Green hydrogen contracting - policy and regulatory developments

1. Introduction

Green hydrogen will play an important role in global efforts to decarbonize carbon intensive sectors (such as transport, production and manufacturing) and the global ambition to achieve net zero by 2050.

According to the International Energy Agency, if the world is to succeed in limiting the rise in global temperatures to 1.5 degrees Celsius by 2100, it will require a complete transformation of how we produce, transport and consume energy.[1] This will require a concerted effort by all countries to transition away from activities which produce greenhouse gasses. Individual countries' ability to do so will depend on a number of factors including access to funding, the technology which is available in each country, existing infrastructure, and access to renewable sources of electricity.

To create an environment which is conducive to positive change, governments must establish legal frameworks that attract investment and promote development. This will require the formulation of supportive policies and laws that create certainty and predictability. These policies and laws will form the legal basis for any contractual arrangements between governments in countries hosting green hydrogen projects and project developers.

This brief considers the key characteristics of good practice legal regimes to support governments that wish to formulate policies or establish legal frameworks to regulate the production, marketing, and distribution of green hydrogen. It comprises three parts.

First, by way of introduction, it provides **a high-level summary of the status of green hydrogen policies across the world**. Following the brief analysis, this section then identifies the international good practice characteristics decision makers may consider in designing green hydrogen policies.

This preliminary set of guidance from the initiative on *Green Hydrogen Contracting – for People and Planet* is aimed to support governments, communities and companies. It is under development and is currently being shared with stakeholders for consultation. The guidance has been developed by a working group consisting of governments, law firms, companies and civil society groups. For further information about the initiative and to access the set of guidance on green hydrogen contracting, visit gh2.org/green-hydrogen-contracting**.** GH2 welcomes comments and feedback on the guidance to be sent to Ines Marques (ines.marques@gh2.org).

[1] https://www.iea.org/reports/net-zero-by-2050

The second section of the paper considers **international good practice characteristics of legal frameworks**. Currently, only a limited number of countries and regions have adopted laws to regulate the production of hydrogen. Often, these frameworks do not specifically address the production of green hydrogen. In light of this, this paper does not consider the approach followed by the different jurisdictions. Instead, it focusses on the *general characteristics* of good-practice legal regimes. Owing to the universal nature of the characteristics, it is recommended that the governments use the general characteristics as guidelines in preparing domestic green hydrogen laws and regulations.

To further support governments, this section of the paper also identifies the key parts of the green hydrogen value chain which ought to be regulated under the laws and regulations.

Finally, the annex to the paper provides **summaries of the green hydrogen policies which specific regions and countries have developed** and, where relevant, the laws and regulations which they have adopted and published.

Part one: Introduction and context setting

While more than 30 countries now have some form of hydrogen or policy in place, few countries have a coherent legal and fiscal framework which regulates the production of hydrogen, including green hydrogen. Salient examples these jurisdictions include France and Germany.

Because the regulatory regimes which concern the production, distribution, and marketing of green hydrogen are generally in their formative stages, lawmakers currently have a unique opportunity to create legal frameworks which follow international good practice. This includes incorporating regulatory principles and imposing standards that can contribute to a common basis for the effective and efficient development of hydrogen as a new major global energy carrier. Where countries already have policies and laws in place, the increasing global focus on green hydrogen could serve as an incentive to reform their laws to better accord with international good practice.

As discussed in greater detail under part two of the brief, to enhance the investment attractiveness of a country's green hydrogen sector the government would need to **formulate a clear policy and create a regulatory framework which promotes predictability and certainty.** Because the green hydrogen sector comprises various component, including the production of renewable energy, the production of hydrogen, the transport and distribution of hydrogen, and the consumption of hydrogen, **governments will need to ensure that each step in the green hydrogen value chain is suitably regulated.**

The nature and extent to which the different stages of the green hydrogen value chain must be regulated will differ from one jurisdiction to the next. This is because parts of the value chain will already be considered under existing policies (such as a country's renewable energy strategy) or regulated under existing laws (existing gas and power laws). The required approach is therefore a question of fact.

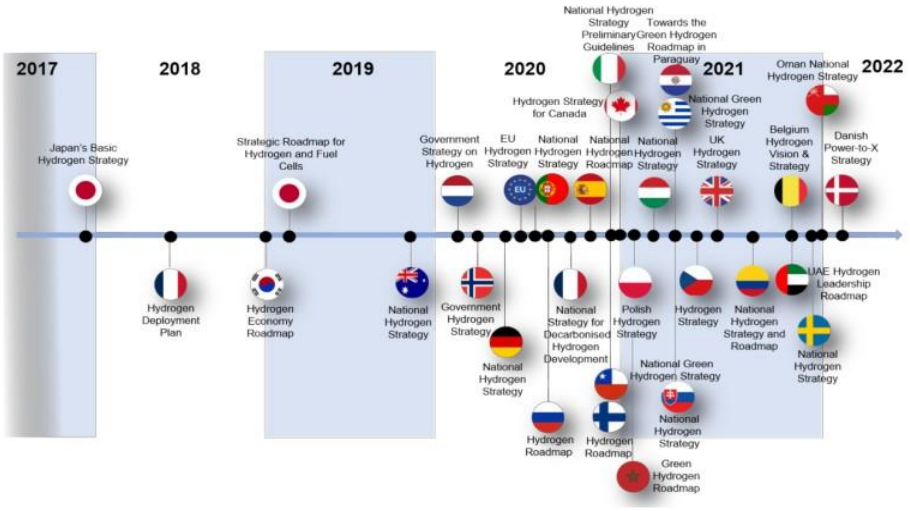
It is anticipated that developing and emerging economies will generally focus on preparing legislation to regulate the production of green hydrogen. Once the hydrogen is produced, parts of the production may be exported to more developed hydrogen markets.

More developed countries and regions may seek to regulate the production as well as the marketing, distribution, and sale of green hydrogen. Under these circumstances, the regulators would need to consider how and to what extent it is necessary to regulate the different elements of the green hydrogen value chain.

Generally, the different branches of government will be responsible for different steps in the law reform process. Typically, the executive branch of government publishes a green hydrogen policy. Second, to give effect to the policy, the legislative branch of government promulgates a law (or laws) to create the legal framework which will regulate the production, marketing, distribution and sale of green hydrogen. Finally, the executive branch of government will implement the new law(s). Subject to the powers which the law(s) vest(s) in the executive branch of government, the different government ministries may be required to publish regulations, issue permits/licences/approvals and guidelines, and conclude contracts with renewable power and green hydrogen producers. These secondary legal instruments would further regulate specific parts of the green hydrogen value chain.

2. A brief overview of international developments

According to publicly available information, at least thirty countries have or are developing hydrogen policies.



Source: Various sources; data compiled by Goldman Sachs Global Investment Research

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Many of the national policies are formulated along general lines and often lack specific strategies and clear targets for the production of hydrogen and decarbonization of other sectors.

The approaches followed by China, Chile, Denmark, France, Germany, India, South Africa, Namibia, and Spain appear to be exceptions to the rule because these countries have formulated ambitious strategies. Many of these strategies must however still be incorporated into national legislation. The approaches adopted by these jurisdictions are summarized in the annex to this paper.

Countries' ambition to decarbonize the energy sectors are affected by several drivers. Important examples of key drivers include the prevailing geopolitical circumstances in the country and the region, domestic economic and development policies, energy policies, the availability of different sources of energy, existing levels of carbon emissions, nationally determined contributions under the Paris Agreement, environmental factors (including biodiversity), and the availability of offshore production areas.

A specific country's energy objectives as such are often the result of other pre-existing national policy objectives and may be defined to a variable degree in government and other public documents. Domestic energy policies may be influenced by the country's:

- Energy transition policy;
- Industrial policy;
- National energy supply policy;

- National revenue and budget policy;
- National financial support capacity;
- Relevant infrastructure development policy;
- Electric power capacity policy;
- Regulatory mechanisms (legislation, concession, contract);
- Parallels and differences to extractive industries regulation (oil, gas and mining); and
- Parallels and differences to regulation of other ("ordinary") industries.

The approach adopted under a country's green hydrogen policy may accordingly be the product of several of these factors. However, a lack of a coherent green hydrogen policy may lead to poor regulation and implementation. This is an important reason for the recent international increase of domestic green hydrogen policies.

At a regional level, the European Green Deal (approved in 2020) is a useful example of a set of policy initiatives which seek to support the EU's transition to no net emissions of greenhouse gases by 2050. Hydrogen is expected to play an important role in achieving the EU objectives to reduce greenhouse gas emissions by a minimum of 55% by 2030 and to reach net zero emissions in the following two decades.

The EU's Hydrogen strategy for a climate-neutral Europe stipulates the region's ambitious targets for the production of hydrogen. This includes increasing member states' hydrogen production capacity and stipulates specific targets, for example the undertaking to install at least 6 GW of renewable hydrogen electrolysers in the EU by 2024 and 40 GW of renewable hydrogen electrolysers by 2030.

To some extent, the viability of the EU's green hydrogen strategy is contingent on the underlying economic support schemes. The main legislative measures in this regard include the EU Clean Energy Package from 2019, the Fit for 55 Package, and the EU Commission's proposed Hydrogen and Decarbonisation Package.

3. Guidelines for general hydrogen policies

A domestic or regional green hydrogen policy would follow international best practice if it:

- Clearly sets out the government's (or region's) strategies, political targets, and specific legal undertakings (including proposed time limits).
- Identifies existing regulatory uncertainties and sets out the mechanisms which the government will implement to address these concerns.
- Indicates the country's (or region's) market creation objectives. These objectives should:

- demonstrate the viability of the proposed green hydrogen sector;
- identify industries that will be prioritized to take up green hydrogen to decarbonise its processes and ideally set use or impact targets; and
- identify the responsibly which will be assigned to the different public and private sector stakeholders.

- Promotes a transparent market design which grant third parties (including foreign investors) access to participate in the sector.
- Stipulates predictable tariffs.
- Acknowledges that subject matter specific policies may be required for each part of the green hydrogen value chain. This includes policies on:
  - access to and the use of land;
  - access to and the use of electricity generated by renewable energy sources;
  - access to and the use of water; and
  - the production, storage, distribution, and use of green hydrogen.
- Stipulates how the government(s) intend(s) to regulate the different parts of the green hydrogen value chain.
- Explains what role (if any) the green hydrogen sector would play in the country's (or region's) carbon dioxide (CO_2) emission trading systems and other CO_2-cost systems. This could include identifying potential incentives to promote the transition to renewable energy sources.
- Confirms the level and type of financial support which the government would provide to participants in the green hydrogen value chain[2] (in particular where the green hydrogen sector and initial projects are still in a formative stage).
- Proposes a pathway which would enable private sector stakeholders to produce green hydrogen at affordable prices for consumers.

It is also critical that the policy should only be formulated **after the government consulted all relevant stakeholders**, including local communities who may be affected by the construction and operation of the renewable energy and green hydrogen production plants.[3] The views of the relevant stakeholders should be reflected in the policy. Where stakeholders identify specific impacts, the policy should indicate how the effects of the negative impacts will be mitigate/addressed and the positive impacts amplified.

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2 Different incentives are considered in the greater detail in the **[Fiscal terms and incentives paper]**.

3 Consultation is considered in greater detail in the **[Local community engagement and management paper].**

4. Key policy measures to support green hydrogen industry

As mentioned above, it is important that governments acknowledge that the green hydrogen value chain comprises various parts. To create an environment which is conducive to investment, the green hydrogen policies of a country or region should consider how and to what extent each part in the value chain should be regulated in the jurisdiction in question.

In light of this, specific policy measures for the different elements in the hydrogen value chain should be defined from the outset. While the subject matter which ought to be addressed under a country's/region's green hydrogen policies may differ from one region to the next (depending on whether a specific topic, such as renewable energy, is already addressed under a separate policy) governments should consider including the following topics in their policies:

a) Sources of renewable energy, generating capacity, and the need for further development

As a premise, a green hydrogen policy must identify the different sources of renewable energy (including hydropower, solar and wind) which would support the development of the green hydrogen sector. Among other things, the policy should confirm what proportion of the electricity which is generated from renewable energy sources would be designated for use by the green hydrogen production plants. If the government determines that the current energy production levels will not be sufficient to sustain the development of the green hydrogen sector, the policy should also stipulate the mechanisms which the government would use to further develop the country's renewable energy generation capacity. To promote compliance with such undertakings, the policy should set out specific targets and time periods for the development of the region's or the country's renewable energy capacity with which the government must comply.

The policy should also consider the existing renewable energy infrastructure, including the renewable energy plants and the electricity distribution and transmission networks.[4] In particular, the policy should identify whether the current infrastructure is able to support the establishment of the green hydrogen sector. If the policy confirms that the current renewable energy infrastructure would not be able to support the establishment of the green hydrogen sector, the policy should set out the process which the government intends to follow to upgrade the power grid. As part of the analysis, the policy should explain why the government's proposed approach will unlock bottlenecks and ensure sufficient power supply to hydrogen production plants.

[4] Infrastructure is considered in greater detail in the **[Infrastructure paper]**

b) Government support[5]

The policy should identify any public finance mechanisms which the government would offer to enable the establishment of the green hydrogen sector. The government financial support may take different forms and will depend on among other things, the host country's financial resources.

Examples of mechanisms which governments could consider include arrangements in respect of long-term power purchase agreements, concessional loans, direct financial support arrangements and other financial incentives where access to adequate financial resources restrict the development of specific green hydrogen projects.

Contracts for difference (CfD) is a further example which governments could consider as CfDs are already used in other energy sectors, such as offshore wind. The contract for difference is entered into between the State and the project parties. The market price risk is shared between the country and the project parties. The parties jointly carry the risk for a market price between a defined "strike price" and a defined positive and negative price range outside this strike price, whereas the State carries the risk for market prices outside this range.

This risk sharing constitutes a hedging instrument for future carbon prices which can allow for financing of the project. It is seen as reasonable that the State carries the risk for market prices outside the defined range as the State is a main interested party and stakeholder in the development of green energies.

Carbon Contracts for Difference (CCfD) may also be a suitable scheme for green hydrogen projects. A CCfD is a government or institution backed contract between two parties whereby the beneficiary is compensated for the difference between the effective CO_2 price and the mitigation costs of the new technology, being the strike price.

c) Production

It goes without saying that the production of green hydrogen will be contingent on a number of underlying drivers, including the existing infrastructure, access to renewable energy, access to water, the ability to market, distribute and sell the hydrogen, and demand by consumers and end users.

The policy should identify the drivers, any capacity constraints, as well as the impact which both variables may have on the country's or region's ability to produce green hydrogen. Consequent upon such an assessment, **the policy should propose appropriate production targets and the timelines within which these will be achieved.**

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[5] Different incentives and fiscal policy responses are considered in the greater detail in the [Fiscal terms and incentives paper].

The policy should also indicate the steps which the government would take to address any capacity constraints to support the development of the green hydrogen sector. This includes proposals to enhance access to renewable energy for project developers.

d) Infrastructure

As mentioned, the status of the renewable energy generation infrastructure may affect a country's or region's ability to establish and develop a green hydrogen sector. In addition to access to renewable energy, the development of the sector will also be affected by downstream infrastructure which would enable or prevent green hydrogen producers from distributing the hydrogen to consumers.

In light of this, the policy should **identify any infrastructure impediments to the establishment of the green hydrogen sector** as well as the **measures which the government will implement to address the issues**. There are several means through which the governments could seek to do so. For example, a government could put green hydrogen projects out to auction by public intermediaries. Private sector parties could in response submit proposals which indicate how they could address the infrastructure deficiencies. The government could also finance infrastructure development, pipelines, and terminals.

e) Consumers and end users

Finally, the policy should **identify the potential consumers or end users of the green hydrogen.**

The potential end user could include specific sectors (such as the aviation and public transport sectors) or specific predetermined offtakers (such as specific mining companies or steel and cement manufacturers). Targets could be included focusing on the amount of green hydrogen to replace fossil-based hydrogen currently used, or the amount of CO2 emissions expected as a result of using green hydrogen.

Governments could also pursue a more general approach and **promote the uptake of green hydrogen by offering fiscal incentives to industries which use green hydrogen** as an energy source to reduce greenhouse gas emissions (e.g. shipping) or favour products which rely on green hydrogen as an energy source during public procurement processes. In the alternative, governments could also reduce fossil fuel subsidies and introduce a carbon tax.

Part two: International good practice characteristics of legal frameworks

5. International good practice

According to the Fraser Institute the investment attractiveness of a jurisdictions is influenced by a number of different parameters. Some of the key parameters which the Fraser Institute conisders in its annual survey of mining companies' opinions of mining jurisdiction are:

1. the characteristics of the legal system - are the legal processes fair, transparent, non-corrupt, timely, efficiently administered;

2. uncertainty concerning the administration, interpretation, or enforcement of existing regulations;

3. the nature and extent of the environmental regulations, stability of these regulations, consistency and timeliness of regulatory process, and are the regulations based on science;

4. are there any regulatory duplications and inconsistencies in the different laws which regulate the operations (includes federal/provincial, federal/state, inter-departmental overlap, and the like);

5. the characterstics of the fiscal regime and the fiscal basket of taxes, including personal, corporate, payroll, capital, and other taxes, and complexity of tax compliance;

6. disputes regarding land claims, security of tenure and property rights;

7. the status of existing infrastructure, such as access to roads and rail networks, power availability, and other distribution networks;

8. socioeconomic agreements and community development requirements, including local content requirements;

9. barriers to trade, such as tariff and non-tariff barriers, restrictions on profit repatriation, currency restrictions, and the import of machinery;

10. political stability; and

11. labour related issues including regulations, employment agreements and labor militancy, industrial action or work disruptions.

While the Fraser Institute survey is designed to capture the opinions of mining executives regarding the level of investment barriers, the parameters which the think tank uses to determine investment attractiveness of a jurisdiction would apply equally to the green hydrogen sector. This is so because mining activities and the production of green hydrogen are affected by the same drivers and subject to similar risks.

Green hydrogen sector is also engaged in the activities which focus on the exploitation of (renewable) natural resources to generate a tradable commodity. The viability of both sectors depends on access to reliable sources of (renewable) energy, water, and labour. The activities conducted in both sectors are subject to strict environmental, social and governance requirements. Both sectors are required to obtain and maintain

a social licence to operate. Finally, both sectors require stable fiscal regimes to run profitable operations.

It is clear from these parameters that **clarity, certainty and predictability are the three fundamental elements of any good practice legal regime.** The investment attractiveness of a legal framework is further enhanced where it establishes **a stable fiscal, trade, environmental, labour, property and socio-economic regime**. Stable in this regard does not mean rigid, but rather predictable.

The Fraser's Institute's parameters accordingly provide a useful starting point to identify the types of provision which regulatory regimes ought (and ought not) to include to create an environment which is conducive to investment.

For example, **the laws must clearly stipulate which permits/licences/approval green hydrogen producers must obtain before they may produce, market, distribute and sell the green hydrogen to end user**. Moreover, the law(s) should clearly stipulate the substantive requirements which the applicants for the permit/licence/approval must satisfy and the process which the applicants must follow when they apply for a new permit/licence/approval or the amendment, renewal or transfer of an existing permit/licence/approval.

The guidance provided under the OECD *Policy Framework For Investment User's Toolkit*[6] is also instructive. Like the Fraser's Institute, the OECD's policy framework offers guidance on the principal elements of good legal frameworks.

According to the OECD, a legal regime follows international best practice if it promotes accountability, transparency, efficiency, effectiveness, responsiveness and the rule of law.

Public governance is important for investors and their businesses. It helps build trust and provides rules and the stability needed for planning investment in the medium and long term. It also facilitates a smooth and productive interaction between the State and the general public. Ultimately, if implemented correctly, there are clear links between good public governance, investment and development.[7]

Predictability, as a premise, is particularly important as it promotes investor confidence. It is established where investors recognise that rules are implemented in a specific way and achieve their objectives in an foreseeable manner.[8]

The quality of public services is a second factor that significantly influences the investment climate. "Quality" in this regard refers to efficiency, effectiveness and responsiveness. Government officials' ability to comply with these principles is shaped

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6 Investment Division of the OECD Directorate for Financial and Enterprise Affairs (2011) *Policy Framework For Investment User's Toolkit* Chapter 10. Public Governance available online at http://www.oecd.org/investment/toolkit/policyareas/publicgovernance/41890394.pdf.

7 OECD *op cit* at 4.

8 *Ibid.*

by regulation within government as well as regulation for private sector providers. It is therefore important that the laws and regulations prescribe mechanisms which promote these principles. From an investor's perspective, regulations should provide proper guidance and benchmarks for action by officials and set out what investors shoul (and should not) expect from government.[9]

Finally, the regulations should limit excessive bureaucratic discretion afforded to regulators and enforcers.[10] By including provisions which limit administrative discretion, governments strengthen the rule of law and remove opportunities for impropriety. [11]

It is, however, equally important that governments refrain from overregulating issues as too many rules may also give rise to uncertainty. This, in turn, may afford government officials greater discretion than envisaged (or intended). The aim should therefore be to create "fewer but better (clearer) rules".[12]

Ultimately, law and related regulations are attractive to investors if they prescribe legal processes that are fair, transparent, remove opportunities for corruption and are timely and efficiently administered. To achieve this, governments should seek to prescribe processes which:

i) Promote certainty by clearly stipulating which rights vest in and obligations are imposed on each stakeholder in the green hydrogen value chain, including the renewable energy producer, the green hydrogen producer, local communities, government officials who wish to participate in the green hydrogen value chain; or

ii) Create legal mechanisms and processes that give rise to predictable outcomes; and

iii) Limit the discretion that is afforded to administrators when they make decisions (such as granting or refusing applications).

6. Elements of the green hydrogen value chain which ought to be regulated.

With these general principles in mind, governments should seek to develop and implement legal frameworks which regualte the following parts of the green hydrogen value chain:

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9 *Ibid.*

10 *Ibid*.

11 By way of example, see Illoong Kwon, Motivation "Discretion, and Corruption" *Journal of Public Administration Research and Theory* Volume 24, Issue 3 (July 2014) 765–794, https://doi.org/10.1093/jopart/mus062; Sean Gailmard "Expertise, Subversion, and Bureaucratic Discretion" *Journal of Law, Economics, & Organisation* Vol. 18 (2002) 536, 537-38. In addition, see V. Tanzi, "Corruption around the World: Causes, Consequences, Scope, and Cures" *IMF Staff*

Papers Vol. 45, No. 4 (December 1998) 10.

12 M De Benedetto *op cit.* at 492.

- Administration: approvals, permitting and licences; application, amendment, transfer and renewal processes; the rights which vest in and obligations that are imposed on competent authorities; concessions and auction processes.

- Property rights: access to the land; use of the land; ownership or lease agreements; exporpriation and compensation; relocation and resettlement of landowners and land users.

- Renewable energy: requirements to qualify as renewable energy suppliers; exclusive use and access to electricity generated from renewable energy; tarrifs; access to and use of infrastructure generation, distribution and transmission infrastructure.

- Water: exclusive access and abstraction rights; water use licences; water use and management plans; recycling; and tarrifs for consumption.

- Environment: environmental impact assessement processes; environmental impact management plans; evironmental permits and approvals including environmental authorisations for listed activities, air quality and emissions licencens, and waste managent licences; management biodiversity; environmental principles (including the precautionary principle); emissions and pollution management plans; waste and pollution management plans; duty of care; rehabilitation and remediation; financial guarantees for remediation; decomissioning and closure.

- Communities: engagement and public participation processes; social impact assessments; socail impact management plans; community development requirements; grievance management processes; local content requirements; protection of significant heritage or religious sites.

- Labour: health and safety standards; basic conditions of employment.

- Infrastucture: access to national distribution networks; licencing and permits; right to use shared infrastructure; transmission and distribution costs.

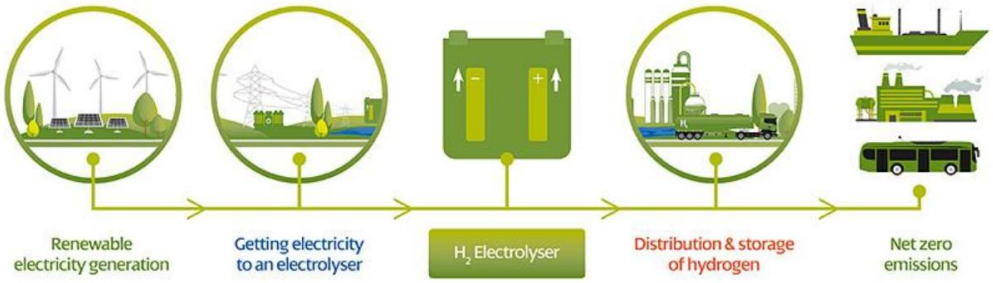
- Fiscal regulatory regime: specific taxes or incentives; export and import duties and concessions.

- Distribution, transporation and storage of hydrogen.

- Green hydrogen market and competition: Basic contractual rights; switching rights and fees; comparison tools; billing; metering; data management.

- Green hydrogen standards: approved sources of renewable energy; acceptable chemcical compound carries; green hydrogen production standards; guarantees of origin; certification; and marketting of green hydrogen

- Reporting and disclosure
- Inspections and monitoring
- Offences and penalties
- Dispute resolution processes (including access to international abritration)



Annex: Hydrogen legal frameworks in the EU as well as select developed and developing countries

1. EU

a) General background to EU energy regulation

The EU liberalised its gas and power market through seven liberalization packages: four packages for the electricity sector and three packages for the gas sector. The fourth package regulating the power market was the Clean energy for all Europeans package which integrated energy and climate regulation to deliver on the EU's Paris Agreement's commitments for reducing greenhouse gas emissions.

The most recent liberalisation package for the gas sector was published on 15 December 2021 under the heading Hydrogen and decarbonised gas market package, comprising a revised Gas Directive and a Regulation. The package applies the different rules adopted on the power and gas market for the EU with a timeline of a more lenient regulation until 2030.

The EU's net-zero ambition is routed in the European Green Deal, published in December 2019. The Fit-for-55 Package published in July 2021, following the EU passing its Climate Law and with this a new 55% emission reduction target for 2030, proposes to amend a number of the Clean Energy Package instruments to bring them in line with the EU's new emission reduction targets. The Fit for 55 Package is one of the most substantial legislative packages proposed for the European energy sector and is currently undergoing the legislative procedure. However, the production and use of Hydrogen continues to be regulated in a disjointed manner under the different instruments of the package.

One of the central proposals under the Fit-for-55 package is the revision of the EU Emissions Trading System (EU ETS) and the Effort Sharing Decision. The proposed changes are likely to further increase the price for EU allowances under the scheme, which may provide a material incentive for the development of the EU's hydrogen market. In particular, it is worth noting that the maritime sector will be included under the ETS and that from 2025 it will not receive any free allocations. It is anticipated this this would have a significant impact on the fueling of the shipping industries and the transport of hydrogen in chemical carrier compound (such as ammonia).

The revision of the State aid for climate, environmental protection and energy 2014-2020 was a core element of the Green Deal. The Commission formally adopted revised Guidelines on State aid for climate, environmental protection and energy (CEEAG) in January 2022.

One issue both regarding state aid and the free movement of hydrogen is the question of what is considered to be green. Green Hydrogen is not defined under the Climate,

Energy and Environmental Aid Guidelines (CEEAG) or the Renewable Energy – Recast to 2030 (RED II). However, green hydrogen falls within the definition of Renewable Fuels of Non-Biological Origin (RFNBOs). RFNBOs will be regulated under two Commission delegated regulations related to the requirement of RED II. One delegated regulation will provide the criteria regarding sustainability and greenhouse gas emissions. The second delegated regulation concerns additionality. However, there is a present concern that these requirements may impede the development of the hydrogen market in Europe.

To address increasing energy prices and reduce the EU's dependence on Russian gas, the Commission published in March 2022 the Joint European Action for more affordable, secure and sustainable energy and the Strategy to REPower EU. The Commission announced that the deployment of an additional 14.4 million tonnes (mt) of renewable hydrogen on top of the 5.6 mt currently foreseen under the Fit-for-55 Package could replace 25-50 bcm of imported gas from Russia per year. This is proposed to be achieved by way of an additional 10 mt of imported hydrogen from diverse sources and additional 5 mt of hydrogen to be produced in Europe, going beyond the targets of the EU's hydrogen strategy and maximizing the domestic production of hydrogen. The Commission will assess state aid notifications for hydrogen projects in this regard as a priority.

The Commission has also expressed a willingness to consider bringing forward the implementation of the Innovation Fund in order to support the transition to electrification and hydrogen including through an EU wide scheme for carbon contracts for difference.

In a separate initiative, already in December 2020, 22 EU Member States signed a manifesto paving the way for a cleaner hydrogen value chain and committing to launch "important projects of common European interest" (IPCEI) in the hydrogen sector. The signatories committed to jointly design, and eventually launch, IPCEIs and agreed that projects should cover the full value chain — from renewable and low-carbon hydrogen production to hydrogen storage, transmission and distribution, and hydrogen application notably in industrial sectors. Many participating countries have completed the national pre-selection of projects that may receive state aid from these countries to be cleared by the European Commission under the IPCEI Communication.

2. Select EU member states

a) *France*

France's ambition is to eliminate greenhouse gas emissions on national soil by 2050. Under its "Net-Zero" goal the country intends to generate net zero greenhouse gas emissions from human activities, with residual gross emissions to be absorbed by carbon sinks - which include forests, grasslands, and later, carbon capture and storage technology.

The primary instruments which establish the French hydrogen regulatory regime may be summarized as follow:

- Law No. 2019-1147 dated 8 November 2019 on Energy and the Climate empowered the French Government to set up a legal framework for hydrogen.
- The Ordinance n°2021-167 dated 17 February 2021 (the Hydrogen Ordinance) grants hydrogen an independent legal status under French Law.
- The Hydrogen Ordinance establishes a detailed legal framework which aims to promote the development of France's hydrogen sector, in particular by distinguishing between three different types of hydrogen: renewable hydrogen, low carbon hydrogen and carbonaceous/fossil hydrogen.
    - To qualify as *renewable hydrogen*, the hydrogen in question must be produced:
        - either by electrolysis using electricity produced by renewable energy sources or by any other technology using exclusively one or more renewable energy sources; and
        - through a process which does not exceed a predetermined greenhouse gas emission threshold.
- The Hydrogen Ordinance also provides:
    - for guarantees of origin and unprecedented guarantees of traceability for renewable and low-carbon hydrogen (also called green tracing guarantee). The green tracing and guarantees of origin will be managed by an independent body which will ensure the issuance, transfer, and cancellation of guarantees;
    - that renewable and low-carbon hydrogen producers are eligible for a support scheme in the form of investment aid ("CAPEX"), operating aid ("OPEX"), or a combination of both.
- The regulatory texts implementing the Hydrogen Ordinance are expected by the end of June 2022. Once published, the texts will set out the public support mechanism for hydrogen, the rules applicable to the guarantees of origin, and the traceability mechanism.
- The hydrogen sector is also regulated under the Climate and Resilience Law (Law No 2021-1104) dated 22 August 2021. Under this law, local authorities are entitled to participate in the development of renewable and low carbon and hydrogen by developing, operating, or delegating the development and operation of hydrogen facilities.
- From a funding perspective:

- the Multiannual Energy Program (Programmation pluriannuelle de l'énergie - PPE), which concerns two periods 2019–2023 and 2024– 2028, provides for an increase in financial support for the French hydrogen sector.
- in September 2020, the French Government unveiled its national hydrogen strategy. The strategy included an undertaking to provide €7.2 billion of public support to support green hydrogen projects for the next 10 years. The undertaking included €2 billion from the "Big Green Recovery Plan", a component of the national "Recovery Plan" (Plan de relance).
- in addition to the support mechanism and local calls for projects, decarbonized hydrogen projects will be funded through the PIA (Investment for the future program) and the Important Projects of Common European Interest (IPCEI).[13]

b) Germany

The German government intends to develop a green hydrogen sector with an electrolysis capacity of 10 GW by 2030.

Currently, a uniform and consistent legal framework for (green) hydrogen does not exist in Germany. There are various regulations contained in different laws without leading to a comprehensive regulatory framework. Particularly, there is no uniform legal definition of Green Hydrogen under German law.

The primary instruments which establish the current German hydrogen regulatory regime may be summarized as follow:

- The German Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz)(EEG), as amended, provides a legal framework for the exemption of green hydrogen from the so-called EEG levy (EEG-Umlage), a German financing model to support the expansion of renewable energies.

- In terms of the framework established under the EEG:
  - hydrogen is classified as "green" based on its manufacturing process.
  - a regulation of the German Government entered into force on 20 July 2021 defines the requirements for hydrogen to be qualified as "green" hydrogen in differentiation to other categories of hydrogen. The requirements provided under the regulation regarding green hydrogen are subject to the state aid approval by the European Commission which is currently still pending. Furthermore, the requirements of this regulation concerning green hydrogen will be amended and adopted accordingly by the German government without

[13] With respect to IPCEI, France expects a notification of four hydrogen projects to the European Commission under the French presidency of the EU, therefore by the end of June 2022, once all the projects and companies involved have been identified.

delay after the European Union has further adopted the requirements for green hydrogen.

  - green hydrogen enjoys certain privileges which are not afforded to other categories of hydrogen (i.e. grey etc.).
  - from 1 January 2022 the payment of the EEG levy shall be reduced to zero for electricity consumed by a green hydrogen production installation for the production of green hydrogen, irrespective of its intended use. However, as stated above, this is subject to the pending state aid approval of the European Commission.

- The Energy Industry Act (Energiewirtschaftsgesetz), as amended, stipulates the legal framework for a pure hydrogen grid infrastructure. However, this regulatory framework mainly applies to hydrogen infrastructure operators who submit themselves to the regulation.
- In addition to the Energy Industry Act, a new regulation entered into force on 1 December 2021 providing a regulatory framework for hydrogen grid operators for the determination of grid charges and the fees for access to hydrogen grids.

i. Spain

The production of green hydrogen in Spain is regulated under a wide range of legal instruments. These include the laws which regulate matters related to chemical and industrial processes, the environment, and the power sector.

In light of this, the Spanish government is currently engaged in a law reform process to simplify the regulatory framework for green hydrogen production. In this regard, the recently approved Royal Decree-Law 6/2022, of 29 March, has established the basic legal framework regulating isolated pipelines exclusively for the supply of hydrogen (and other renewable gases), as well as the direct lines that would allow hydrogen production plants to be linked to the natural gas network (Spanish legal framework allows hydrogen injection in the natural gas network up to 5%).

Given the complex governmental structure of the Kingdom of Spain (with different layers of competent authorities), sponsors of hydrogen projects shall consider national, regional and local regulations applicable to the development of hydrogen, industrial and power facilities.

- The Spanish Government has set ambitious goals as to the implementation of hydrogen projects, including a 4 GW installed capacity of electrolysers from renewable energy sources by 2030. For the purposes of achieving such target, the Spanish State has already approved the Strategic Projects for the Recovery and Economic Transformation (Proyectos Estratégicos para la Recuperación y Transformación Económica - PERTE) of Renewable Energies, Renewable Hydrogen. It will consist in the investment of nearly 500 million euros exclusively allocated to hydrogen developments, including (i) a credit of line of 150 million

euros for pioneering renewable hydrogen projects, with commercial viability, for local production and consumption in sectors that are difficult to decarbonise, such as heavy industry or heavy transport, and (ii) 250 million euros credit line to promote the renewable hydrogen value chain, from components manufacturing to prototypes of new vehicles or electrolyser manufacturing projects to produce renewable hydrogen on a large scale.

- A first Nation-wide consortium (Shyne – Spanish Hydrogen Network) has been launched in January 2022 which includes 33 of the most important players in the Spanish energy market, as well as industrial and transport companies. The consortium is led by incumbent operators such as Repsol, Enagás, Iberia and Navantia and plants to develop projects in a dozen autonomous regions with a combined investment of 3,230 million euros.
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ii. The Netherlands

The Dutch policy for Hydrogen started its second phase in 2022 launching the real start of the National Hydrogen Programme.

Main regulatory elements are:

- According to the ministerial decree on gas quality (Regeling Gaskwaliteit), the Dutch legal framework allows hydrogen injection up to 0.5% in regional gas distribution systems and the Government is also considering the possibility of mandatory injection of green hydrogen (physically or through certificates) to create a demand for green hydrogen.
- The new 2020 and broadened Renewable Energy Production Incentive Scheme (SDE++) targets of a 49% reduction in CO2 emissions in the Netherlands by 2030 (compared to 1990 and 95% by 2050). In this support mechanism, ecological technologies may benefit - through calls for tenders - a subsidy to compensate for the difference between the cost price of the technologies and the market value of the product that the technologies deliver.
- According to the 2019 "National Climate Agreement", the stakeholders have formulated a goal to scale-up electrolysis to 500MW between 2022 and 2025; and 3GW to 4GW between 2026 and 2030. The program for hydrogen is further explained in the national "Energy and Climate Plan 2021-2030".

iii. United States

Preliminarily, unlike many other countries, the U.S. does not have one coherent, binding energy "policy" as such. Rather, in keeping with its system of governmental power shared between the federal government and the fifty states, energy policy in the U.S. is found in different, fragmented policies, statutes and regulations, notwithstanding its periodic passage of federal laws nominally entitled "Energy Policy Act of ### ("EPAct").[14]

[14] *See, e.g.*, R ; Tomain & Cudahy, ENERGY LAW IN A NUTSHELL, West Publishing, 3d ed. (2017), pp. 51-52, 91-99; E. Don Elliott, *Why The United States Does Not Have A Renewable Energy Policy*, Environmental Law Institute (2013), *avail. at* https://www.cov.com/~/media/files/corporate/publications/2013/02/why_the_united_states_does_not_have_a_renewable_energy_policy.pdf.

Laws which encourage the deployment of renewable energy are found most prominently in the federal tax code, and state renewable portfolio standards applicable to electricity sellers. Moreover, in the context of electricity and natural gas, regulatory authority is allocated between federal and state jurisdictions largely in accord with several 1930s statutes, in ways in which the Supreme Court has been asked to sort out in recent years as the energy transition fitfully progresses nationally and among the states. Meanwhile, local authorities typically retain some degree of land use control via zoning or other forms of regulation. Finally, the deeply divided nature of U.S. politics over the past 20+ years, including the periodic passing back and forth of political power between the Democrats and the Republicans in the two houses of Congress as well as the White House, has led to some fairly broad swings in federal approaches to energy policies.

Against this background, in recent years a number of federal and state initiatives in the U.S. have encouraged the increased use of hydrogen as both an energy carrier and end use, found in various aspirational policies as well as laws granting significant new funding. Additionally, the patchwork of federal (and several state) laws and regulations that variously apply (or may apply, given certain ambiguities discussed below) to economic and EHS issues associated with hydrogen are being reassessed and in some cases are the subject of new proposals, as the potential for hydrogen to play a significant role in decarbonization is being more broadly recognized and promoted. The following briefly outlines several key recent developments in each of these areas.

Beginning with the passage of EPAct 1992 and in each of its subsequent iterations, the U.S. has funded various hydrogen research and development ("R&D") programs by the U.S. Department of Energy ("DOE"), which in turn regularly publishes aspirational hydrogen 'strategies,' most recently in 2020, generally summarizing the current state of hydrogen technologies and infrastructure, and DOE's supporting work.[15] One recent effort is DOE's Hydrogen Energy 'Earthshot' initiative, which seeks to coordinate various R&D initiatives to reduce the cost of clean hydrogen to $1 per kilogram in less than a decade.[16]

At the end of 2020 then-President Trump signed into law the Energy Act of 2020 as part of the Consolidated Appropriations Act. In keeping with his administration's preference for keeping fossil fuels strongly in the U.S. energy mix, Section 4007 of the Act required DOE to conduct a study on the benefits of blue hydrogen technology and how that technology can further enhance the deployment and adoption of carbon capture and storage.

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[15] *See, e.g.,* U.S. DOE, *Hydrogen Strategy: Enabling A Low-Carbon Economy* (July, 2020), issued in accord with EPAct 2005, *avail. at* https://www.energy.gov/sites/prod/files/2020/07/f76/USDOE_FE_Hydrogen_Strategy_July2020.pdf; *Department of Energy Hydrogen Program Plan* (2020), https://www.hydrogen.energy.gov/pdfs/hydrogen-program-plan-2020.pdf. *See generally* https://www.hydrogen.energy.gov/roadmaps_vision.html.

[16] https://www.energy.gov/eere/fuelcells/hydrogen-shot.

President Biden took office in early 2021 having run on a platform that promised increased funding for infrastructure and climate change mitigation and adaptation measures, and in November of that year secured passage of the $1.2 trillion Infrastructure Investment and Jobs Act ("IIJA"). The IIJA includes significant funding for several initiatives promoting the development of "clean hydrogen," preliminarily defined as "hydrogen produced with a carbon intensity equal to or less than 2 kilograms of carbon dioxide (CO2)-equivalent produced at the site of production per kilogram of hydrogen produced." Thus the required source of hydrogen can include hydrogen production from renewable, fossil fuel with CCUS, nuclear, and other fuel sources, so long as this carbon intensity standard is met. (Practically, this likely means that hydrogen derived from methane and other fossil fuels need not account for potential upstream production emissions to meet this standard.)

Most significantly, Section 40314 authorizes an $8 billion program over the next four years to support the development of at least four regional clean hydrogen hubs in the U.S., to include network hydrogen producers, storage facilities, industrial and other offtakers, and transport infrastructure. DOE is required to solicit proposals in accord with several criteria:

- One hydrogen hub for each of the following hydrogen feedstocks: fossil fuels, renewables, and nuclear;
- one hydrogen hub for each of the following sectors: power generation, industrial, residential and commercial heating; and transportation;
- The hubs are to be located in different regions of the country, using resources that are abundant in that region, including at least two hubs in regions that produce natural gas; and
- Priority will be given to hubs likely to create skilled training and long term employment opportunities in that region.[17]

The IIJA also authorizes the spending of $1 billion over the next four years to fund a research, demonstration, commercialization and deployment program for green hydrogen electrolyzers, and a $500 million program over this same period to support clean hydrogen manufacturing and recycling programs in aid of improved hydrogen domestic supply chains. The IIJA further includes funds for a number of other hydrogen-related programs on a smaller scale, such as R&D for hydrogen fueling infrastructure and fuel cell technologies. Finally, the IIJA requires that DOE develop (yet

[17] Details of the DOE Solicitation are available here: https://eere-exchange.energy.gov/Default.aspx#FoaId5d96172f-e9b6-48ff-94ac-5579c3531526.

another) national strategy and roadmap to facilitate a clean hydrogen economy in the U.S., to be updated every three years.

Turning to U.S. hydrogen initiatives directly impacting private sector project financing, a bill pending in Congress would grant production tax credits ("PTC") to hydrogen projects, similar to those used to support projects based on other forms of renewable energy. The current iteration of President Biden's proposed "Build Back Better" bill would give anyone producing "clean hydrogen" a PTC of up to $3 a kilogram for the first 10 years in which on hydrogen is produced. (A previous draft had also included an investment tax credit for hydrogen electrolyzers, which could return in a final bill.) To claim the PTC at the full rate, the production process would have to lead to less than 0.45 kilograms of CO2 emissions per kilogram of hydrogen. Smaller levels of support would be given for hydrogen with a higher carbon footprint, i.e. that derived from fossil fuels.

A number of U.S. states have also taken steps to encourage the adoption of various hydrogen-based technologies, often in the context of helping to support hydrogen fueling stations for hydrogen fuel cell vehicles or incentivizing the purchase of hydrogen fuel cell electric vehicles ("FCEVs"). Most prominently, California has subsidized such programs for several decades, and leads the U.S. in FCEVs on the road. The state requires that 40% of all hydrogen sold at state-funded stations be green hydrogen. Apart from the transportation sector, several U.S. states are funding efforts to encourage the introduction of a set percentage of hydrogen into their fuel supply for existing natural gas-fired power plants, and natural gas distribution systems.[18]

Turning from the tools the U.S. is using to encourage hydrogen deployment to those laws which regulate its sale and use, in some key respects hydrogen falls into a grey area, especially as it takes on a new, expanded role as part of decarbonization and energy transition efforts. Other laws, including several which are HSE-oriented, incidentally regulate hydrogen in ways that may benefit from better coordination.

In the U.S., under the 1938 Natural Gas Act ("NGA") the Federal Energy Regulatory Commission ("FERC") regulates the economic terms for the wholesale sale, and interstate transmission (including pipeline siting) of natural gas. The NGA leaves the regulation of rates for retail sales, intrastate transmission, and distribution, and siting, to individual state utility commissions. A broadly similar allocation of federal and state regulatory authorities applies to the sale and transmission of electricity under the 1935 Federal Power Act. Beginning in the late 1970s FERC issued a series of orders under both the NGA and the FPA which generally liberalized the gas and electricity markets under their purview, by (broadly) separating generation and transmission ownership, and ensuring open access to transmission.

[18] *See* Hydrogen Projects in the U.S., Clean Energy Group, https://www.cleanegroup.org/ceg-projects/hydrogen/projects-in-the-us/.

FERC has jurisdiction over hydrogen sales and transmission so long as the hydrogen is blended into natural gas as part of its resale and interstate transmission; however it appears that pure hydrogen does not fall within the purview of the NGA, based on its definition of "natural gas." Moreover, to the extent that the sale of hydrogen is to an ultimate user (i.e. not for "resale"), individual state rate regulation would govern, assuming a state's utility regulation law otherwise applied to it. To date, essentially all of the 1,600 miles of pipelines that carry pure hydrogen in the U.S. are owned by merchant hydrogen producers, who sell hydrogen directly to large hydrogen users such as petroleum refineries and chemical plants. Thus the creation of new, nation-wide large scale hydrogen markets and transportation networks, whether involving sales for resale or to an end customer, may benefit from regulatory revisions at the federal and/or state level, at the least to specifically address hydrogen to remove uncertainty.

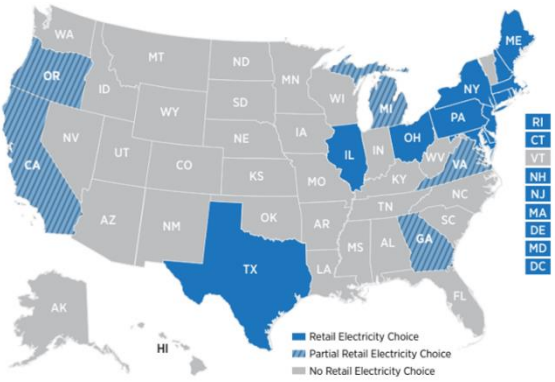

Figure 1. States with retail electricity choice
Source: State public utility commissions (2017)[1]

An Introduction To Retail Electricity Choice In The United States, NREL, https://www.nrel.gov/docs/fy18osti/68993.pdf

The regulatory status of green hydrogen facilities may be further complicated by their need to procure large quantities of renewable electricity for their electrolyzers from grid-connected third parties, i.e. to the extent that their renewable energy source is not entirely 'behind the [green hydrogen project's] meter.' Thirteen U.S. states and the District of Columbia have liberalized their retail electricity markets, allowing consumers to choose their own supplier; the remaining states require all consumers to buy electricity from the incumbent local utility. Thus green hydrogen developers in the majority of U.S. states may need to obtain power from the local utility whose interests may not fully coincide with theirs (although the potential for the parties to find common ground with regard to the potential for grid balancing along with hydrogen production seems apparent).

Finally, a range of HSE laws and regulations applicable to heavy industrial and petrochemical plants generally, and often implemented under a coordinated system of federal and state authorities carried out by respective HSE agencies, will govern green hydrogen projects. Even if hydrogen itself is not currently a regulated substance under a particular law,[19] other substances commonly found as part of hydrogen 'hubs' typically will be, such as ammonia, e-methane, or liquid organic hydrogen carriers. Brief

[19] For example, hydrogen by itself is not covered by the planning and reporting requirements under the Emergency Preparedness and Community Right to Know Act, nor the reporting and response requirements under the Comprehensive Environmental Response, Compensation and Liability Act.

summaries of a few of the key U.S. HSE laws that likely will govern hydrogen projects are included in the Annex. [CAA Risk Management Plan and GHG reporting requirements, OSHA, PHMSA.]

iv. China

[Schjordt / Bird&Bird to include]

v. Chile

[Schjordt / Bird&Bird to include]

vi. Denmark

[Schjordt / Bird&Bird to include]

vii. South Africa

South Africa does not currently have a specific law or regulation which regulates the green hydrogen industry. Instead, several policy papers by different government Departments, feasibility studies and government policy positions offer some guidance on the future of the green hydrogen economy in South Africa.

The following are a few examples:

- In 2007, Cabinet approved the national hydrogen and fuel cells research, development and innovation Strategy (HySA Strategy). The HySA Strategy is the responsibility of the Department of Science and Innovation. The primary aim of the programme is to develop South Africa's knowledge, technological expertise and human resources development in the hydrogen sector.
- During the 2019/20 financial year, the HySA Programme underwent its second five-year review, which recommended the development of an overarching Hydrogen Society Roadmap (HSRM). Cabinet subsequently approved of the HSRM on 14 September 2021.
- The HSRM represents South Africa's roadmap to unlock its green hydrogen economy. The HSRM brings together private and public stakeholders to achieve ambitious targets. One of the primary aims of the HSRM is to establish South Africa as a world-leading export destination for green hydrogen that can be produced at a cost similar, if not equal to the cost of grey hydrogen.
- The Department of Science and Innovation is responsible to implement the HSRM. It must do so in collaboration with several public and private sector stakeholders across the country to develop green hydrogen policy and establish South Africa's green hydrogen sector. The following are examples of current collaboration:

- The Department of Trade, Industry and Competition (DTIC) is developing a National Green Hydrogen Commercialisation Strategy that will provide confidence to investors that South Africa is a destination for investment in the Hydrogen Economy.
- The DTIC has mandated the Industrial Development Corporation (IDC) to actively pursue partnerships with the private sector to create funding opportunities to promote the green hydrogen economy.
- The Deputy Minister in the DTIC confirmed in October 2021, that his department was in the process of reviewing its Critical Infrastructure Program, with a view to assist in alleviating some of the infrastructure costs associated with hydrogen production, fueling and transport facilities.

- South Africa has established a partnership with the United Nation Industrial Development Organisation (UNIDO). The aim of the partnership is to assist South Africa in creating an agile, effective and relevant National Hydrogen Energy Centre that will institutionalise the implementation of the HSRM.
- Finally, of the US$ 8.5 billion secured by South African President Cyril Ramaphosa at COP26, a portion of the funding is earmarked for investment in green hydrogen production.

viii. Namibia

Namibia is aiming to be Africa's green hydrogen hub. There is no specific green hydrogen regulatory framework in Namibia, however the government has indicated that it intends to create a legal framework for green hydrogen due to its incredibly complex and technical nature.

Main regulatory elements are:

- During COP26, the Minister of Energy of Belgium and the Minister of Mine and Energy of Namibia signed a Memorandum of Understanding (MoU) on cooperation in the green hydrogen sector. Belgium intends on importing green hydrogen from Namibia.
- The Namibian Ports Authority (Namport) signed a MoU with the Port of Rotterdam to prepare Namibia to become a green hydrogen export hub for Europe and the rest of the world. This MoU will help Namibia and the Netherlands collaborate and facilitate the forecasted growth and flow of the green hydrogen supply chain from Namibia to Rotterdam.
- In November 2021, Namibia announced that Hyphen Hydrogen Energy (a German consortium) is its preferred bidder for its first large-scale green hydrogen plant in the Tsau //Khaeb National Park, set to commence in 2026. The plant plans to produce 300,000 tonnes of green hydrogen per year by 2030, by converting 5,000 MW of solar and wind power.

- The Namibian government's approach to the generation of the renewable energy whcih is required to create green hydrogen is provided for under Namibia's National Renewable Energy Policy (July 2017) and the National Energy Policy, July 2017.[20] The Renewable Energy Policy specifically focuses on developing Namibia's renewable energy sector indicates how the government intends to regulate the sector.
- The National Energy Policy and the National Renewable Energy Policy jointly set out the manner in which Namibia intends to regulate the upstream and downstream gas sectors.

[20] The National Energy Policy replaces the old White Paper on Energy Policy from 1998, and was created to have a 'future proof' energy policy.