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FRANCE

The H₂ Handbook

Legal, Regulatory, Policy, and Commercial
Issues Impacting the Future of Hydrogen

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CONTENTS

Part I - Strategy for the Development of Decarbonized Hydrogen in France	2
I. Introduction	2
A. What Is Decarbonized Hydrogen?	2
B. Decarbonized Hydrogen and Its Advantages	2
II. What Are the Objectives of the National Hydrogen Strategy?	3
III. Status of the Support for the Development of Hydrogen in France	3
IV. Recent Developments	4
A. The “France 2030” Investment Plan	4
B. Announcement of a New Scheme for Financing Low-Carbon Hydrogen Production	5
V. Calls for Projects in France	5
A. Recently Launched Projects	5
B. Ongoing Projects	6
Part II - French and European Legal Framework	8
I. The French Legal Framework	8
A. The Energy Law	8
B. The Hydrogen Ordinance	8
C. The Climate and Resilience Law	9
D. The Multiannual Energy Program	9
E. A General Order on Hydrogen Fueling Stations	13
II. Hydrogen: A European Challenge	13
A. Political Context: the European Green Deal	13
B. How Can Hydrogen Support Recovery, Growth, and Jobs?	14
C. How Will the Hydrogen Strategy Support Investments in the Hydrogen Economy?	14
D. What European Financial Instruments Can Be Used to Invest in Hydrogen?	14
III. REPowerEU	15
Glossary	17
Authors	19

PART I - STRATEGY FOR THE DEVELOPMENT OF DECARBONIZED HYDROGEN IN FRANCE

I. Introduction

The French government has expressed its intention to decarbonize industry, with an objective to reduce emissions by 81% by 2050 compared to 2015. Decarbonized hydrogen is one of the solutions proposed to reduce carbon dioxide (CO₂) emissions.

France is pursuing its plan to decarbonize industry with the aim to:

- Develop the industrial sector from an ecological, technological, and economic point of view; and
- Reduce emissions while enabling industries to better store energy and promoting the emergence of renewable energies.

A. What Is Decarbonized Hydrogen?

Today, hydrogen is largely produced from fossil fuels (e.g., coal, natural gas, oil) using processes that emit greenhouse gases. It can also be produced by electrolysis of water from decarbonized or renewable electricity. Hydrogen is then called “decarbonized,” or green, when its production does not emit CO₂. Given its low CO₂-emitting electricity mix, France has a number of advantages for producing decarbonized hydrogen.

Hydrogen is already commonly used in the oil industry (refining) and chemical industry (fertilizer production), for a total French consumption of around 900,000 tons per year.

The vast majority of that hydrogen is produced from fossil fuels and generates around 9 million tons of CO₂ per year.

Therefore, the use of green hydrogen will reduce CO₂ emissions into the atmosphere. This will contribute to achieving the objective that has been set in the framework of the national low-carbon strategy for industry: 53 million tons emitted per year in 2030 compared to 80 million tons emitted annually today.

Hydrogen can also be used as an energy carrier for many mobility applications, particularly heavy mobility, such as public passenger and freight transportation, where battery-based solutions are more difficult to implement. It has the advantage of emitting only water, which eliminates emissions of particulate matter, sulfur, and nitrogen oxide and contributes to improving air quality.

B. Decarbonized Hydrogen and Its Advantages

For the French industry’s decarbonization approach, green hydrogen is one of the preferred solutions. Using green hydrogen makes it possible to respond favorably to several problems:

- From an environmental point of view, hydrogen will facilitate the decarbonization of industry and transportation.

- From an economic point of view, hydrogen makes it possible to create new sectors and, as a result, new jobs.
- The use of decarbonized hydrogen meets France's desire to reduce its dependence on imported energy.
- Decarbonized hydrogen should enable France to assert its technological independence.

To date, €2 billion already has been allocated to the development of green hydrogen as part of the recovery plan. A total of €7 billion in public support is planned up to 2030.

II. What Are the Objectives of the National Hydrogen Strategy?

The development of hydrogen technologies is an opportunity to accelerate the ecological transition and to create a dedicated industrial sector, both regionally in France and on a European scale.

The French strategy sets three main objectives:

1. Install enough electrolyzers to make a significant contribution to the decarbonization of the economy.

This will be possible thanks to the installation of a 6.5 gigawatt (GW) green hydrogen production capacity via electrolysis.

2. Develop clean mobility, particularly for heavy vehicles.

In parallel with an initial phase of conversion of land passenger and freight transport to hydrogen technologies (commercial vehicles and heavy goods vehicles, buses, hydrogen-powered trains), the development of key technologies and components will continue, in particular through pilot projects for hydrogen-powered river shuttles and ships, as well as the acceleration of innovation efforts in favor of a decarbonized hydrogen-powered aircraft, which could enter into service in the 2030s. The development of hydrogen uses in French territories will also be encouraged.

The goal is to save more than 6 million tons of CO₂ in 2030, which is equivalent to the annual CO₂ emissions of the city of Paris.

3. Build an industrial sector in France that creates jobs and guarantees France's technological expertise.

The stated objective is to generate between 50,000 and 150,000 direct and indirect jobs in France. Developing green jobs in the industrial sector will assist in achieving this objective and will provide for the mastery of critical technological foundations in France.

III. Status of the Support for the Development of Hydrogen in France

France was one of the first nations to deploy a hydrogen plan in 2018. Over the last three years, the French government has provided significant support to the sector:

- The Investments for the Future Program (PIA) has mobilized more than €100 million by supporting the implementation of demonstration projects and the acquisition of stakes in high-potential companies.
- The French National Research Agency (ANR) has supported public research by mobilizing more than €110 million over the last 10 years.

- Bpifrance (French government public investment bank) has supported many startups and small and medium-sized enterprises (SME) in their innovation and technological development projects.
- The French Agency for Ecological Transition (ADEME) has supported the deployment of hydrogen mobility by contributing €80 million.
- The Bank of the Territories (Banque des Territoires) has also positioned itself by supporting deployment projects led by communities.

In February 2020, green hydrogen was identified as a priority among the 11 key markets finally selected by the college of experts gathered around the French Innovation Council and on which France will concentrate resources for the new wave of future investments. This selection was made on the basis of criteria such as environmental transition, sovereignty, technological maturity, and the existence of barriers to be removed in order to assess the legitimacy and potential impact of government intervention.

A broad consultation in the form of a “call for expression of interest” (CEI) was then launched in the first half of 2020, enabling project leaders (industries, territories, research centers) to publicize their projects and to identify the obstacles (technical, regulatory, financial) to the emergence of a hydrogen value chain. This strategy has also involved the French National Council of Industry and sector representatives, in particular the Strategic Committees of the “Automotive” and “New Energy Systems” sectors. This CEI was a success—more than 160 applications were submitted, representing €32.5 billion in investments and a need for public support of around €7 billion.

The French government presented its national hydrogen strategy in September 2020. It is based on a strategic vision that has been consolidated for over a year and on a broad consultation of all stakeholders (e.g., research, companies, institutions), which has made it possible to identify the obstacles to be overcome in research and development (R&D), the obstacles to the transition to industrial scale, the opportunities for large-scale development, and the need for financial support through equity investments.

As part of this strategy, on 23 October 2020, the Ministry of Ecology and Solidarity Transition announced the launch of two calls for projects aimed at companies and communities that want to develop green hydrogen in the French territories.

Today, France has a very active industrial and research ecosystem, with several promising companies that could make substantial investments. Major French companies also have a very proactive strategy for developing the sector, and French companies are at the cutting edge of technology in this field and have the vocation to become European and world leaders. Finally, local authorities are showing strong interest and are investing to support the deployment of this technology. The recovery plan is an opportunity to give them the necessary impetus.

IV. Recent Developments

A. The “France 2030” Investment Plan

On 28 September 2022, French Prime Minister Élisabeth Borne announced an investment of €2.1 billion to support and accompany the development of the hydrogen sector in France, as part of the “France 2030” investment plan designed to strengthen France’s industrial competitiveness and to develop new technologies.

In addition, under the Important Project of Common European Interest (IPCEI) on hydrogen entitled “Hy2Tech” jointly supported by 15 European countries and set up to support research, development

and early industrial deployment of low-carbon hydrogen technologies, France has announced its intention to dedicate more than €3 billion in public support through the project and the France 2030 investment plan.

Among the 41 projects selected under IPCEI, 10 are French; making France the most represented country in the first IPCEI on hydrogen. Focused on the development of the industrial offer of equipment for decarbonized hydrogen, these projects will allow:

- The construction of four electrolyzer gigafactories in France (representing up to 40% of the European electrolyzer market by 2030);
- Production sites for hydrogen tanks;
- Fuel cells for sustainable mobility;
- Hydrogen-powered trains and commercial vehicles; and
- The materials needed to produce this equipment.

B. Announcement of a New Scheme for Financing Low-Carbon Hydrogen Production

On 28 August 2023, it was reported in the French press that the French government would allocate another €4 billion to support low-carbon hydrogen production in France via calls for projects. Winners of the calls for projects will be awarded a score based 70% on price criteria and 30% on nonprice criteria.

In addition, aid will be paid to hydrogen producers when production costs are higher than those of conventional hydrogen—otherwise, they will have to pay back the difference. Furthermore, bonuses are also planned to reward projects that undertake to switch off in the event of high demand on electricity grids, and for projects where at least half the production comes from new renewable parks built within this framework.

V. Calls for Projects in France

A. Recently Launched Projects

“Territorial Hydrogen Ecosystems EcosysH₂” (2023)

As part of the “France 2030” investment plan, this call for projects launched on 17 May 2023 will allocate an envelope of €275 million to finance the production and distribution of hydrogen and the deployment of vehicles, to develop ecosystems that combine the various links in the chain on a given territory: hydrogen production, hydrogen distribution and hydrogen uses, whether industrial or for mobility.

Operated by ADEME, this call for projects aims to facilitate the emergence of shared infrastructures to optimize the cost of hydrogen, and the synchronization of investments across the entire chain, and encourage the formation of consortia of partners, bringing together investors/infrastructure operators and hydrogen users.

The submitted projects will be evaluated, put into competition, and selected in three categories:

- Category 1: new ecosystems with predominantly industrial uses
- Category 2: new ecosystems with a majority of mobility uses

- Category 3: extension of existing ecosystems via new mobility uses

Interested parties have until 29 September 2023 to submit their proposals.

B. Ongoing Projects

“Territorial Hydrogen Ecosystems” (2020)

Launched by ADEME for the deployment, by consortia, bringing together local authorities and industrial solution providers of large-scale territorial ecosystems combining different uses (industry and mobility), to promote maximum economies of scale. ADEME will select projects that combine the production, distribution, and use of hydrogen in a single territory or geographical area in an integrated manner. This call for projects will be worth €275 million between 2020 and 2023, with an aim to create consortia bringing together governmental authorities and businesses at the local level. Three deadlines have been announced for the submission of applications: 17 December 2020, 16 March 2021, and 14 September 2021.

In addition, as part of its intervention at the Hyvolution exhibition on 11 and 12 May 2022 in Paris, ADEME has provided an update on the “Territorial Hydrogen Ecosystems” call for projects, launched in 2020 and open for 2020 and 2021.

ADEME considered this call for projects as a great success, with total demand for aid far exceeding the available budget. Out of the 59 candidate projects, 18 were preselected for an in-depth examination by ADEME. If selected, these projects could represent:

- New hydrogen production capacity from electricity, equivalent to 51 megawatt (MW) of electrolysis;
- 38 new hydrogen distribution stations;
- The deployment of more than 440 heavy vehicles and several hundred commercial vehicles for professional mobility;
- More than 7,500 tons of hydrogen distributed per year, mainly by these service stations, reducing the equivalent of 75,000 tons of CO₂/year.

The amount of aid to be allocated for these projects is currently estimated at approximately €180 million.

“Technological Bricks and Demonstrators” (2020)

Targets companies that develop or improve components and systems related to the production and transportation of hydrogen and its uses. It also targets companies that design and develop new vehicles, in particular for road or rail transport. Finally, it may also support demonstrator projects (with a power greater than 20 MW) on the French territory. This call for projects is financed by the PIA and operated by ADEME. Companies had until 31 December 2020 to submit their project (from €2–5 million minimum).

Mobilization of the PIA’s Equity Investment Schemes (2020)

To finance companies requiring support for the development of innovative technologies (Ecotechnologies Fund), industrialization (SPI Fund), or the launch of commercial firsts in the field of energy infrastructure (ADEME Investissements).

Construction of an IPCEI on Hydrogen (2021)

Following the example of the European project on battery storage, this project in particular will enable support to R&D and the industrialization of electrolyzers to produce green hydrogen and to deploy these solutions in industry. This project could also involve “gigafactory” electrolyzer projects in France, as well as the industrialization of other technological building blocks (e.g., fuel cells, storage tanks, materials), as part of an integrated hydrogen economy at the European level. The French government has set aside an exceptional financial allocation of €1.5 billion for this action. On 15 July 2022, the European Commission approved the first IPCEI in the hydrogen field involving 35 companies from 15 member states, including France.

A second IPCEI in the field of hydrogen was approved on 21 September 2022 by the European Commission and 35 companies from 13 member states (including France) were involved in this project.

“Hydrogen Applications” (2021)

Operated by the ANR, this priority research program (PPR) will support upstream research and prepare the future generation of hydrogen technologies (e.g., batteries, tanks, materials, electrolyzers). It will contribute to French excellence in hydrogen research and will be endowed with €65 million.

PART II - FRENCH AND EUROPEAN LEGAL FRAMEWORK

I. The French Legal Framework

A. The Energy Law

Hydrogen deployment in France is mainly governed by Law No. 2019-1147 of 8 November 2019 on energy and climate (the Energy Law).

Article 1 of the Energy Law enshrines in the French Energy Code the objective of carbon neutrality by 2050, and the goal of developing low-carbon hydrogen to reach 20–40% of total hydrogen and industrial hydrogen consumption by 2030.

The Energy Law also paves the way for a regulatory framework setup by ordinances. Article 52 authorizes the French government to enact ordinances to define the terminology for different types of hydrogen, to define a support framework for low-carbon hydrogen, and to allow for the production, transportation, storage, and traceability of hydrogen. A system of guarantees of origin is also planned for green hydrogen.

Finally, Article 49 of the Energy Law guarantees the right of access to natural gas facilities to low-carbon hydrogen producers. This right of access covers gas transmission and distribution facilities and liquefied natural gas (LNG) installations, and is guaranteed subject to preserving the proper operation and safety of the infrastructure.

B. The Hydrogen Ordinance

As a follow-up on the Energy Law, the French government published Ordinance No. 2021-167 relating to hydrogen (the Hydrogen Ordinance) on 18 February 2021.

The main purpose of the Hydrogen Ordinance is to introduce in French legislation (i) three categories of hydrogen: renewable, low-carbon, and carbonated (i.e., fossil-based); (ii) a traceability system for renewable and low-carbon hydrogen; as well as (iii) a support scheme for the production channels of these categories of hydrogen.

The traceability of hydrogen, as well as the “guarantee of origin,” is intended to provide better information to buyers.

The system will be managed by an independent body similar to the one already in place for guarantees of origin of renewable energy, and shall also take into account the guarantees of origin issued by other EU countries pursuant to EU Directive No. 2018/2001 of 11 December 2018 on the promotion of the use of energy from renewable sources.

The support scheme for the production channels of renewable and low carbon hydrogen by water electrolysis will consist in a preselection phase, followed by a competitive dialogue phase, in order to be able to select projects and adjust the levels of support they receive under a contract offering additional remuneration and, depending on the case, investment aid.

In addition to the main measures described above, the Hydrogen Ordinance contains provisions regarding the injection and blending of hydrogen into existing natural gas networks, where the managers of transport and distribution networks shall implement all necessary provisions to ensure

the proper operation and balancing of the systems, the continuity of natural gas transmission and delivery service, and the safety of property and persons.

Finally, the Hydrogen Ordinance introduces two modifications to existing legislation: (i) an amendment to the French Mining Code to extend the legal framework applicable to underground storage of hydrogen, and (ii) an extension of the investigation and control powers provided for in the French Energy Code (already applicable to electricity and gas) to hydrogen.

C. The Climate and Resilience Law

Articles 87 and 88 of the Law n° 2021-1104 of 22 August 2021 on combating climate change and strengthening resilience to its effects (Climate and Resilience Law) specify the legal framework for the production of renewable and low-carbon hydrogen defined by the Hydrogen Ordinance of 17 February 2021.

As a background, Article L. 811-1 of the French Energy Code defines three categories of hydrogen production:

1. Renewable hydrogen produced from electricity generated from renewable energy, such as solar, wind and hydro-energy (formerly “green” hydrogen).
2. Low-carbon hydrogen (formerly “blue” and “yellow” hydrogen) manufactured by thermochemical processes using fossil energy sources (e.g., coal or natural gas) as raw material, whereby the CO₂ emitted during its production is captured to be reused or stored (formerly “blue” hydrogen), or produced from nuclear energy (formerly “yellow” hydrogen).
3. Carbon-based hydrogen produced exclusively from fossil fuels (formerly “grey” hydrogen).

Article 87, I, of the Climate and Resilience Law includes hydrogen production in the list of objectives and priorities of the national energy policy defined in Article L. 100-1 A, I, 3° of the French Energy Code. This article provides for the adoption every five years of a “five-year programming law” which will ensure the coherence of the French national energy policy, determine its objectives and set the priorities for action. The preparatory works indicate that the five-year programming law is intended to replace all regulatory documents in the field of energy, such as the Multiannual Energy Program (PPE) and the National Low Carbon Strategy (SNBC).

In addition, Article 87, III, of the Climate and Resilience Law allows facilities for the production of renewable and low-carbon hydrogen produced by electrolysis of water, to benefit from flexibility for their installation on the public domain of the state (like those of renewable electricity and gas).

Article 88 itself allows local authorities, municipalities, intermunicipalities, regions, and departments to participate in the financing of renewable or low carbon hydrogen and to encourage the development of the decarbonized hydrogen sector, both to use it as a fuel for public transport and to decarbonize industry, in partnership with manufacturers.

The French legislator also confirmed its intention to accelerate the development of hydrogen storage. Article 81, 3°, d) of the Climate and Resilience Law authorizes the government to modernize mining law by ordinance, by “specifying the legal regimes for underground storage and mining in order to define the terms and conditions for their extension to other substances, such as hydrogen”.

D. The Multiannual Energy Program

Notably, France’s energy policy is implemented through the PPE, which develops the main energy objectives in a decree and a report, as well as the public authorities’ orientations and priorities for action. The 2019-2028 PPE, published on 23 April 2020, aims in particular to improve the competitiveness of the French hydrogen industry by deploying solutions for the period 2030-2040.

The 2019-2028 PPE targets industrial hydrogen, hydrogen for mobility, and hydrogen for storage, and sets objectives in each of these areas to increase hydrogen consumption by 2023 and 2028:

- One to 10 power to gas demonstration projects in 2023 and 10 to 100 demonstration projects in 2028.
- Incorporation of decarbonized green hydrogen into existing industrial use of hydrogen of 10% in 2023 and 20–40% in 2028.
- 5,000 hydrogen-powered light-duty vehicles in 2023 and 20,000 to 50,000 in 2028.
- From 200 heavy hydrogen vehicles in 2023 to between 800 and 2,000 in 2028.

Transversal Measures for the Reduction of Energy Consumption

- Defining the objective and the modalities of the next two periods of the Energy Saving Certificates (CEE) scheme on the basis of an analysis of the energy saving potential.
- Supporting an ambitious and effective European policy on the eco-design of energy-related products and the energy labelling of these products.
- Defining a new carbon price trajectory (carbon component of energy taxation).
- Promoting a floor price for carbon at the European level, as well as the setting of a carbon price for all sectors outside the European carbon quota system.

Measures to Reduce Energy Consumption and Greenhouse Gas Emissions in Transportation

- Meeting the European greenhouse gas emission target of 95 grams CO₂/kilometer on average for new cars sold in 2021.
- Achieving, in the most efficient way, the European objective for 2030 of a 37.5% reduction in CO₂ emissions from passenger cars sold compared to 2021.
- Stopping the sale of new vehicles that emit greenhouse gases in 2040.
- Removing the impediments to the development of electric vehicles, i.e., additional total cost of ownership (in particular additional face cost at purchase) and usage constraints (autonomy, recharging infrastructure).
- Balancing the cost of ownership through the implementation of subsidy mechanisms or tax incentives.
- Introducing regulatory measures or extending the use of existing incentive instruments to change the planning of urban spaces (e.g., development of low-emission zones, usage advantages such as dedicated parking lanes or spaces).
- Supporting investment in clean heavy vehicles through a reinforced system of additional depreciation: extending the system of additional depreciation for heavy natural gas vehicles until 2021; reinforcing the system for heavy vehicles under 16 tons and implementing technological neutrality (extension to hydrogen and electricity); and extending it to other modes, particularly maritime.
- Supporting carpooling and all alternative mobility solutions to individual car use.

- Enabling the deployment of a network of recharging infrastructure capable of supporting the targeted growth in the number of electric vehicles: mobilize financing tools (PIA, Energy Transition Tax Credit (CITE), CEE, and EV Infrastructure Charging Program (ADVENIR), increased coverage of connection costs by network tariffs); remove obstacles to installation (evolution of co-ownership rights, on-demand terminals); facilitate recharging in companies (reform of in-kind benefits).

Clean Mobility Development Strategy

The main orientations and courses of action were drawn from the National Mobility Conference, and the Mobility Orientation Law enacted on 24 December 2019 serves as the main vehicle for implementing these actions:

- Enabling all French territories and regions to benefit from alternative mobility services to individual car use and unleash innovation by:
 - Making clean mobility accessible to all by providing each territory with a mobility organizing authority (AOM) and by extending the role of the AOMs to active or shared mobility and mobility services of a social nature, with an aim to give everyone the choice of their mobility, by offering a more diversified, more efficient, more connected, and more shared service offer throughout the territory; and
 - Facilitating the experimentation and deployment of new mobility solutions in sparsely populated areas, as well as the circulation of autonomous vehicles on public roads, thanks to an appropriate legislative and regulatory framework.
- Developing low-emission vehicles and transportation (including river, sea, and air) and improve the energy efficiency of the fleet by relying on the market for alternative fuels by:
 - Relying on purchase and tax incentives to achieve ambitious market share targets for low-emission vehicles (purchasing a low-emissions vehicle creates a “bonus,” whereas buying vehicles emitting a high amount of CO₂ will give rise to additional taxes also called “malus”), for both private and professional uses;
 - Accompanying this development by deploying alternative fuel distribution infrastructure: deployment of electric recharging stations (including the right to plug in) and compressed natural gas (CNG) and hydrogen stations;
 - Promoting the energy efficiency of domestic waterway and maritime transport and achieving the objective of carbon neutrality by allowing refueling using low carbon fuels in all French ports and facilitating the conversion to other low carbon technologies (e.g., energy storage batteries, biofuels, hydrogen, sailing); and
 - Limiting the impact of air transport on climate change by aiming for substantial gains in energy efficiency and a substantial substitution of the share of biofuels (50% in 2050) for fossil fuels.

Measures to Develop Biofuels

Today, natural gas is an essential energy source for the French energy system. Its storage capacity is necessary to get through winter peaks in heating and electricity production. Moreover, natural gas is the least carbon-intensive fossil fuel, and therefore reduces CO₂ and air pollutant emissions when it replaces oil, for example in transportation. Natural gas is, nevertheless, a fossil energy source, and therefore should be replaced in the long term by biogas or new synthetic gases produced with

decarbonized energies: hydrogen or power to gas (manufacture of synthetic gas, in particular methane, using renewable electricity).

In this context, the main French measures are aimed at:

- Continuing national support for the development of biofuels through an incorporation incentive for operators who put the fuels into consumption.
- Beyond the existing limits on conventional biofuels, limiting the incorporation of biofuels made from raw materials with a high risk of inducing indirect changes in land use (e.g., certain palm or soybean oils), as provided for in the new European directive on renewable energies.

Main Measures for the Promotion of Hydrogen

- Setting up support for hydrogen development to the tune of €100 million and launch calls for projects on mobility and hydrogen production using electrolyzers.
- Setting up a traceability system for decarbonized green hydrogen by 2020.
- Extending the over-amortization measure for the purchase of hydrogen vehicles at least under the same conditions as for CNG (heavy trucks over 3.5 tons).
- Mobilizing financial institutions (private and public funding including French public investment banks, i.e., Deposits and Consignments Fund (CDC) and Bpifrance) and standardize cofinancing models for ecosystem deployment projects in the French territories and regions.
- Working with all the stakeholders involved to simplify and harmonize the authorizations and certifications procedures for marine vessels and the associated hydrogen refueling solutions.

Measures to Ensure the Security of Electricity Supply

Current analyses do not show any risk to the safety of the electrical system within the timeframe of the French PPE, particularly due to the flexibility of the existing means of production. However, margins remain limited at the beginning of the period with the continued decommissioning of thermal power plants.

The tools for power system flexibility (e.g., demand management, erasure (curtailment), interruptibility, storage, interconnections), even if they are not immediately indispensable, will have to continue to be developed in the medium term, particularly in connection with the growth of intermittent renewable energies. The aim is therefore to:

- Set a target of 6.5 GW of erasure by 2028 with an intermediate target of 4.5 GW in 2023; and
- Conduct studies to prepare a possible longer-term deployment of hydrogen as a flexible solution for power and gas systems.

Main Measures to Develop Recharging Infrastructure for Alternative Fuels

The development of alternative fuels, such as CNG, liquefied petroleum gas (LPG), electricity, and hydrogen represents an important lever for the transition of the transport sector, particularly road and river transport.

Setting up and maintaining a network of recharging and refueling infrastructures is a major challenge for the development of alternative fuels. It is, therefore, a question of:

- Revising the legislative and regulatory framework concerning the evolution of technology and risk control of CNG and hydrogen refueling facilities in order to facilitate the deployment and operation of electric recharging stations by 2020; and
- Encouraging the development of electrical terminals by lowering the cost of connection, CITE, and mobilizing CEEs.

E. A General Order on Hydrogen Fueling Stations

Two legal texts enacted on the same date also introduced regulations for hydrogen fueling stations:

- Decree No. 2018-900 of 22 October 2018, which created a new category 1416 for “Storage or use of hydrogen” in the nomenclature of registered facilities for the protection of the environment (ICPE).
- Order of 22 October 2018, which provides for the regulations applicable since 1 January 2019. The order covers stations, open or not to the public, that produce more than two kilograms of hydrogen per day and where hydrogen is transferred into vehicle tanks. The text sets out the rules relating to the compliance of hydrogen stations, the operation of facilities, safety, and the management of water, waste, and noise.

II. Hydrogen: A European Challenge

The European Commission published on 8 July 2020, in line with its work on strategic value chains, its hydrogen strategy for the European Union. Europe is thus establishing hydrogen as a key component of its climate plan and a means to create industrial jobs.

On this occasion, the European Commission created the Clean Hydrogen Alliance, to organize and coordinate the collective work of member states and various manufacturers on this topic, and to which France actively contributes. Several member states, such as Germany, Spain, the Netherlands, Norway, and Portugal have already outlined their hydrogen strategy. Others are planning to do so in the near future.

France will be mobilized, alongside its European partners and the Clean Hydrogen Alliance, for the appraisal and construction of an IPCEI, which makes it possible to jointly finance the creation of a Europe-wide hydrogen value chain, following the example of the projects financed under the “batteries plan.” Closer exchanges with Germany will enable the identification of joint projects to be carried out under this IPCEI. France will also be involved in work to remove various obstacles (regulatory, normative, and financial) to encourage the emergence of a sustainable and resilient European hydrogen economy.

A. Political Context: the European Green Deal

The communication on the European Green Deal, published by the European Commission on 11 December 2019 targets, among other things, hydrogen.

First, the European Commission indicates that the regulatory framework for energy infrastructure, including the Trans-European Networks for Energy (TEN-E) Regulation (Regulation (EU) 347/2013 on Trans-European Energy Networks), will need to be reviewed to ensure consistency with the objective of climate neutrality. This framework should foster the deployment of innovative technologies and infrastructures, such as smart electricity grids, hydrogen distribution networks or carbon capture, storage and use, and energy storage.

In addition, in its December 2019 communication, the European Commission stresses that European industry needs “climate and resource pioneers” to develop the first commercial applications of advanced technologies in key industrial sectors by 2030. Priority areas include hydrogen, fuel cells, and other clean alternative fuels; energy storage; and carbon dioxide capture, use, and storage.

Finally, the European Commission states that it will support the necessary research and innovation efforts under the Horizon Europe program, Europe’s framework program for research and innovation for the period 2021–2027. Partnerships with industry and member states will support research and innovation in the field of transport, including batteries, clean hydrogen, and low-carbon steel.

As such, the European Commission is calling for the development of advanced technologies for the energy transition (e.g., batteries, hydrogen, storage).

B. How Can Hydrogen Support Recovery, Growth, and Jobs?

Investments in hydrogen will be a vector of growth that will be crucial to emerge from the crisis caused by the COVID-19 pandemic. The European Commission’s recovery plan emphasizes the need to unlock investment in key clean technologies and value chains to promote sustainable growth and jobs. The European Commission identifies clean hydrogen as one of the key areas for action in the energy transition and lists a number of avenues to support its use.

In addition, Europe is highly competitive in the field of clean hydrogen technologies and is well placed to benefit from the development of clean hydrogen as a global energy carrier. Cumulative investments for renewable hydrogen in Europe could be in the range of €180–470 billion by 2050, and in the range of €3–18 billion for low-carbon fossil hydrogen. Combined with Europe’s leadership in renewable energy technologies, the emergence of a hydrogen value chain serving a multitude of industrial sectors and other end uses could create almost 1,000,000 direct and indirect jobs. Analysts estimate that clean hydrogen could satisfy 24% of the world’s energy demand by 2050, with annual sales in the range of €630 billion.

C. How Will the Hydrogen Strategy Support Investments in the Hydrogen Economy?

The strategy sets out a comprehensive investment program, including investments in electrolyzers, renewable power generation capacity needed to produce clean hydrogen, transportation and storage, modernization of existing gas infrastructure, and carbon dioxide capture and storage.

To support these investments and foster the emergence of a complete hydrogen ecosystem, the Commission launched the European Clean Hydrogen Alliance, as announced in its communication on a new industrial strategy. The European Clean Hydrogen Alliance will play a crucial role in the implementation of this strategy and in supporting investments to increase production and demand. It will bring together industry; public authorities at national, regional and local levels; and civil society. Through sector-specific roundtables of leaders interacting with each other and a platform of policymakers, the European Clean Hydrogen Alliance will provide a broad forum for coordinating investments by all stakeholders and engaging civil society. Its main objective will be to identify viable investment projects.

D. What European Financial Instruments Can Be Used to Invest in Hydrogen?

The European Commission will follow up on the recommendations made in a report of the Strategic Forum on IPCEI to promote joint or coordinated actions and investments in several member states to support a hydrogen supply chain.

In addition, the InvestEU program’s capabilities will be more than doubled under the new Next Generation EU recovery instrument. The InvestEU program will finance hydrogen deployment by stimulating private investment with a strong leverage effect.

Many member states have identified renewable and low-carbon hydrogen as a strategic component of their national energy and climate plans.

In addition, the European Regional Development Fund and the Cohesion Fund, which will be complemented by the new Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU) initiative, remain available to finance the environmental transition. Opportunities for carbon-intensive regions under the Just Transition Mechanism should also be explored.

Synergies between the European Interconnection Mechanism–Energy and the European Interconnection Mechanism–Transport will be exploited to finance dedicated hydrogen infrastructure, gas network reallocation, carbon dioxide capture projects, and hydrogen fueling stations.

In addition, the EU Emissions Trading Scheme (EU ETS) Innovation Fund, which will pool around €10 billion to support low-carbon technologies over the period 2020–2030, could facilitate the demonstration of innovative hydrogen technologies. A first call for proposals under this fund was launched on 3 July 2020 and closed on 29 October 2020. In March 2021, 70 best-ranked projects were invited to submit a full application for the second stage, which closed on 23 June 2021. The process was wrapped on March 2022 with the award of grants.

The latest EU ETS Innovation Fund auction and call will both open on 23 November 2023. The auction will close on 8 February 2024 (indicative) while the call is expected to close on 9 April 2024 (indicative).

III. REPowerEU

On 18 May 2022, the European Commission presented the REPowerEU plan, a response to the hardships and global energy market disruption caused by Ukrainian crisis and aiming to make Europe independent from fossil fuels, and particularly Russian gas, before 2030.

REPowerEU outlines a series of measures to respond to rising energy prices in the European Union, and to replenish gas stocks by diversifying gas supplies via higher LNG and pipeline imports from non-Russian suppliers, as well as larger volumes of biomethane and renewable hydrogen production and import. The plan also aims to more quickly reduce the use of fossil fuels in homes, buildings, industry, and power system, by boosting energy efficiency, increasing renewables and electrification, and addressing infrastructure bottlenecks.

One energy source that is receiving more attention in the REPowerEU plan is hydrogen, along with its derivatives, such as ammonia, methanol, e-kerosene, and e-petrol. While the 2030 target for renewable hydrogen in the “Fit for 55” package is set at 5.6 megatons (Mt), the new REPowerEU strategy has increased the target to 20 Mt, with a view to replacing 50 bcm (billion cubic meters) of Russian gas. This means that the use of hydrogen in industrial heat is planned to increase 4.5-fold compared to the “Fit for 55” targets, and a more than 2.5-fold increase is planned for transport.

As part of efforts to diversify energy imports, the Commission in coordination with member states has set up the EU Energy Platform for the voluntary common purchase of gas, LNG, and hydrogen.

One of the functions of the EU Energy Platform is a joined international outreach with focus on concluding long-term cooperation frameworks with trusted partners via binding or nonbinding agreements that support the purchasing of gas and hydrogen and clean energy project development.

Under the REPowerEU action plan, the Commission proposed on 18 October 2022 the AggregateEU, an EU mechanism allowing demand aggregation and joint gas purchasing at the European level, which was set up following the adoption of Council Regulation (EU) 2022/2576. This mechanism enables companies to aggregate their demand for gas and match it with the most competitive offers

on the global market. AggregateEU will put in place a series of suppliers tenders through which EU companies can buy pipeline gas and LNG on the global market, excluding Russian supplies.

In order to participate in tenders, companies must first register with the service provider PRISMA and subscribe to the AggregateEU mechanism. Both European and non-European companies are able to take part as suppliers, with the exception of Russian companies.

EU member states are required to ensure that local companies apply for the equivalent of 15% of each member state's gas storage obligations, as set out in the Gas Storage Regulation. However, the purchase of gas by companies will be entirely voluntary. Each company may participate in a tender to AggregateEU as a seller or as a buyer, but not both simultaneously.

The EU Energy Platform will also set up a dedicated work stream with member states on joint purchasing of hydrogen.

GLOSSARY

ADEME	French Agency for Ecological Transition
ADVENIR	EV Infrastructure Charging Program
AggregateEU	A demand aggregation and joint purchasing mechanism, operated by PRISMA, the service provider, under the EU Energy Platform, in accordance with Council Regulation 2022/2576.
ANR	French National Research Agency
AOM	mobility organizing authority
CDC	Deposits and Consignments Fund
CEE	Energy Savings Certificates
CEI	call for expression of interest
CITE	Energy Transition Tax Credit
Climate and Resilience Law	Law n° 2021-1104 of 22 August 2021 on combating climate change and strengthening resilience to its effects
CNG	compressed natural gas
CO₂	Carbon dioxide
Energy Law	Law No. 2019-1147 of 8 November 2019 on energy and climate
EU ETS	EU Emissions Trading Scheme
gigafactory	A very large manufacturing facility (term attributed to Elon Musk's Tesla Motors in 2013)
guarantee of origin	An electronic document providing proof that a quantity of electricity was produced from renewable sources
GW	gigawatt
Hydrogen Ordinance	Ordinance No. 2021-167 relating to hydrogen

ICPE	Facilities Classified for Environmental Protection
InvestEU	A program of the European Union to kick start the European economy
IPCEI	Important Projects of Common European Interest
LNG	liquefied natural gas
LPG	liquefied petroleum gas
Mt	megatons
MW	megawatt
PIA	Investments for the Future Program
PPE	Multiannual Energy Program
PPR	priority research program
R&D	research and development
REPowerEU	A plan implemented in response to Russia' invasion of Ukraine to help the European Union save energy, produce clean energy, and diversity its energy supplies
REACT-EU	Recovery Assistance for Cohesion and the Territories of Europe
SME	small and medium-sized enterprise
SNBC	National Low Carbon Strategy
TEN-E	Trans-European Networks for Energy

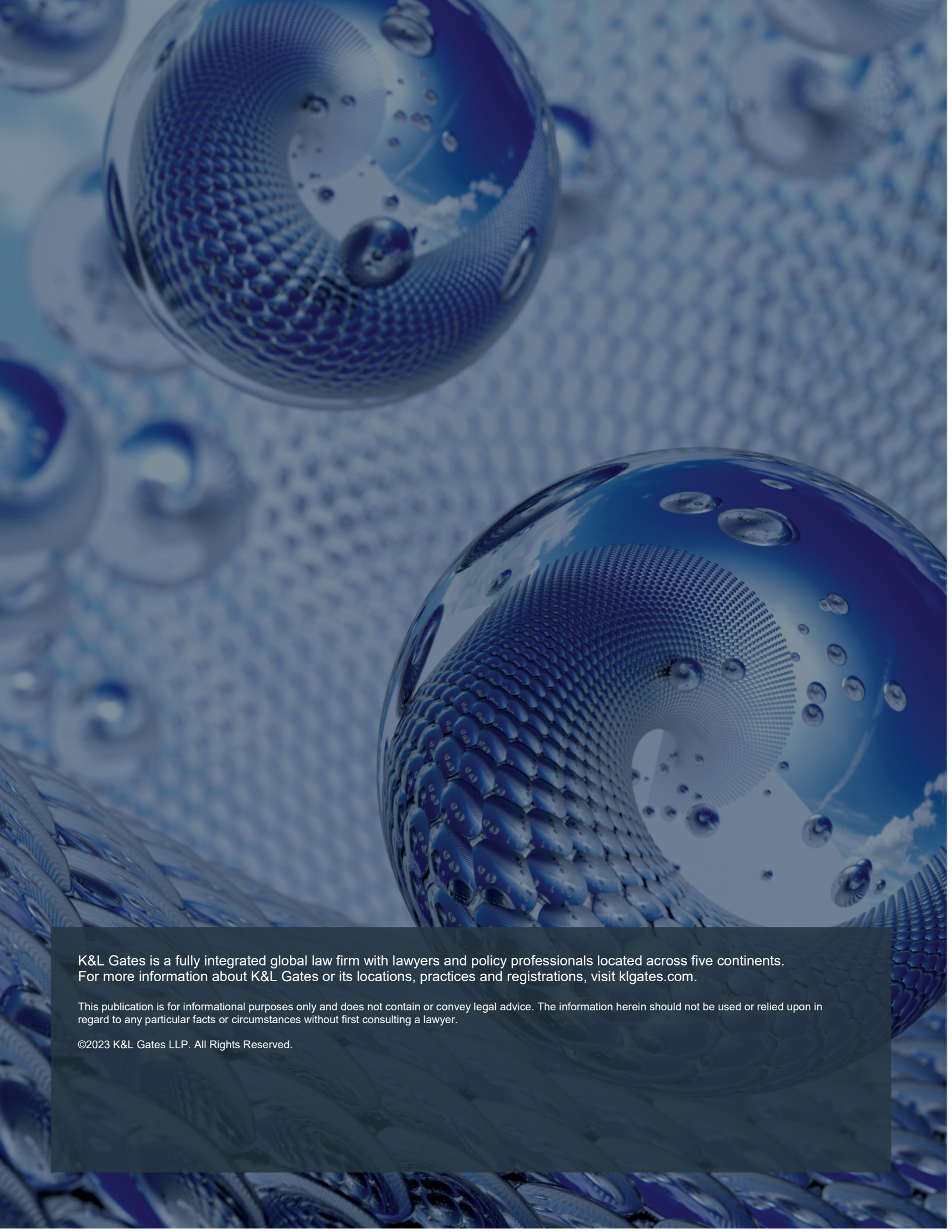
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The background is a complex, abstract composition of blue tones. It features several large, reflective spheres that appear to be made of a metallic or crystalline material. These spheres are arranged in a way that creates a sense of depth and perspective. The surface of the spheres is covered in a fine, grid-like pattern of small, rounded protrusions, giving them a textured, almost organic appearance. The lighting is soft and diffused, highlighting the curvature and reflections of the spheres. The overall effect is one of a futuristic, high-tech environment.

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