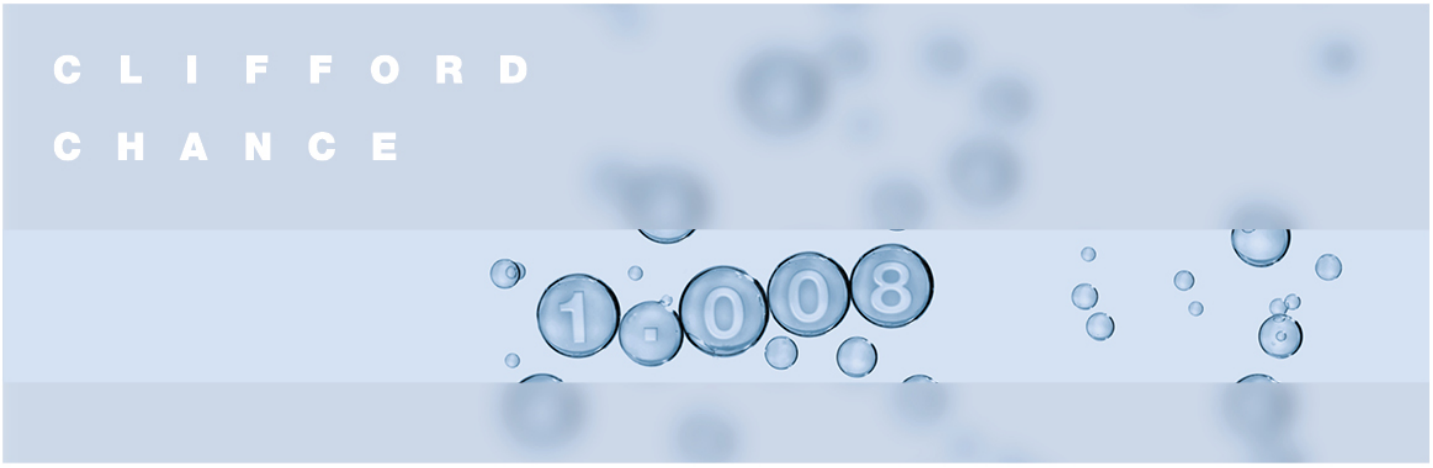

NATIONAL HYDROGEN STRATEGY – GERMANY AIMS TO TAKE THE LEAD

The German Federal Government has adopted its National Hydrogen Strategy. Germany, which will hold the Presidency of the Council of the European Union in the second half of 2020, intends to take a leading role in the development of hydrogen technologies. The strategy provides a number of ambitious measures and goals – 38 in total – underscoring that hydrogen, and in particular green hydrogen, is key for the future of a clean, secure and affordable energy supply.

GERMANY'S NATIONAL HYDROGEN STRATEGY

Germany has just adopted its long-awaited and highly anticipated National Hydrogen Strategy (*Nationale Wasserstoffstrategie*, "**NWS**"). In this strategy, the German Federal Government acknowledges the potential and importance of hydrogen for the future supply with clean, secure and affordable energy. Especially, according to the Government, technologies using hydrogen as energy source have the potential to play a huge role in reducing CO_2 emissions caused by industry, transport and other sectors. In this respect, it is clear that the German Federal Government only sees green hydrogen to be sufficiently sustainable.[1]

The German Federal Government stresses its aim to enable the economic use of hydrogen and its intention to take a leading position in the global hydrogen market.

POTENTIAL / GOALS AND AMBITIONS / STATUS QUO AND FUTURE MARKETS

In its NWS the German Federal Government clearly determines hydrogen, in particular green hydrogen, to be key for the future of a clean, secure and affordable supply of energy and therefore to help Germany meeting its goals to help reducing global warming in accordance with the Paris Convention. Green hydrogen is identified as playing key roles in several aspects, including:

- energy source;
- energy storage;
- element of the sector coupling;

Key issues/Takeaways

- NWS boosts (green) hydrogen throughout the entire value chain with an action plan of 38 planned measures for 2020 – 2023.
- Financial support of more than EUR 10 billion.
- Ambitious hydrogen production capacity target of up to 10 GW by 2040.
- Key aims and ambitions comprise making hydrogen competitive, developing a "home market" for hydrogen in Germany, paving the way for hydrogen imports as well as establishing hydrogen as an alternative energy carrier and a raw material for industrial processes.
- Facilitating the development of a hydrogen market on EU level will be a key aspect and driving force of Germany's Presidency of the Council of the European Union.
- Facilitating and improvement of international cooperation, in particular, with North-African countries.
- It can be expected that Germany will use its Presidency to advance hydrogen projects on the EU level, with an increased focus on the importance of hydrogen technologies.

[1] The term "hydrogen" used in this document shall mean "green hydrogen" (hydrogen produced on the basis of renewable energies) unless explicitly stated differently.

- substitute of grey hydrogen for industrial and chemical processes; and
- medium for carbon capture and utilization (CCU).

To promote hydrogen and, in particular, to decrease costs of hydrogen technologies, the program for the future of the coalition commission ("*Zukunftspaket des Koalitionsausschusses*") dated 3 June 2020 provides for EUR 7 billion for the run-up of hydrogen technologies. Another EUR 2 billion will be provided for international partnerships in that field. This adds to the EUR 1 billion already foreseen by the National Decarbonisation Programm ("*Nationales Dekarbonisierungsprogramm*") in the years 2020 to 2023 for investments in large-scale industry plants using hydrogen.

Acknowledging Germany's role and responsibility for the reduction of emissions of global warming gases, the NWS sets the following goals and ambitions:

- Establish competitiveness of hydrogen;
- Create a market in Germany for hydrogen technologies and possibilities for imports;
- Establish hydrogen as an alternative energy source;
- Make hydrogen sustainable for industrial processes;
- Development of the infrastructure for transport of hydrogen;
- Promotion of research;
- Establish international market places and cooperation.

Against the current demand of (grey) hydrogen of approx. 55 TWh in Germany which is predominantly driven by production processes in the raw material or petrochemical sectors, the NWS expects the main increase in demand for green hydrogen in these sectors but less so in the transport sector. Still, the NWS aims at the following future markets:

- Generation;
- Industry;
- Transport;
- Heat.

Further spheres of activity include the creation of a common European hydrogen market, and the entrance into international trading as well as establishing the relevant infrastructure and providing the basis for research and innovation.

The NWS sets out a remarkably ambitious action plan, detailing certain measures to be taken. These measures are described in more detail further below.

GENERATION

The German Federal Government expects that the hydrogen demand will rise significantly up to 90 to 110 TWh until 2030. To cover such demand, it is intended to raise the share of CO_2 free (green) hydrogen as a reliable, affordable and sustainable generation of hydrogen is considered to be the basis for its future use. That said, generation units of up to 5 GW total electrolysis capacity including the required offshore and onshore energy

generation facilities shall be constructed in Germany. If possible until 2035, at the latest until 2040 another 5 GW shall be added.

To achieve this goal, the NWS lists certain measures, such as improving the framework for the use of renewable electric energy (e.g. sector coupling) and a reform of the state-induced price components of electric energy. Moreover, it is intended to introduce CO_2 prices for fossil fuels in the transport and heat markets. Other important measures are the intended exemption of the generation of hydrogen from the EEG levy as well as the enabling of new business and cooperation models between operators of electrolyses plants and power and/or gas grid operators. Further, electrolysers producing green hydrogen shall receive state support and the conditions for investments in units producing hydrogen from offshore wind shall be improved.

DEMAND

The NWS acknowledges that the development of a hydrogen market requires a reliable demand and an increased use of hydrogen. That said, the action plan foresees certain measures to implement hydrogen as alternative fuel in the transportation sector or as raw material in the industry.

Industry

According to the NWS, conventional technologies will not suffice to decarbonise certain industry sectors. Instead gaseous and liquid energy sources must be increasingly substituted by alternative technologies and alternative raw materials or processes with no or very low CO_2 emissions. In many of these industrial processes hydrogen (and its derivatives) can and will play a pivotal role in the future. Consequently, the NWS aims to ensure that upcoming investments for production plants on an industrial scale also flow into climate-friendly technologies.

Investment costs in CO_2-free technologies cannot be fully passed on to the customers due to fierce global competition. The German Government therefore already supports the conversion of conventional fossil technologies with process-related emissions to low-greenhouse gas or greenhouse gas-neutral processes in the industry sector (especially the steel and chemical industry) by way of various programmes already implemented. These support programmes, *inter alia*, include the fund for "decarbonisation in industry" (*Dekarbonisierung in der Industrie*) and the programme for "Use of hydrogen in industrial production" (2020-2024) (*Wasserstoffeinsatz in der Industrieproduktion*) to financially support the use of hydrogen in industrial processes.

The conversion to climate-friendly industrial process not only requires certain investment support schemes. Additionally, the NWS aims to implement measures to support the operation of electrolysis plants. For this purpose, a new pilot program for "Carbon Contracts for Difference (CfD)" will be established which primarily relate to the steel and chemical industries with relatively high process-related emissions. In this regard, the German Federal Government will guarantee funding for the difference in costs between actual avoidance costs or a project-related, contractually defined CO_2 price per avoided quantity of greenhouse gas emissions and ETS prices for the development and operation of decarbonisation technologies aiming at greenhouse gas neutrality. Should the ETS price rise above the contractually defined CO_2 price (and thus the avoidance costs of the respective technology) in the future, the companies are obliged to pay the difference to the German

Federal Government. This shall provide for investment security and incentivise climate protection projects which indirectly incentivise the production of hydrogen and lead to a market ramp-up of hydrogen.

In addition, it is planned to conduct several dialogue formats with different stakeholders of several industrial sectors (chemical and steel industry, logistics, aviation and others) to discuss decarbonisation strategies and further possibilities of using hydrogen.

Furthermore, the demand for industrial products, which are manufactured using low-emission processes as well as the use of hydrogen shall be strengthened. The German Federal Government is committed to examining solutions at national and EU level to stimulate markets for climate-neutral and recycled products in energy-intensive industrial sectors. In this regard, it considers a meaningful, ambitious and comprehensible labelling of the more climate-friendly or sustainable intermediate and end products as a prerequisite for such measures.

Transport

The NWS provides for a broad variety of highly ambitious goals and measures with respect to the transport sector.

First of all, Germany considers the timely and ambitious implementation of the EU Renewable Energies Directive ("**RED II**") as essential in order to anchor the use of hydrogen in fuel production and as an alternative to conventional fuels by implementing the following measures:

- Implementation of a quota in the sense that the minimum proportion of renewable energies in the total energy consumption of the transport sector until 2030 shall be significantly higher than the 14% quota determined by EU law;
- Utilizing the implementation of RED II on German level to enable the use of hydrogen in the production of fuels to be counted towards the greenhouse gas reduction quota. In addition, Germany will set incentives in the implementation of RED II in such a way that hydrogen is used in the production of fuels as soon as possible. The aim is to build up an electrolysis capacity of 2 GW;
- Facilitating the use of renewable kerosene in the aviation sector whereby an obligation of distributers to use electricity-based aviation fuels, for the production of which hydrogen is necessary, principally appears reasonable. In the sense of an ambitious market ramp-up, The German Federal Government considers an initial quota of at least 2% of renewable kerosene in the aviation sector by 2030 as worth to be discussed and Germany will seek to achieve a corresponding multilateral agreement on EU level.

Additionally, Germany will continue and strengthen further the already existing support schemes under the National Innovation Programme Hydrogen and Fuel Cell Technology (*Nationales Innovationsprogramm Wasserstoff- und Brennstoffzellentechnologie,* **"NIP"**). The additional funds available from the Energy and Climate Fund (*Energie- und Klimafond*s, "**EKF**") until 2023 will also create more funding opportunities for hydrogen and fuel cell technology. The measures foreseen under the action plan primarily aim at a market activation to support investments in hydrogen vehicles (light and heavy trucks/commercial vehicles, buses, trains, inland and coastal shipping, passenger cars in fleet applications). Alongside the support under the NIP, the

following financial support from the EKF is available across all technologies, i.e. also for use for hydrogen applications, until 2023:

- EUR 2.1 billion in subsidies for the purchase of electric vehicles,
- EUR 0.9 billion as grants for the purchase of commercial vehicles with alternative, climate-friendly drive systems,
- EUR 0.6 billion to promote the purchase of buses with alternative drive systems.

Another EUR 1.1 billion are made available for the support of plants for the generation of electricity-based fuels, especially electricity-based kerosene, and for advanced biofuels.

One of the most important measures to enable the broad use of hydrogen in the transport sector is to establish the necessary fuelling infrastructure quickly. Up to EUR 3.4 billion will be made available to support the development of charging and fuelling infrastructure (including electric charging stations) until 2023. The Federal German Government intends to work towards ambitious further development of European infrastructure to facilitate cross-border transport using hydrogen-powered fuel cells. To support this goal, fuelling standards should be internationally harmonised.

According to the NWS, not only the use of hydrogen-based fuels shall be supported, but also the production of vehicles using hydrogen to reduce CO_2 emissions. The competitive development of the supply industry for fuel cells and components for fuel cell systems shall therefore be supported as well.

It is also planned to advocate a CO_2 differentiation of the truck toll in favour of climate-friendly drive systems and for the international harmonisation of standards for mobility applications for hydrogen and fuel cell systems.

Heat market

Since hydrogen can also help to reduce CO_2 emissions in the heat market, the German Federal Government intends to provide up to another EUR 700 million for the period between 2020 and 2024 to, *inter alia*, facilitate the purchase of highly efficient fuel cell heaters for buildings through existing support programmes. In addition, the promotion of "hydrogen-readiness" plants within the framework of the Combined Heat and Power Act (*Kraft-Wärme Kopplungsgesetz,- KWKG*) in order to strengthen the long-term orientation of the heat supply to the use of renewable energies shall be examined.

HYDROGEN INFRASTRUCTURE

The German Federal Government identifies a safe and reliable, demand-oriented and overall efficient supply of hydrogen as a crucial aspect for the development of a hydrogen market. Consequently, the potential of existing infrastructures shall be exploited as far as possible and, if necessary, new supply structures will be established. In this respect the planned measures can be summarized as follows:

- Consultation and cooperation with the relevant stakeholders to determine recommendations for further actions in a corresponding report. In particular, the possibilities for using existing transportation / distribution infrastructures must be discussed and implemented in good time. Same applies to the options for the rededication and subsequent use of pipelines

structures that are currently not in operation. In any case, the German Federal Government plans to swiftly amend the regulatory bases necessary for the establishment and expansion of a hydrogen infrastructure. To this end, a so-called "market exploration procedure" will be carried out in the short term.

- Facilitation of interlinking the existing electricity, heat and gas infrastructures. Planning and financing as well as the regulatory framework shall be designed in a way that the various infrastructures are further developed in a coordinated manner and in a way that is energy-efficient, demand-oriented and cost-effective. Connectivity of the infrastructure in the EU context must be ensured by establishing uniform standards for hydrogen and its infrastructure.
- When building new hydrogen infrastructure, special attention will be paid to the demand-oriented expansion of the hydrogen fuel station network, both in road traffic and at suitable points in the rail network and at waterways.

The NWS particularly highlights that the well-developed European gas infrastructure offers a good starting point for the transport of hydrogen within the EU explicitly stressing that a strong European framework will be essential to create the conditions for an intra-European market and that this central challenge can only be appropriately solved on EU level.

RESEARCH

Another important component of the NWS is the broad support of research with respect to hydrogen technologies throughout the entire value chain as well as the development and training of specialists.

The Government plans to establish and support several research projects as part of a cross-sector research programme called "Hydrogen Technologies 2030" ("*Wasserstofftechnologien 2030*"). These research projects shall be practice-oriented and close to market to accelerate the transfer of innovations into practical use. Research projects for several sectors shall be established and supported (steel and chemical industry, transport sector, in particular aviation and maritime transport)).

The German Federal government also aims to strengthen the interlink between research/sciences and political measures concerning hydrogen. In this regard, a programme for scientific policy advice shall be established so that innovation-friendly framework conditions can pave the way for the practical use of hydrogen technologies. The dialogue between research and politics shall aim to facilitate the market entry of hydrogen technologies and their transfer into practice.

EUROPEAN NEED FOR ACTION

Throughout the NWS the German Federal Government emphasises that advancing legislative acts to support the development of a hydrogen market on EU level will be a key aspect and driving force of Germany's Presidency of the Council of the European Union. This includes a proactive facilitation of the preparation of the legislative package on sector coupling and gas market design, in particular, the "Hydrogen" action plan of the EU Commission as well as the strategy for Smart Energy System Integration.

In order to develop a market that contributes to decarbonisation and strengthens German and European export capacities, the NWS identifies a need for reliable sustainability standards as well as for a high-quality infrastructure, certificates of origin for electricity from renewable energies and

for green hydrogen and its derivatives. In regard to hydrogen and Power-to-X products, the German Federal Government envisages certain sustainability and quality standards and thus, intends to actively support the development of the hydrogen market on bothEU and international levels. This includes facilitating the development of European regulations, codes and standards with respect the various application areas of hydrogen. In parallel, German intends to enter discussions with other non-EU countries to intensify the exchange on such standards with the ultimate goal that certain standards shall be universalised through international organisations.

On EU level, Germany stresses its intention to increase investments in research, development and demonstration of (green) hydrogen throughout the entire value chain (production, transport, distribution, use). Finally, the German Federal Government states that it will accelerate the implementation of EU hydrogen initiatives. One option the German Federal Government has in mind in this regard, is the implementation of a new "Important Project of Common European Interest (IPCEI)" for hydrogen technologies and systems as a joint project with other Member States. Therefore, Germany will actively approach the EU Commission and other Member States to facilitate such a project.

In light of the "European Green Deal", another measure envisaged by the German Federal Government is to commit itself to accelerating the implementation of the EU hydrogen initiatives and to support the preparation of a Commission Green Paper on the content of an EU hydrogen strategy.

INTERNATIONAL PARTNERSHIPS

It is explicitly acknowledged that Germany will not be able to cover its demand for hydrogen on its own and will also have to depend on the import of hydrogen from other (EU and non-EU) countries. To facilitate and improve international cooperation in the field of hydrogen, the Coalition Committee's Package for the Future dated 3 July 2020 (*Zukunftspaket des Koalitionsausschusses*) provides for additional EUR 2 billion. Germany intends to step up its activities to establish and intensify international cooperation on hydrogen at all levels. In addition to the development of hydrogen technologies and markets together with the partner countries, the focus will also be on the possibilities and opportunities of converting the production and export of fossil energy carriers to hydrogen. The measures foreseen by the German Federal Government in this respect essentially comprise:

- Expansion of already existing international energy partnerships with regard to hydrogen, e.g. by exporting German hydrogen technologies to partner countries in order to enable and facilitate the production of hydrogen in these countries and the export of hydrogen from these countries to Germany;
- Strengthening international activities already underway, particularly in the context of energy partnerships and multilateral cooperation such as the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), the International Renewable Energy Agency (IRENA) or the International Energy Agency (IEA) to identify export chances for hydrogen technology as well as potential import countries for hydrogen;
- Implementation of pilot projects in partner countries to demonstrate whether and how hydrogen and its derivatives can be produced and

marketed sustainably and competitively without endangering the renewable energy supply or water supply in the partner countries.

It can be expected that (North-)African countries are likely to play a prominent role during the transformation process towards the use of hydrogen. In this context, the future role of Africa and the importance of African hydrogen for the sustainable development of African partner countries and the European hydrogen market have been stressed pointing out that together with Morocco, Germany is now developing the first industrial plant for "green hydrogen" in Africa.

PUBLIC GOVERNANCE

A flexible and results-oriented governance structure will be put in place to monitor the implementation and further development of the NWS. The NWS shall be continuously monitored by a committee of competent state secretaries that will take the necessary measures if there are signs of a delay in implementation or failure to meet the targets of the NWS.

In addition, a National Hydrogen Council (*Nationaler Wasserstoffrat*) and a Control Centre (*Leitstelle*) shall be established to monitor the implementation of the NWS and for advising the committee of state secretaries.

OUTLOOK

Although the NWS is quite detailed and already provides for an action plan with concrete measures to be taken immediately and in the future, it is obvious that the implementation of the ambitious goals of the NWS will require further considerable efforts. Due to the numerous stakeholders from the various sectors involved and the complexities of markets it can be expected that these processes will not always be straightforward. Given the German Federal Government's clear commitment to hydrogen all relevant stakeholders would, however, be well advised to contribute to the implementation processes.

In the second half of 2020, Germany will hold the Presidency of the Council of the European Union. Germany clearly intends to put the potential and use of hydrogen at the core of its engagement during this period. It can be expected that Germany will use its Presidency to advance hydrogen projects on the EU level, with an increased focus on the importance of hydrogen technologies.

ABOUT

Focus on Hydrogen is a Clifford Chance briefing series covering hydrogen-related developments globally. 1.008 is the standard atomic mass of hydrogen.

For other hydrogen publications, please see our Climate, sustainability, green finance and renewables page here.

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