid connection costs between network operator and H2 production plant operator
Are there any capex subsidies offered for re-electrification of hydrogen (capable of burning high concentration of H2)?
Are there other incentives or support schemes that incentivize the introduction of hydrogen into the gas grid?
Is there any capex subsidy for biogas plants when the produced biogas is subsequently injected into the gas grid?
Is there a legal hydrogen concentration limit into the gas grid?

Most policies supporting integration of hydrogen into the gas grid are significantly less prevalent than policies in other sectors, such as transport.

Six countries (Denmark, France, Italy, Netherlands, Sweden, UK) currently provide tariffs or premiums for injection of biogas or synthetic methane into the gas grid, providing an opportunity for hydrogen to be included.

However, only the Netherlands and its new Stimulering Duurzame Energietransitie (SDE++) policy allows hydrogen projects to apply for feed-in premiums for producing hydrogen from electrolysis. The Netherlands's SDE++ no longer judges technologies based on generated renewable energy, but rather on the cost of avoided ton of CO2. All technologies will compete with each other for the maximum claimable subsidy of 300 EUR per ton of avoided CO2. Technologies with a higher subsidy intensity can apply for the SDE++ but the awarded amount might not compensate for the entire unprofitable part of the projects. It is unclear whether any hydrogen projects will be able to clear the 300 EUR per ton of avoided CO2 level. The Netherlands also plans two other subsidy schemes applicable for hydrogen, DEI+ (Energy Innovation Demonstration Scheme) for demonstration projects and a scaling up scheme whose aim is to accelerate cost reductions.

In terms of capex subsidies, only ***Austria, Australia, and Finland*** *currently offer* ***capex subsidies for renewable or low-carbon hydrogen production plants that will inject hydrogen into the gas grid.*** *Bulgaria, Finland, and Germany provide capex subsidies for re-electrification of hydrogen.*

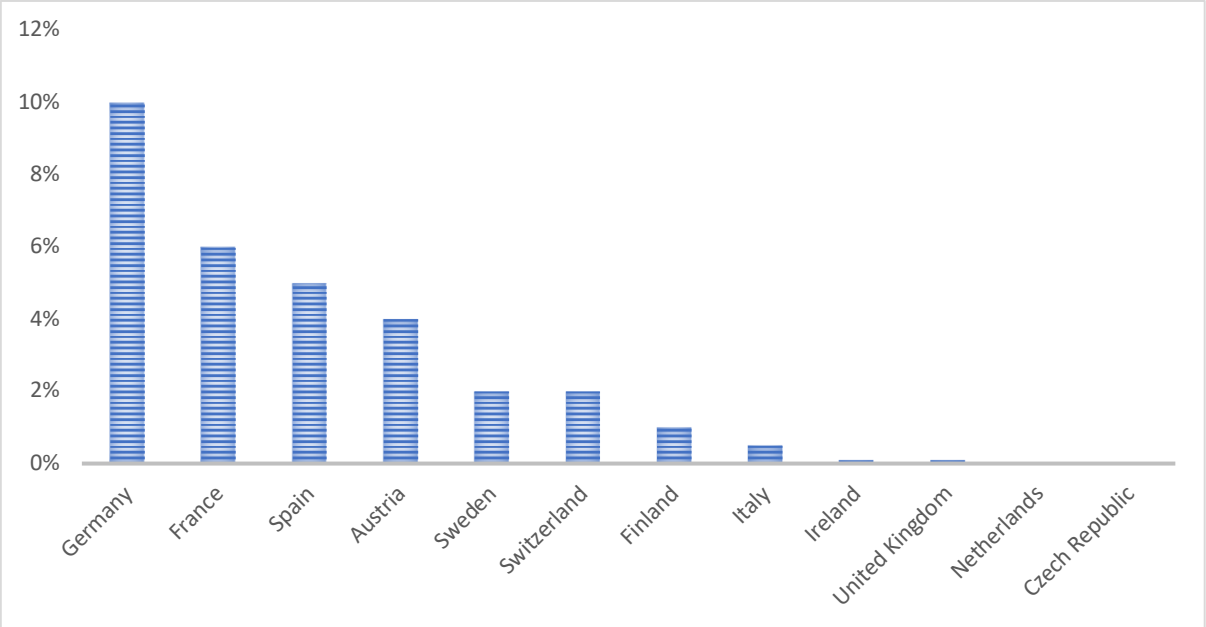
13 countries allow hydrogen producers that will inject hydrogen into the gas grid to access electricity at or below the wholesale market price**. These include Austria, Bulgaria, Chile, China, Denmark, France, Netherlands, Norway, Poland, Slovenia, Spain, Sweden, and United Kingdom. In this category, **Sweden is the only country exempting hydrogen producers that inject hydrogen into the gas grid from electricity tax.

France and Germany provide exemptions or reductions from gas network fees and tariffs with Germany treating hydrogen similarly to biogas.

*Out of the 29 countries, **Denmark, Germany, and the Netherlands** are the only three countries with a **specific policy on the allocation of gas grid connection costs** between network operator and H2 production plant operator. In Germany, the connection cost split is 75% by the network operator and 25% by the connecting party with specific limits and details for connections of 10 km.*

*In terms of non-financial policies, the most common policy is a **legal hydrogen concentration limit in the gas grid**. Countries' limits **range from 0% in Czech Republic, 0.1% in the United Kingdom to 5% in Spain, and 10% in Germany.***

Figure 15: Overview of countries with legal limits of hydrogen concentration in their gas grids[17]



*Another supporting policy is **guarantees of origin** (GoO) for renewable hydrogen in Flanders **Belgium, Bulgaria, France, and the United Kingdom**. Similar to GoO in renewable electricity production, they provide potential buyers with certainty that the hydrogen was produced from renewable sources.*
*As of April 2020, **no country** of 29 surveyed currently has a **legal quota for renewable hydrogen in its gas mix** although some countries like Italy count on renewable hydrogen and assume a certain level of its concentration in their National Energy and Climate Plans.*

3.7. Hydrogen in Industry

Even though hydrogen has been used in the industry for decades, it is only at the beginning of its industrial decarbonization journey. This chapter of the Observatory explores policies supporting increased usage of clean hydrogen in industry.

[17] Non-graphically represented values include Ireland (0.1%), United Kingdom (0.1%), Netherlands (TSO 0.02%, DSO 0.5%), and Czech Republic (0%).

Table 7: Main questions answered in the hydrogen in the industry chapter

Hydrogen in the industry chapter questions (selection)
Are there any capex subsidies for renewable/low-carbon hydrogen production plants used in industry and aimed at decarbonizing / reducing emissions for industry?
Is there any exemption from or reduction of certain electricity price components for the electricity used for renewable/low-carbon hydrogen production for industrial use?
Is there any national funding for low-carbon demonstration projects in industry which involve the use of renewable or low carbon hydrogen?

The questionnaire sought to answer whether the policies are in place, their economic value, and any other relevant details about the policy.

The most common policy are ***low-carbon hydrogen demonstration subsidies****. These exist in* ***13*** *of the 29 surveyed countries and provide funding for hydrogen demonstration projects.*[18] *Countries with relevant support include Australia, Austria, Bulgaria, Denmark, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland, and the United Kingdom.*

In Bulgaria, these funds can be obtained from various programs with total available funding of 85 million EUR. Denmark's funding focuses on energy storage technologies with approximately 17 million EUR available. ***Finland's*** *includes hydrogen demonstrations under its* ***Energy Aid*** *program providing a wide range of funding to various projects and technologies under specific conditions.* ***The Netherlands dedicated 86 million EUR*** *to demonstration projects under* ***Demonstration Energy- and Climate Innovation 2020 policy****. In the* ***United Kingdom****, grant funding is offered under the Industrial Energy Transformation Fund (IETF) with £30 million in 2020 and* ***£285 million during 2021 - 2024****. Additional grant funding for hydrogen is also available under an Industrial Cluster Mission fund aimed at establishing at least one low-carbon cluster by 2030 and a net-zero carbon industrial cluster by 2040.*

Capex subsidies *for renewable/low carbon non-demonstration hydrogen production projects used in industry are in effect in* ***six countries Austria, Belgium, Bulgaria, Finland, Germany, and Netherlands.*** *Austria provides up to 1.5 million EUR in capex costs through KPC (Kommunalkredit Public Consulting) that has the possibility to fund up to 30% of the environmentally relevant additional capex costs of demonstration and innovation projects.* ***The Flemish government in Belgium covers 20 to 40% of the involved capital expenditure*** *with a maximum of 1 million EUR through its Ecology bonus Flanders program. This is a financial subsidy for SMEs and large companies to encourage them to make their processes more environmentally friendly and energy efficient. Similarly, to subsidies for demonstration projects, Bulgaria's various operational programs can also be used for capex subsidies for specific renewable hydrogen projects. Finland's Energy Aid program provides up to 40% of the initial investment to new technologies and demonstration projects that achieve reduction of greenhouse gas emissions and/or energy savings. The* ***Netherlands's Energy Investment Allowance provides tax deductions up to 45% of the investment*** *under certain conditions.*

Another means of supporting the use of hydrogen in the industry is a ***reduction or exemption from specific electricity price components when producing hydrogen destined for industrial consumption*** *that is applicable in five countries. Bulgaria provides discounts to the electricity price generated from renewable sources in general without specifying hydrogen use. Germany provides reduction of the Renewable Energy (EEG) levies. French, Norwegian, and Swedish companies can obtain an exemption (FR) or a reduction (NO, SE) from the electricity tax. In Sweden's case, the regulation specifies the hydrogen has to be produced by electrolysis.*

[18] 12 out of 24 for EU/EEA/UK countries.

3.8. Hydrogen Roadmaps and Strategies

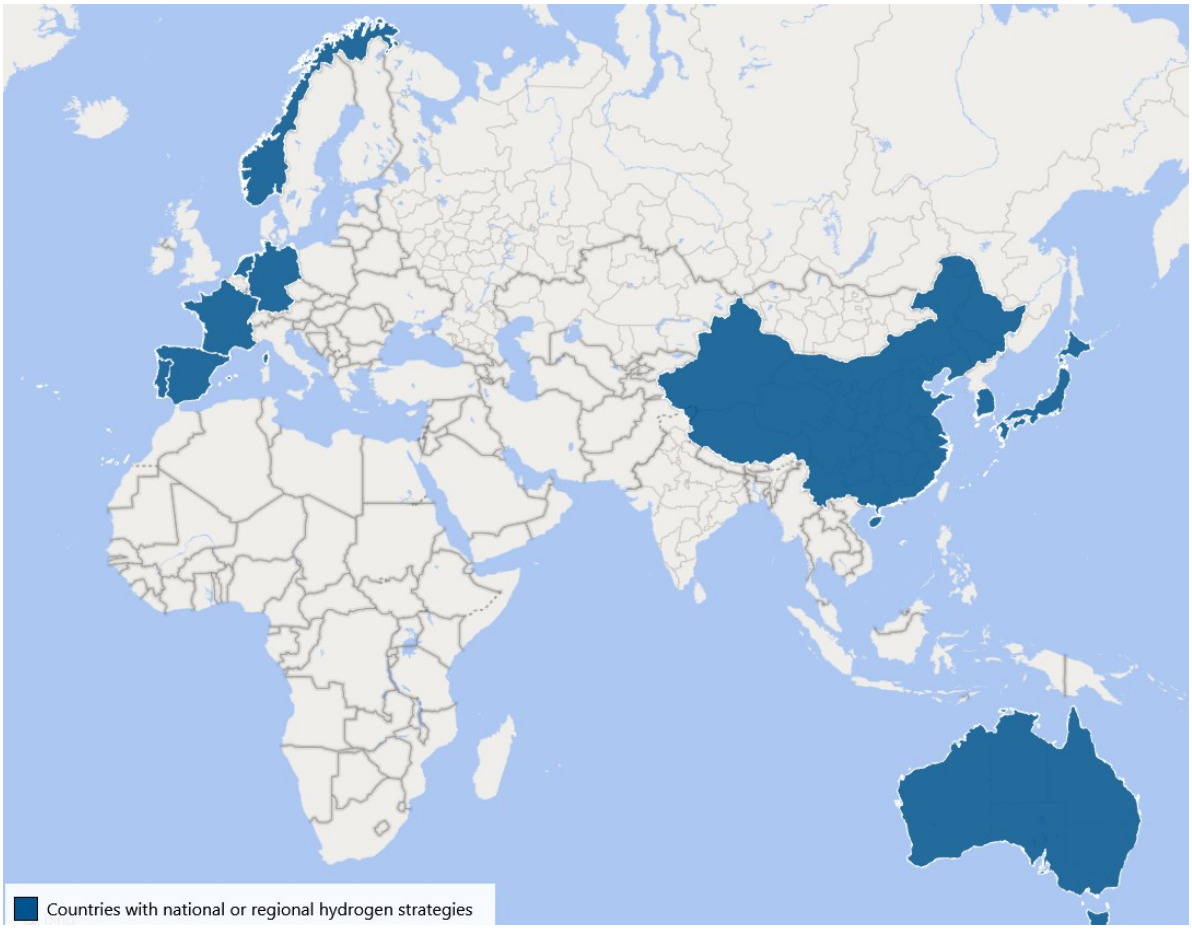
Hydrogen roadmaps and strategies *are relatively commonplace among the surveyed countries with* ***13 out of 29*** *indicating that their country has some sort of hydrogen strategy.* ***10 countries****, displayed in Figure 16, have individual* ***national or regional hydrogen roadmaps or strategies.***[19]

Australia's National Hydrogen Strategy specifies Australia's potential through multiple scenarios, presents benefits of developing hydrogen in the various sectors, and identifies means of developing a hydrogen economy. Germany's strategy called Government Program Hydrogen and Fuel Cell Technology 2016-2026 - from Market Preparation to Competitive Products is innovation driven and is a part of strategies under Innovations for Energy Transition research program of the Federal Government. The new Dutch Government Strategy on Hydrogen outlines the historical role of Netherlands as an energy hub, stresses the future importance of renewable gases in the future energy system with hydrogen at its core, underlines Dutch experience with hydrogen and Europe's first hydrogen valley, and presents policies on scaling up hydrogen technologies and decreasing their costs.

In three countries Bulgaria, Czech Republic, and Greece, hydrogen strategies are a part of a bigger energy, climate, or mobility plans. In Bulgaria, the future of hydrogen is mapped in two documents: National Framework for Alternative Fuels and Infrastructure (NFP) and the Draft version of the Integrated Plan in the Area of Energy and Climate (IPAEC). In Greece, it is a part of the Greek Energy Roadmap 2050.

[19] Out of these 10 countries, EU/EEA/UK countries are France, Germany, Netherlands, Norway, Portugal, and Spain. Others include Australia, China, Japan, South Korea.

Figure 16: Map of countries with national or regional hydrogen strategies



4. Annex

Table 8: List of national contributors for the national policies chapter of the FCH Observatory

EU COUNTRIES	
Austria	Austrian Energy Agency
Belgium	WaterstofNet vzw
Bulgaria	Bulgarian Hydrogen, Fuel Cell and Energy Storage Association
Croatia	University of Split
Cyprus	n/a
Czech Republic	HYTEP
Denmark	BrintBranchen
Estonia	Latvian Hydrogen Association
Finland	VTT Technical Research Centre of Finland LTD
France	AFHYPAC
Germany	German Hydrogen and Fuel Cell Association (DWV)
Greece	National Centre for Scientific Research "Demokritos"
Hungary	Hungarian Hydrogen & Fuel Cell Association
Ireland	Hydrogen Ireland / Sustainable Energy Authority of Ireland
Italy	Italian National Agency for new technologies, energy and sustainable economic development H2 Italy
Latvia	Latvian Hydrogen Association
Lithuania	Latvian Hydrogen Association
Luxembourg	Ministry of Economy
Malta	n/a
Netherlands	NEN
Poland	Institute of Power Engineering
Portugal	Aragon Hydrogen Foundation
Romania	Romanian Association for Hydrogen Energy
Slovakia	Slovak National Association
Slovenia	Energy Agency of Savinjska, Šaleška and Koroška region
Spain	Aragon Hydrogen Foundation
Sweden	Hydrogen Sweden
ASSOCIATED COUNTIRES	
Norway	Norwegian Hydrogen Forum
Switzerland	Swiss Federal Office of Energy
Non-EU/EEA COUNTRIES	
Australia	Hydrogen Mobility Australia and the Government of Western Australia
California/United States of America	California Hydrogen Business Council and California Fuel Cell Partnership
Canada	CHFCA-Canadian Hydrogen and Fuel Cell Association
Chile	Hans Kulenkampff, H2 Chile
China	Hack Heyward
Japan	New Energy and Industrial Technology Development Organization and Japan Electrical Manufacturers' Association

Morocco	*Adil GAOUI, AMHID*
South Korea	*H2Korea*
United Kingdom	*UK Hydrogen and Fuel Cell Association*

Table 9: List of 38 entities covered by the national policies part of the FCH Observatory

EU COUNTRIES
Austria
Belgium
Bulgaria
Croatia
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden
ASSOCIATED COUNTIRES
Norway
Switzerland
Non-EU/EEA COUNTRIES
Australia
California/United States of America
Canada
Chile
China
Japan

Morocco
South Korea
United Kingdom

Table 10: List of 29 entities used for producing this report

EU COUNTRIES
Austria
Belgium
Bulgaria
Croatia
Czech Republic
Denmark
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Japan
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden
ASSOCIATED COUNTIRES
Switzerland
Norway
Non-EU/EEA COUNTRIES
Australia
South Korea
China
Chile
United Kingdom