

## ◆ STATEMENT

# Key issues paper on revisions to the National Hydrogen Strategy

## EXECUTIVE SUMMARY

In its coalition agreement, the German government announced an ambitious revision of the National Hydrogen Strategy (Nationale Wasserstoffstrategie, NWS). Some framework conditions have fundamentally changed since the publication of the NWS, making hydrogen even more important for achieving climate protection targets, diversifying energy imports and ensuring security of supply. This will also lead to a significant increase in the demand for climate-neutral<sup>1</sup> hydrogen and its derivatives, a demand which will now have to be met more quickly than before.

This 'Key issues paper on revisions to the National Hydrogen Strategy' describes the package of measures that, in the opinion of the National Hydrogen Council (NWR), should be implemented with high priority in a targeted and very timely manner:

- ◆ Creation of a certification and trading system to establish a financially solvent hydrogen market
- ◆ Rapid development and expansion of the hydrogen infrastructure
- ◆ Rapid ramp-up of the availability of climate-neutral hydrogen and its derivatives via domestic production and, in particular, early imports from other European and non-European countries
- ◆ Creation of a coherent (support) framework for the development of sales markets for hydrogen
- ◆ Research and development for a sustainable hydrogen evolution with a focus on the realisation of large-scale and holistic demonstration projects.

## BACKGROUND

On 24 November 2021, the German government presented its coalition agreement for this legislative period. It contains ambitious climate protection targets and includes a significant increase in the expansion targets for renewable electricity generation. In addition to stressing the importance of renewable electricity, the coalition agreement also emphasises the significance of hydrogen for achieving the climate protection targets and successfully implementing the energy transition. The increase in the national expansion target for electrolysis capacity from five to ten GW, rapid development of the hydro-

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<sup>1</sup> The majority of the NWR defines hydrogen as climate-neutral when no greenhouse gases are released into the atmosphere during production regardless of the production process and raw material used. This can safely be assumed to be the case if the hydrogen is produced using additional emission-free energy sources or if the carbon released during production is completely and permanently prevented from entering the atmosphere. Another part of the NWR defines climate-neutral hydrogen as hydrogen which is exclusively produced using renewable energy sources.

gen infrastructure to complement the electricity infrastructure as the backbone of the energy transition and the goal of further developing framework conditions that will promote the market ramp-up of hydrogen are viewed as important cornerstones by the German government. The measures required to achieve these goals are to be defined in a revision of an ambitious hydrogen strategy.

In July 2021, the NWR presented the 'Hydrogen Action Plan Germany 2021–2025' to the German government. In this document, the NWR defines its recommendations for the measures to implement the goals set out in the NWS for the current legislative period. This 'Key issues paper on revisions to the National Hydrogen Strategy' should be read and understood as a supplement to and in combination with the 'Hydrogen Action Plan Germany 2021–2025'. It reflects the changed framework conditions, (re) prioritises implementation measures as a consequence of these changes and bundles these measures together to ensure rapid and coherent implementation along the entire value chain, as well as within various market roles.

Since the publication of the Action Plan, some framework conditions that have a significant influence on the role of hydrogen and its derivatives, as well as on the planned ramp-up of the hydrogen economy, have changed fundamentally. The German Bundestag has tightened the climate protection targets as a result of the decision issued by the Federal Constitutional Court. Therefore, the deadline for achieving climate neutrality in Germany has been brought forward by five years to 2045. The Russian attack on Ukraine is having a massive impact on Germany's energy supply as well as its supply security. The current high dependency of Germany's energy supply on fossil fuel imports from Russia highlights the urgent need for sustainable diversification with respect to energy sources and energy suppliers. Climate-neutral hydrogen and its derivatives will play a key role here, also due to the fact that the availability of natural gas as a flexible option is fraught with uncertainty. Climate-neutral hydrogen and its derivatives could make a significant contribution both to diversifying energy imports and ensuring security of supply as early as the second half of the 2020's. To this end, however, it is imperative that the German government already creates well-defined framework conditions this year in order to stimulate the development of a hydrogen infrastructure and supply chains, the industrial production of climate-neutral hydrogen and its derivatives as well as an industrial transformation and the application of hydrogen in the transport sector.

## REVISIONS TO THE NWS

The NWR believes that the increased importance of climate-neutral hydrogen and its derivatives must be considered in the ambitious revisions to the NWS announced by the German government. In addition to the existing goals such as the climate policy goal of making a significant contribution to achieving climate protection targets using climate-neutral hydrogen, the industrial policy goal of positioning Germany on the global market as a leading supplier of green hydrogen technologies and bringing about industrial transformation and sector coupling; it is also important that the energy industry goal of achieving security of supply is given greater weight. This includes diversifying energy sources and partner countries, as well as giving greater consideration to system stability.

While renewable electricity will form the backbone, climate-neutral hydrogen and its derivatives will be the energy sources for the climate-neutral energy system of the future. The hydrogen meta-study commissioned by the NWR clearly shows that the demand for hydrogen was already higher than the level assumed by the NWS before the framework conditions were changed. The study also shows that the demand for hydrogen will increase if climate protection targets are tightened. In order to use climate-neutral hydrogen to now make the necessary additional contributions to diversifying energy imports and ensuring security of supply, the demand for hydrogen will have to be met more quickly.

At the same time, the goal of competitiveness is gaining in importance, as Germany and the EU are in competition with other countries, such as the USA, Australia, South Korea, Japan and China. While scaling up technologies and maintaining a leading position with regard to technology remain important, the aim must be to guarantee imports and also diversify and secure the supply of energy, using climate-neutral hydrogen and its derivatives. It is anticipated that the EU will impose more extensive sustainability requirements than other importing countries as regards certification, production and transport processes for the import of climate-neutral hydrogen and its derivatives. Moreover, the verification, certification and eligibility requirements regarding the green properties of hydrogen and its derivatives have not yet been defined. This lack of planning security is a competitive disadvantage, especially in trade with non-EU countries. Therefore, we need internationally compatible European regulations that take sustainability and competitiveness into account. The German government must work to ensure that internationally valid sustainability criteria are defined in order to avoid distortions of competition. Furthermore, it is important for Germany and the EU to develop trade partnerships with export countries in the short term in order to establish themselves as buyers of green products on the global market.

The revision of the NWS must create the framework conditions for a more rapid, targeted and more far-reaching ramp-up of the hydrogen economy. At the same time, the measures must be implemented promptly to allow the many investment decisions that must be taken to achieve the goals associated with the NWS to be made at very short notice.

The NWR maintains that the following key points for the revisions to the NWS should be implemented in a targeted manner with high priority and as quickly as possible:

- ◆ Creation of a certification and trading system to establish a financially solvent hydrogen market
- ◆ Rapid development and expansion of the hydrogen infrastructure
- ◆ Rapid ramp-up of the availability of climate-neutral hydrogen and its derivatives via domestic production and, in particular, early imports from other European and non-European countries
- ◆ Creation of a coherent (support) framework for the development of sales markets for hydrogen
- ◆ Research and development for a sustainable hydrogen evolution with a focus on the realisation of large-scale and holistic demonstration projects.

## 1 CREATION OF A CERTIFICATION AND TRADING SYSTEM TO ESTABLISH A FINANCIALLY SOLVENT HYDROGEN MARKET

A well-defined, reliable and coherent regulatory environment is a sine qua non for enabling investment security for companies, the creation of a competitive and transparent market and climate protection. A uniform and harmonised European system for the provision of Guarantees of Origin for climate-neutral hydrogen is required in order to establish a regulatory framework that promotes competition and implement the necessary funding instruments for ramping up the hydrogen economy. In addition, a definition of climate-neutral hydrogen and its derivatives that is uniform across all sectors of application as well as the GHG emissions calculation methodology for climate-neutral hydrogen should be established as soon as possible when updating the Renewable Energy Directive. This will enable the rapid ramp-up of climate-neutral hydrogen production and, at the same time, ensure a reduction in GHG emissions. It is expedient to develop a system that replaces the current methodology for defining green power and for GHG accounting and that reflects the aforementioned goals (ramp-up of hydrogen production and climate protection) in a simpler, more market-friendly and more internationally compatible way than it does today. Aspects such as co-processing in existing plants, the additionality of renewable electricity generation and the CO<sub>2</sub> emissions generated in the production of derivatives should be included in the methodology.

These aspects, together with a certification of compliance with other sustainability requirements, will act as a fundamental basis for supply and consumption. The certification systems in EU Member States and non-member states should be established quickly and accepted by every party involved. This is the only way to create the required conditions for a financially solvent hydrogen market.

Establishing market and trading mechanisms with transparent price signals early on will be essential for quickly achieving liquidity and competitiveness. Market mechanisms for initiating balancing and trading via exchanges should already be established during the ramp-up phase in order to lower market entry barriers at an early stage, create fair and equal competitive conditions for everyone and create new income opportunities for hydrogen producers that go beyond subsidies. The rapid ramp-up of a hydrogen economy will be highly dependent on whether there are clear guidelines on how to determine and report the carbon footprint for one tonne of produced hydrogen. Introducing and implementing a uniform certification system for climate-neutral hydrogen is all the more urgent in light of the growing importance of hydrogen for climate protection and as a diversification option. The result should be a certificate that verifies the amount of CO<sub>2</sub> emitted during the production of climate-neutral hydrogen or hydrogen-based derivatives and is recognised and tradable throughout the EU, ideally for imports from outside Europe.

For the critical ramp-up phase, in which the hydrogen infrastructure is gradually being expanded, this certificate should be tradable based on a market-friendly balancing system that generously accounts for the limits of logistical facilities.<sup>2</sup> In order to enable the rapid ramp-up of logistics and value chains, it should be possible to mix climate-neutral hydrogen and its derivatives with non-renewable products in production and transport without these green products losing their green classification – at least in the market phase and as long as no separate grid infrastructure exists.

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<sup>2</sup> As hydrogen and its derivatives will pass through several transport stages (connected and not connected to the grid) during the ramp-up phase, the limits of logistical facilities should be evaluated in generous detail using flat rate CO<sub>2</sub> emissions for average transport distances in the EU in order to create a market-friendly accounting system that is conducive to a ramp-up.

## 2 RAPID DEVELOPMENT AND EXPANSION OF THE HYDROGEN INFRASTRUCTURE

In light of the need to rapidly ramp up the hydrogen economy, quickly developing and expanding the hydrogen infrastructure is imperative, both because of the current geopolitical developments and for helping achieve the climate protection targets. Industry must be ensured a quick access to hydrogen and its derivatives through pipelines, ports and supply chains and by rail, river and road. Storage facilities and depots are indispensable for the ramp-up phase, both as a buffer and for security of supply. At the same time, third-party access to grids and storage facilities must be granted on equal terms.

If a Germany-wide H<sub>2</sub> backbone with international connectivity is to be created by the network operators by 2030 the latest, the necessary framework conditions must be created this year due to the lead times in infrastructure development. This covers all sectors of infrastructure relevant to the transport and storage of hydrogen and its derivatives: the development and expansion of cross-border and national infrastructure for transporting and distributing hydrogen, the construction of import terminals for transport by ship, the integration of storage structures and the expansion of a filling station network.

In order to accelerate the necessary development and expansion of the hydrogen infrastructure and the associated planning and approval processes, the NWR proposes that this development and expansion of the hydrogen infrastructure be classified as serving the overriding public interest and public safety, much like the expansion of renewable energy. The hydrogen infrastructure should be developed not only with a focus on emerging production, import and demand clusters, but also in accordance with the precautionary principle. The strategic development of future import corridors or issues relating to the security of supply, including a practicable solution for handling a strategic hydrogen reserve that will be established in the future, are also things that should be considered during the development process. This generally requires closely coordinated plans that involve the electricity, gas, hydrogen and heating grids, but also stipulate compliance with the climate targets.

Furthermore, it is essential to create security for large private-sector investments in the development of the hydrogen infrastructure by developing suitable and reliable framework conditions at European and national level. The vertical and horizontal unbundling regulations planned at European level will hinder the hydrogen ramp-up and must not be adopted in their current form. The NWR recommends that the German government urgently advocates that those forms of unbundling that have already proven themselves in practice, such as the ITO model, continue to be applied indefinitely in future. It will also be necessary to mitigate the risk associated with the market ramp-up phase – either by immediately including hydrogen in existing cost regulations for natural gas grids or via direct risk hedging by the state.

The expansion of the refuelling infrastructure will be decisive for ramping up the use of hydrogen in road transport. To this end, the Alternative Fuels Infrastructure Regulation (AFIR) is expected to be drafted at the European level this year. In the opinion of the NWR, the German government should push for highly ambitious targets during the negotiations. However, it is already clear that any consensus reached between eastern and western European states, as well as between the Parliament and the Council, will not result in a fully satisfactory expansion of the corresponding infrastructure. The German government should push the expansion forward – in particular, the expansion of the hydrogen infrastructure – at an early stage above and beyond the requirements of the AFIR and across the entire breadth of the industry (35 MPa, 70 MPa, LH<sub>2</sub>), as there will be different applications for the different means of transport.

### 3 RAPID RAMP-UP OF THE AVAILABILITY OF CLIMATE-NEUTRAL HYDROGEN AND ITS DERIVATIVES VIA DOMESTIC PRODUCTION AND, IN PARTICULAR, EARLY IMPORTS FROM OTHER EUROPEAN AND NON-EUROPEAN COUNTRIES

In order to be able to meet the increasing and high demand for climate-neutral hydrogen and its derivatives, the NWR believes that a key focus when revising the NWS should be a rapid ramp-up of hydrogen volumes. This will require both an expansion of domestic production and parallel development of sustainable international trade partnerships for importing climate-neutral hydrogen and its derivatives, including the corresponding transport infrastructure. Expanding production, infrastructure, supply chains and demand in parallel, while taking account of their interdependencies, will be a particular challenge here.

The massive expansion of renewable energies announced by the German government in its Easter Package will provide the fundamental basis for the domestic production of climate-neutral hydrogen. During the initial ramp-up phase, it must also be possible to expand generation capacities close to where the hydrogen will be used as the hydrogen grid will only gradually connect industrial centres. Therefore, in order to secure the supply, it must be possible to operate electrolyzers locally and economically with a high number of annual full load hours.

However, domestic production will not be enough on its own. Germany will continue to be dependent on energy imports in future. In anticipation of a very strong increase in the demand for hydrogen as early as the mid-2020s, international value chains and how they are interlinked must be strategically pushed forward in the decisions being made now. This concerns both European and international partnerships. It is necessary to plan and expedite the expansion of the hydrogen economy to a greater extent on a European level, especially in light of the new framework conditions. In particular, the regions in southern Europe and those bordering the North, Baltic, Mediterranean and Black Seas can be developed into large-scale suppliers of climate-neutral hydrogen relatively quickly.

Furthermore, international trading partnerships with new supply regions for hydrogen and its derivatives have the potential to contribute to efforts to replace fossil fuels and to greater diversification of Germany's energy supply regions. In this context, the focus should also be placed earlier on regions that offer good local conditions and sufficient energy production capacities without the risk of competition for use. For example, H2Global or H2Diplo could be used to facilitate competition-based production and import of green products in partner countries and thereby support the development of value chains, trade and infrastructure.

Analogous to the European REPowerEU plan, the German government should also supplement the domestic expansion targets of 10 GW with an import target based on the increased demand for hydrogen. This should be done in order to quickly establish international supply chains and develop a procurement strategy. The competitiveness of German industry will also be dependent on countries that are willing to make investments and take risks as first movers. The requirements show that both domestic and foreign production will be needed in order to reach a state of degression and ensure that all possibilities to reduce costs are exploited.

## 4 CREATION OF A COHERENT (SUPPORT) FRAMEWORK FOR THE DEVELOPMENT OF SALES MARKETS FOR HYDROGEN

The ramp-up of applications for hydrogen must be accelerated despite the increased uncertainties on the energy markets, and efforts must be made to ensure that investment projects are now implemented as planned as quickly as possible. This makes it all the more important to create a coherent support system and framework for action in order to stimulate the market ramp-up along the entire value chain and within various market roles. To promote the development of hydrogen value chains, consistent, differentiated and legally robust funding instruments must be created which accompany the high levels of investment that will be required from the private sector.

A key role will be played by the application technologies in which CO<sub>2</sub> emissions can be quickly reduced on a large scale with the help of hydrogen and which also feature a high level of abatement efficiency. Availability issues and, where relevant, competing uses must be addressed at an early stage, including the question of whether and how natural gas can be secured as a flexible option. An overriding priority among the main instruments that must now be implemented as quickly as possible is the long overdue IPCEI decision in relation to the Guidelines on State aid for climate, environmental protection and energy (CEEAG) without any reduction in the available subsidies. These guidelines must be compatible with carbon contracts (CCs), which play a key role in the area of industrial application.

The CCs should be designed in such a way that subsidised plants can also remain competitive internationally. As long as the CCs are designed according to the approach taken with Carbon Contracts for Difference, it is imperative that they are accompanied by effective carbon leakage protection. If this cannot be realised at EU level, it will have to be compensated for by adjustments to the CCs.

The CCs should be embedded in a clearly defined concept for the creation of lead markets for energy-intensive raw materials in order to reduce state subsidies and even fully replace them in future. This will only be possible if definitional problems can be resolved (creating transparency for tracing the CO<sub>2</sub> footprint, establishing a labelling system for climate-friendly raw materials) and instruments can be identified with which a green premium can be realised on the markets. Attention must be paid here to ensuring compatibility with international initiatives at a European and global level. Germany should take on a pioneering role internationally in the creation of green leading markets.

Due to its current costs, the transport sector – and especially its divisions involving road freight transport – is also suitable as an entry market for establishing a hydrogen value chain in Germany that has a target of up to 500,000 tonnes of largely climate-neutral hydrogen by the year 2030. In order to accelerate the development of this sector, it will be necessary to support and fund fully integrated pilot projects on a large scale along the value chain. These should include both truck and rail transport. Using liquid hydrogen and accelerating the use of synthetic fuels based on climate-neutral hydrogen in the aviation sector will require demonstration programmes.

The role of hydrogen in the heating market must be addressed to a greater extent in the revisions to the future hydrogen strategy than it was in the previous version. The initial results of the 'Bottom-up study on possible paths for efficient and socially acceptable decarbonisation of the heating sector' conducted by the Fraunhofer Institutes ISE and IEE show that hydrogen, along with heat pumps and heating grids, is one of the technological options necessary for decarbonising the heating market. This is why the solution space for the heating transition based on local factors must be open to all types of technology.

Therefore, the grid-based supply of climate-neutral H<sub>2</sub> is an important building block for achieving medium-term and long-term climate goals in the heating market. The revision should thus consistently address the issue of H<sub>2</sub>-readiness both with respect to heat generators and also the necessary grid infrastructure.

Funding instruments to support private-sector investments in the development of sales markets for hydrogen must be adapted over time in line with the ramp-up of the national and international hydrogen economy and their individual states of maturity. Due to lacking structure and still high costs, there have not yet been any business cases that would offer companies long-term investment security. Nevertheless, the 2030 climate targets are so ambitious that they will not be achieved by a large margin without the widespread use of hydrogen. The NWR maintains that the funding instruments mentioned are thus also imperative even beyond 2024. These must be greatly simplified and become much quicker to implement than the current concepts, such as the IPCEI and so on.

## 5 RESEARCH AND DEVELOPMENT FOR A SUSTAINABLE HYDROGEN EVOLUTION WITH A FOCUS ON THE REALISATION OF LARGE-SCALE AND HOLISTIC DEMONSTRATION PROJECTS

The aim of revising the NWS must be to focus research and development activities on the already prioritised topics that promote industrial implementation. Developing new technologies for the industrial production of hydrogen systems and material concepts to boost their performance, while taking into account safety issues and resource efficiency, is necessary in addition to basic research. In this context, it is particularly important to solve technological challenges that may arise as the industry is being transformed. In addition to developing investment and planning security and industrial implementation in manufacturing processes, as well as any conversions needed as a result, it will therefore be necessary to develop new technological approaches and upscale them without significantly interrupting essential industrial processes. At the same time, quickly implemented pilot and reference projects that are based on technologies, boasting great potential to increase economic efficiency and scalability, and are carried out on an industrial scale, are both necessary and of vital importance. It is also crucial that the funding for research and development is sustainable and long-term in order to initiate a long-lasting evolution of the hydrogen industry and ultimately develop a functioning hydrogen economy.

In addition, education and training of necessary specialists must be comprehensively addressed both at the university level and in the area of vocational training. Maintaining an overview of the requirements and implementation measures is recommended. Making sure that uniform standards and all those issues of the technological or of another nature, are holistically covered, beginning with what is already being offered today.



## THE GERMAN NATIONAL HYDROGEN COUNCIL

On 10 June 2020, the German Federal Government adopted the National Hydrogen Strategy and appointed the German National Hydrogen Council. The Council consists of 26 high-ranking experts in the fields of economy, science and civil society. These experts are not part of public administration. The members of the National Hydrogen Council are experts in the fields of production, research and innovation, industrial decarbonisation, transportation and buildings/heating, infrastructure, international partnerships as well as climate and sustainability. The National Hydrogen Council is chaired by former Parliamentary State Secretary Katherina Reiche.

The task of the National Hydrogen Council is to advise and support the State Secretary's Committee for Hydrogen with proposals and recommendations for action in the implementation and further development of Germany's National Hydrogen Strategy.

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