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Report of the Federal Government on the Implementation of the National Hydrogen Strategy



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Report of the Federal Government on the Implementation of the National Hydrogen Strategy

The National Hydrogen Strategy – one year on

The Federal Government adopted the National Hydrogen Strategy on 10 June 2020 with a view to establishing green hydrogen and its derivatives as a key enabling technology for the energy transition via a rapid market roll-out and thus to make a major contribution towards the attainment of the climate targets.

The Federal Government has moved quickly to implement the Strategy, putting in place key factors for private-sector investment and for research initiatives. These are helping to make Germany a pioneer and technological leader. One important measure was the launch of the Important Projects of Common European Interest (IPCEIs) in the field of hydrogen. This has entailed the selection of 62 large-scale hydrogen projects for which a total of €8 billion is being provided by the Federation and the federal states (Länder). A special focus has been placed on the industrial and transport sectors. The focus is particularly on the steel sector, as the decarbonisation of the steel industry is an important field of action for the German economy. The Steel Action Concept proposes an overall framework for this. The launch, scheduled for 2022, of funding for industrial transition projects via carbon contracts for difference is also intended to make a major contribution towards this.

The decision to exempt the production of green hydrogen from the EEG surcharge¹ is also of special significance for the cross-sectoral roll-out, as it will help to reduce the costs of the production of green hydrogen. The revision of the Energy Industry Act in the summer of 2021 has put the first regulatory basis in place for a pure hydrogen grid infrastructure.

In the field of energy research, the “Hydrogen Technologies 2030” research campaign has been launched in order to pool the Federal Government’s research measures. In this context, several projects have already been started in order to support the move from research and development to practical applications (e.g. the H2Giga, H2Mare and TransHyDE lead projects, and in the context of the Living Labs for the Energy Transition). Also, the H2-Compass project has laid the foundation stone for the preparation of the hydrogen roadmap for the research work of the Federal Government.

In the international sphere, the Federal Government has launched several funding measures and initiatives in order to promote the import of green hydrogen from outside Europe (e.g. projects in Saudi Arabia and Chile) and to improve the prospects of German technology leaders on for-

1 Parts of this measure are still subject to authorisation by the European Commission in accordance with State aid rules.

oreign markets. Before the end of 2021, auctions are to begin for the H2-Global funding instrument in order to incentivise investments in production facilities for green hydrogen and its derivatives on an industrial scale outside the EU, along with the related supply chains to Germany. Also before the end of 2021, funding is to go towards investment along the value chain outside Europe via an investment funding guideline.

The great response to the Federal Government's activities from the business and research communities, and the numerous ideas for projects, show that the hydrogen roll-out has started well and that there is a high level of willingness to invest. The Strategy has established a coherent framework for action in this first market ramp-up phase. It basically relies on the instruments of funding, an appropriate energy-policy and regulatory environment, and carbon pricing. Specifically, the Strategy contains an Action Plan with a broad mixture of 38 measures. The Federal Government allocated a total of €9 billion for this in the June 2020 stimulus programme.

Roughly a year after the adoption of the Strategy, the time is ripe for a first interim assessment. The monitoring report envisaged by the Strategy will provide a comprehensive review next year.

Integrated projects lay the foundation stone for the market roll-out

In the first phase of the market roll-out, it is necessary to fund integrated projects, i.e. projects which embrace the entire hydrogen value chain.

Here, the IPCEI on Hydrogen is of central importance. The call to propose related investment projects met with an unusually high response from the German business community. Out of a total of 230 project outlines, 62 projects with planned investment totalling around €33 billion have been selected.

The IPCEI projects relate to the Strategy targets in multiple ways: they could help to create electrolysis capacity of more than 2 gigawatts (GW) by 2030 (Strategy target: 5 GW). In the field of infrastructure, an initial hydrogen network of roughly 1,700 km could be built. In the industrial sector, 16 projects have been selected which primarily focus on low-carbon steel production and the necessary transition in the chemicals industry. Further to this, twelve mobility projects have been selected which can make a major contribution towards the (further) development and manufacture of fuel cell systems, hydrogen-powered vehicles and the establishment of a hydrogen fuelling infrastructure.²

An improved environment for investment: cutting production costs and expanding infrastructure

In addition to providing funding, the Federal Government is also looking to put a supportive policy environment in place in order to foster the market ramp-up.

For example, the Federal Government has targeted barriers which exist in the field of electricity costs, as these are a major factor in the production

² The projects will be launched following approval by the European Commission.

costs and thus affect the competitiveness of green hydrogen. To this end, the 2021 Renewable Energy Sources Act has introduced additional exemptions from and limitations to the EEG surcharge.³

Infrastructure such as pipelines is a necessary precondition to transport the hydrogen from the producer to the user. In view of the long lifetimes and high investment involved in such infrastructure, it is important to establish in good time an appropriate policy environment which offers certainty for investment. For this reason, the revision of the Energy Industry Act introduced transitional regulations for the conversion of existing gas pipelines to pure hydrogen pipelines, and entry rules for the regulatory treatment of pure hydrogen networks. These create certainty for planning and investment in hydrogen networks. These policies are to be developed further, not least in response to developments at European level.

Fields of application

In order to cushion the currently higher costs of green hydrogen in particular and thus to foster a rapid market roll-out, the Federal Government has, for instance, set up various funding programmes for an expedited decarbonisation of industry, or is in the course of drafting these programmes; examples include the Decarbonisation of Industry funding programme (launched in January 2021) and the funding for carbon contracts for difference (launch planned for 2022). Here, the steel industry is an important field of application: the Steel Action Concept of July 2020 provides an overall picture of how decarbonisation of the

sector can succeed in the coming years. Further to this, consideration is currently being given to a demand quota for climate-friendly basic materials, such as green steel.

In the first phase of the roll-out, the focus is primarily on deploying hydrogen firstly in fields which are close to economic viability, whereby it is necessary to avoid the emergence of unsustainable path dependencies, and secondly in areas where no other options exist, e.g. in the steel sector, basic chemicals, and parts of the transport sector. Given good availability, hydrogen could also play a role in other areas in future. For example, the possible contributions of hydrogen and its derivatives to decarbonise parts of the heat market are being discussed.

Supporting the roll-out of hydrogen in parts of the transport sector

Hydrogen and its derivatives are an important building block for the decarbonisation of transport, particularly in areas in which battery-driven engines are not suitable, especially heavy-duty commercial vehicles such as buses or trains, in the air, on water, and possibly also in the road haulage sector.

On the basis of the interministerial National Hydrogen and Fuel Cell Technology Innovation Programme (NIP), the Federal Government has since 2006 been funding applied, industrial R&D and investment in the purchase of fuel cell applications. In the field of market activation, furthermore, funding guidelines have been drawn up for

3 Parts of this measure are still subject to authorisation by the European Commission in accordance with State aid rules.

the procurement of commercial vehicles, trains and buses with alternative propulsion, including fuel cell vehicles. In the context of the National Hydrogen and Fuel Cell Technology Innovation Programme, the HyLand - Hydrogen Regions in Germany competition was successfully continued in 2021 with two calls. In addition to vehicles, electricity-based fuels (PtX) are also addressed. To this end, an overall funding concept for renewable fuels was drawn up; alongside development and demonstration projects, it promotes installations to produce renewable fuels. A further element is support for the fuelling infrastructure in the context of various funding programmes.

In the transport sector, too, the Federal Government – in addition to funding programmes – has prioritised the design of the regulatory environment. The statutory greenhouse gas reduction rate for fuels, which not least regulates the deployment of PtX fuels based on green hydrogen, has put an important factor in place for the ramp-up of hydrogen. The decision to impose a 25% reduction rate up to 2030 means that Germany is clearly overfulfilling the European requirements in the Renewable Energy Directive (RED II).

R&D supports the roll-out of green hydrogen and the technology sector in Germany

German industry and research institutions are playing a pioneering role in the global development of green hydrogen technologies. Further efforts in the field of R&D are necessary if this lead is to be maintained and the long-term competitiveness of German firms safeguarded. The

Federal Government was quick to establish an efficient research landscape for hydrogen. This has been expanded and deepened in the course of implementing the National Hydrogen Strategy.

Various research activities have been pooled together in the newly established interministerial Hydrogen Technologies 2030 research campaign – from basic research, for example in the Hydrogen Republic Germany competition for ideas, to applied energy research in the Hydrogen Technology Campaign, and testing on an industrial scale in the Living Labs for the Energy Transition. Since 2020, three lead hydrogen projects (H2Giga, H2Mare and TransHyDE) have been launched, as well as four Living Labs which firstly deliver technological innovations on core issues of the hydrogen economy and secondly demonstrate the possibilities offered by the use of hydrogen in practice. Further to this, initiatives for the transport sector are taking place under the umbrella of the research campaign, with several research alliances on electricity-based and synthetic fuels.

In order to identify the future need for R&D and to target it towards a rapid market ramp-up, a hydrogen roadmap is to be drawn up for the research sector. The H2-Compass project, which was launched in June 2021, will lay the foundation stone for this. Furthermore, the Energy Research Network Hydrogen has been set up to give the experts a technology-neutral, interdisciplinary forum on hydrogen.

Anchoring the national ramp-up of green hydrogen at European and international level

The long-term goal of the National Hydrogen Strategy is to establish an efficient market for green hydrogen in Germany and to anchor this in the global context in order to permit and safeguard imports and trade. This is because Germany will not be able, even in the long term, to meet all its demand itself, but will continue to rely on imports.

Several funding measures and initiatives have been launched in the international sphere in order to implement the Strategy. For example, H2Global, with roughly €900 million in funding, is to incentivise the production of green hydrogen and its derivatives outside the EU whilst also promoting the use of the imported green hydrogen and its derivatives in Germany, with the state offsetting for a limited period the difference between the foreign purchasing price and the domestic selling price in a double auction mechanism. A funding guideline is to provide non-repayable grants towards investment along the hydrogen value chain outside Europe. H2Uppp is designed in particular to support German and European SMEs with measures to help prepare and support hydrogen pilot projects abroad. This is to take place in coordination with the Energy Export Initiative. Also, several specific hydrogen projects have been launched abroad with German funding (e.g. Saudi Arabia, Chile, Tunisia). Hydrogen will increasingly be anchored as a focal issue for cooperation in existing and future energy partnerships, and it also offers a great deal of potential in the context of German development cooperation. In addition to this, various bilateral agreements on

hydrogen cooperation have been concluded since the adoption of the National Hydrogen Strategy, e.g. with Australia and Namibia. Further initiatives, such as agreements on scientific and technical cooperation and the international climate action initiative, are also driving the issue forward at international level. In addition, the dialogue on the opportunities offered by green hydrogen for a sustainable economy in countries which export fossil fuels is particularly important in geopolitical terms.

Hydrogen is also a central issue for the future of the European energy transition. The focus is on the establishment of a European hydrogen market and cross-border hydrogen infrastructure. In the field of regulation, the Fit-for-55 package of the European Commission will set out key policies in the near future, e.g. on hydrogen infrastructure, sustainability criteria, uniform certification and classification standards, and the rules on funding. During its Council Presidency, Germany laid the foundations at the end of 2020 for a targeted European debate, for example by adopting Council conclusions on hydrogen and launching the agenda process on research and innovation for green hydrogen.

Continuing the ramp-up of green hydrogen

The adoption of and the implementation of the first measures in the National Hydrogen Strategy has given a strong fresh boost to the hydrogen economy, and this has attracted much attention around the world. This momentum needs to be used, and the next steps to facilitate the ramp-up of green hydrogen and the ongoing implementa-

tion of the Strategy need to be taken. An important advisory role here is played by the National Hydrogen Council set up by the Federal Government. This body has become established as a recognised voice and source of momentum via its position papers and publications (e.g. the recent Hydrogen Action Plan for Germany 2021 – 2025).

Hydrogen is an issue which is developing dynamically. For this reason, it will be important in the coming months not least to examine the National Hydrogen Strategy for any need for further development, and to take account of current market developments, experience from the funded projects and the new policy environment resulting

from the more ambitious targets set out in the 2021 Climate Action Act. Also, the policy environment at European level should be designed in a way that gives investors a reliable basis on which to plan and – taking consumer interests into account – a business environment which is globally competitive.

The initiatives taken so far by the Federal Government to implement the 38 measures in the Strategy's Action Plan are presented in detail in the following overview (annex).

Annex to the report: implementation status of the National Hydrogen Strategy (NHS)

Measures of the National Hydrogen Strategy (abridged version)

Implementation status
(as at: 31 August 2021)

Part I: Measures at national level

I.1 Integrated projects along the value chain

NHS Measures

In the phase of the market roll-out, it is crucial to fund integrated projects, i.e. projects which embrace the entire value chain (production, transport, use).

The funding of integrated projects is a horizontal measure; it is therefore not presented in the National Hydrogen Strategy Action Plan as a specific “measure”, but is particularly to be found in measures 25 and 31.

Implementation status

A central role is played here by the Important Projects of Common European Interest (IPCEIs) in the field of hydrogen. Out of 230 proposals, 62 projects (with planned investment totalling €33 billion, and funding requests for €10.5 billion) have been preselected. They include electrolysis projects totalling more than 2 GW, and make it possible to build up an initial hydrogen network with 1,700 km of pipelines. On the user side, the focus is chiefly on the decarbonisation of the steel and chemical industries. In the field of mobility, the focus is on the industrial ramp-up of fuel cell systems, hydrogen-powered vehicles and the establishment of a hydrogen fueling infrastructure.

The establishment of integrated projects is also being encouraged via the Hydrogen Republic Germany competition for ideas (funding: more than €700 million). This includes the following lead projects: H2Giga (development of approaches and technologies for the serial and automated production of electrolyzers), H2Mare (research into offshore production of green hydrogen and PtX products) and TransHyDE (development, assessment and demonstration of technologies to transport hydrogen). Many of the projects were launched on 1 April 2021.

I.2 Hydrogen production

NHS Measure 1

The aim is to improve the policy environment for the production of green hydrogen, particularly with a view to an appropriate design of state-induced price components of energy carriers.

Consideration must be given in particular to reforms of state-induced price components; at the same time, carbon pricing is to be established as a central steering instrument. It will also be necessary to see whether it might be possible to largely exempt the production of green hydrogen from taxes, levies, and surcharges. In particular, the aim is to exempt the production of green hydrogen from the EEG surcharge.

Implementation status

The 2021 revision of the Renewable Energy Sources Act implemented the central element of Measure 1 by adapting the EEG surcharge, which is a central cost barrier to the ramp-up of green hydrogen, as follows:

- introduction of additional exemptions from and limitations to the EEG surcharge in the 2021 Renewable Energy Sources Act;
- stipulation of the requirements for the full exemption from the EEG surcharge for the purchase of electricity to produce green hydrogen via a revision of the Renewable Energy Sources Ordinance; expansion of the group of companies eligible for the exemption (some changes subject to confirmation under State aid rules).

NHS Measure 2

This focuses on new business and cooperation models for electrolyser operators and electricity and gas grid operators in line with the principle of regulatory unbundling. Here, approaches that could significantly ease the burden on the grids at an affordable price without distorting the hydrogen market are to be tested in the form of one or two model projects, and the need for changes to the regulatory framework is to be examined.

Implementation status

To this end, the Federal Ministry for Economic Affairs and Energy has launched a discussion process with other EU Member States, thus starting the implementation of this measure.

The testing of model projects is also taking place in the context of the Living Labs for the Energy Transition.

NHS Measure 3

As part of our Climate Action Innovation Pact, we are supporting the switchover to hydrogen in the industrial sector by providing funding for investments in electrolysers (implementation from 2020, cf. Measure 14). We are also exploring potential tendering schemes for the production of green hydrogen, e.g. to help decarbonise the steel and chemical industries. If necessary, the financing that has been earmarked for the National Decarbonisation Programme will be topped up.

Implementation status

The establishment of electrolysers will largely be funded under the IPCEI projects. This could incentivise electrolysis capacity of up to 2.2 GW by 2026 (and possibly more than 3 GW by 2030). In addition, there is more than 2 GW of electrolysis capacity in the petrochemical sector which could be incentivised via the implementation of Renewable Energy Directive II (RED II).

NHS Measure 4

Offshore wind energy is an attractive technology for the production of renewable electricity and green hydrogen. The framework for this is being developed further to ensure that these investments pay off. Discussions will focus, for example, on the designation of additional sites that can be used for offshore production of hydrogen / PtX, the infrastructure necessary for this, and the potential for additional auction rounds for the production of renewables.

Implementation status

The Ordinance on Auctioning Sites for Alternative Energy Generation in the Exclusive Economic Zone is to be adopted before the end of 2021. In the other fields of energy production in the exclusive economic zone, it is to be possible not least to realise offshore electrolysis projects. Also, the Federal Ministry for Economic Affairs and Energy will set up a new programme to fund offshore electrolysis.

The offshore production of hydrogen will also be advanced via research projects of the Federal Ministry of Education and Research.

I.3 Transport**NHS Measure 5**

The use of green hydrogen for the production of fuel and as an alternative to conventional types of fuel is to be embedded as part of a swift and ambitious transposition of the EU's RED II into German law (implementation in 2020).

Implementation status

The Act to Further Develop the Greenhouse Gas Reduction Rate in the context of the revision of the Federal Immission Control Act of May 2021 implements RED II in national law in Germany in the transport sector. The stipulation of a greenhouse gas reduction rate of 25% for fuels by 2030 clearly overfulfils the EU requirements. This creates significant incentives for the production and deployment of green hydrogen and hydrogen-based fuels in transport. This fully implements Measure 5. The act is to be promulgated in September and enter into force on 1 October 2021.

NHS Measure 6

The funding measures under the National Innovation Programme for Hydrogen and Fuel Cell Technology (NIP) will continue. The additional funding (€3.6 billion) available from the Energy and Climate Fund (ECF) until 2023 creates greater scope, also for hydrogen and fuel cell technology. →

Implementation status

In the field of market activation, the last calls of the National Hydrogen and Fuel Cell Technology Innovation Programme covered areas like funding for the procurement of fuel-based waste collection and street cleaning vehicles, green intralogistics and car fleets, and the establishment of electrolyser installations to produce hydrogen for the transport sector. →

- Market activation to boost investment in hydrogen-powered vehicles (light and heavy-duty commercial vehicles, buses, trains, inland and coastal navigation, car fleets).
- R&D activities with the objective of achieving further cost reductions (e.g. for utility vehicles, small aircraft).
- HyLand – Hydrogen Regions in Germany, as a three-tiered approach for the development, finetuning and implementation of integrated regional hydrogen concepts. The plan is to extend this funding strategy that was successfully implemented in 2019.

NHS Measure 7

Development of and funding for installations for the production of electricity-based fuels, in particular electricity-based kerosene, and advanced biofuels. For this measure, €1.1 billion from the Energy and Climate Fund (ECF) has been earmarked until 2023.

Note: The funding measures also take account of the fact that the supply of electricity-based synthetic fuels for special vehicles and vehicles which serve the defence of the country and the Alliance as well as corresponding international obligations of the Federal Republic of Germany must be safeguarded. Interoperability between NATO and other Alliance partners must be upheld.

In spring 2021, the Federal Ministry of Transport and Digital Infrastructure continued its regional funding programme HyLand – Hydrogen Regions in Germany. The first calls, HyStarter and HyExperts, met with a great response from regions and municipalities; the application phase for the HyPerformer category is to begin at the end of 2021.

The Federal Ministry of Transport and Digital Infrastructure has also published technology-neutral funding guidelines, including first calls for proposals, for buses, commercial vehicles and trains with alternative propulsion.

Implementation status

The Federal Ministry of Transport and Digital Infrastructure has drawn up an overall funding concept for renewable fuels in order to support the development and production of advanced biofuels and electricity-based fuels. Approx. €640 million is earmarked for applied development and demonstration projects and for innovation clusters. A first funding guideline for the development of regenerative fuels was published in May 2021; also, there was a competitive call for bids in August 2021 for the construction and operation of a development platform for power-to-liquid fuels.

Further to this, the Federal Ministry of Transport and Digital Infrastructure is providing €900 million towards installations to produce renewable fuels. The funding guideline for investment to retrofit or build new production plants for advanced biofuels and electricity-based fuels is to be published in the second half of 2021; a further funding guideline is currently being drafted to cover the market roll-out of electricity-based kerosene. A non-binding market test procedure for this was launched in August 2021.

NHS Measures 8 and 22

Measure 8: Funding is being provided for the coordinated construction of a needs-based fuelling infrastructure for vehicles, including heavy-duty road haulage vehicles, local public transport and in local passenger rail services (cf. Measure 20). The Energy and Climate Fund contains €3.4 billion in grants for the construction of fuelling and charging infrastructure up to 2023; it may be the case that the provision of funding for the hydrogen infrastructure can be brought forward. Under its 2030 Climate Action Programme, the Federal Government wants to develop concepts for the construction of hydrogen fuelling stations for commercial vehicles. As part of the efforts to promote the use of green hydrogen in heavy-duty road haulage, the network of hydrogen fuelling stations will be quickly expanded.

Measure 22: Special attention is being given to a needs-based expansion of the network of hydrogen fuelling stations in road transport, at suitable locations within the railway network, and on the waterways. Individual users and fleet operators of vehicles with hydrogen or fuel cell propulsion are being targeted.

NHS Measure 9

Advocacy for an ambitious development of the European infrastructure facilitating cross-border transport powered by fuel cells; recast of the European Alternative Fuels Infrastructure Directive (AFID) (implementation begins in 2021).

Implementation status

The expansion of a needs-based public fuelling infrastructure is being implemented via calls for funding in the context of the National Hydrogen and Fuel Cell Technology Innovation Programme. Building on a basic network for cars and light commercial vehicles, the focus at present is on hydrogen fuelling stations for heavy-duty commercial vehicles.

In addition to this, a project has been selected in the IPCEI on Hydrogen to build up a hydrogen fuelling station infrastructure for the transport sector. The funding guidelines for the procurement of fuel cell vehicles also cover aspects of funding for the establishment of the fuelling infrastructure and hydrogen production (cf. Measure 6). The implementation of the Overall Concept for Climate-friendly Commercial Vehicles is steering the establishment of a fuelling and charging infrastructure for commercial vehicles which is coordinated with the roll-out of the vehicles.

Implementation status

The proposal for a revision of the AFID and its conversion to a Regulation (AFIR) is currently being discussed in the EU Council. The draft regulation provides for an obligation for Member States to ensure binding, distance-based and site-based targets for the expansion of hydrogen fuelling infrastructure.

NHS Measure 10

Support for the establishment of a competitive supply industry for fuel cell systems including an industrial basis for large-scale fuel cell stack production for vehicle applications. Exploration of the possibility of creating a centre for hydrogen technology and innovation to facilitate the emergence of vehicle platforms for fuel cell drivelines and support for the establishment of a German fuel cell systems supplier for logistics/intralogistics.

Implementation status

The Federal Ministry of Transport and Digital Infrastructure launched a competition for the site for a hydrogen innovation and technology centre at the end of 2020. The centre is to offer a development and standardisation platform, primarily for SMEs and medium-sized suppliers. Four sites were selected for the implementation: Chemnitz, Peffershausen, Duisburg and a northern German cluster of Bremen/Bremerhaven, Stade and Hamburg.

NHS Measure 11

Target-driven transposition of the Clean Vehicles Directive (CVD) to support zero-emission vehicles in local transport.

Implementation status

The revised EU CVD of 2019 introduces mandatory minimum targets for the public procurement of low- and zero-emission vehicles, including buses, in local public transport. To implement this, the Clean Vehicles Procurement Act entered into force on 15 June 2021.

NHS Measure 12

Advocacy for a carbon-based differentiation of the truck toll with reduced rates for climate-friendly drivelines under the Eurovignette Directive.

Implementation status

With a view to differentiating the truck toll in line with carbon emissions, the European Commission, European Council and European Parliament reached a provisional agreement in the summer of 2021 on a new Eurovignette Directive. Final adoption at EU level has yet to take place. This establishes the basis for implementing Measure 12.

NHS Measure 13

Advocacy for an international harmonisation of standards for mobility applications for hydrogen and fuel-cell-based systems (e.g. fuelling standards, hydrogen quality, official calibration, hydrogen-powered car type approval, licensing for ships, etc.).

Implementation status

The harmonisation of standards for mobility applications is an ongoing process. The Federal Ministry of Transport and Digital Infrastructure plays an active role, e.g. via the federal programme company NOW GmbH, in the bodies of the relevant institutions (e.g. DIN, ISO, IPHE, CEN and CENELEC) on the development and updating of the rules.

I.4 Industrial sector

NHS Measure 14

International competition makes it impossible to pass on the cost of investment in zero-carbon technologies to the customer in full. This is why the Federal Government is rewarding the switchover from fossil-fuel technologies that come with inherent emissions to industrial processes that are low in greenhouse gas emissions or even climate-neutral; a central role is played by the switch to hydrogen, particularly in the steel and chemical industries. Funding programmes: Decarbonising the Industrial Sector funding programme, and the programmes for Hydrogen Use in Industrial Production (2020 – 2024) and Avoiding and Using CO₂ in Industries Relying on Base Substances.

NHS Measure 15

As part of the efforts to move to climate-friendly industrial procedures, Germany is not only providing investment grants, but also supporting the use of electrolyzers. For this purpose, the Federal Government will launch a new pilot programme entitled Carbon Contracts for Difference (CCfDs), which primarily targets the steel and chemical industries and their process-related emissions. Once the pilot phase has been successfully completed, it will be possible to expand this type of instrument to other industrial sectors. We are aiming for close coordination with the European Commission.

NHS Measure 16

The Federal Government wants to encourage work to explore solutions as to how the markets for climate-neutral and recycled products can be boosted in energy-intensive industries. A demand quota for climate-friendly base substances, e.g. green steel, is being considered. Such measures would require a clear and ambitious label to mark out the more climate-friendly or sustainable intermediate and finished products in a way that is easy to understand.

Implementation status

Via the Decarbonising the Industrial Sector funding programme, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has been supporting energy-intensive industry on the path to greenhouse gas neutrality since January 2021.

The Hydrogen Use in Industrial Production programme is currently funding the industrial applications of the IPCEI on Hydrogen.

The funding guideline for the Avoiding and Using CO₂ in Industries Relying on Base Substances programme is currently being notified to the European Commission.

Implementation status

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is currently developing a funding programme for CCfDs in dialogue with industry; it is to be launched in 2022. The CCfDs are to offset the higher operating costs of low- and zero-GHG processes.

Funding totalling approx. €3 billion is available up to 2024 for the funding programme and the planned CCfDs.

Implementation status

The Federal Ministry for Economic Affairs and Energy is examining a range of instruments to boost demand for climate-friendly base substances (e.g. steel) and to establish corresponding markets. These include e.g. labelling to increase product transparency (e.g. regarding the GHG footprint) and product-specific demand quotas (e.g. for green steel).

NHS Measure 17

Develop hydrogen-based long-term decarbonisation strategies together with stakeholders – particularly from the energy-intensive industries – within sector-specific dialogue formats. The focus is on the following sectors:

- chemicals
- steel
- logistics
- aviation

Implementation status

Stakeholders have been involved via the sectoral dialogues on chemicals, steel, infrastructure and electrolysis technologies, and in an expert dialogue on PtX technologies and applications. The Steel Action Concept is the Federal Government's first ever overarching industrial policy concept for the steel sector, setting a comprehensive framework for the decarbonisation of a sector and including the following measures:

- the long-term safeguarding of carbon-leakage protection for the steel and other energy-intensive industries in Germany and Europe
- facilitation of the switch to low-carbon (and, going forward, to zero-carbon) steel production
- levelling the playing field for German and European steel-makers on the global steel market
- In addition, May 2021 saw the launch of the German Chemical Industry Association's Chemistry4Climate platform, with funding from the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: it is to draw up a specific path to the transformation of the chemical industry.
- In the continuation of the sector-specific dialogue formats with further energy-intensive industries, the focus will be placed on the efficient use of hydrogen and hydrogen-based CCU (carbon capture and utilisation) processes

I.5 Heat

NHS Measure 18

As far as the building sector (residential and non-residential property) is concerned, we have had our Energy Efficiency Incentive Programme for highly-efficient fuel cell heating systems in place since 2016. The Federal Government will continue to provide this funding and, if necessary, top it up. Furthermore, the scope of application of this funding is being assessed with a view to expanding it. For the period from 2020 to 2024, up to €700 million has been earmarked within the Energy Efficiency Incentive Programme and the future Federal Compensation Act, and this money can also be used for funding fuel cell heating systems.

Implementation status

In order to implement Measure 18, the established KfW funding for the installation of innovative fuel cell heating equipment into existing residential and non-residential buildings was expanded in February 2021, and the maximum funding per unit was raised. In the dialogue “Climate-Neutral Heating in 2045”, the Federal Ministry for Economic Affairs and Energy discussed with experts, stakeholders and the public about ways to decarbonise the heating sector, including the role of green gases.

NHS Measure 19

With a view to strengthening the long-term shift of the heating sector towards the use of renewables, the Federal Government is looking at ways to provide funding for the hydrogen readiness of installations under the Combined Heat and Power Act (CHP Act).

Implementation status

The CHP Act is to be evaluated in 2022, and this will include consideration of whether the hydrogen readiness of CHP installations can be introduced as a condition for funding.

I.6 Infrastructure/supply

NHS Measure 20

The long-term need for action within this transformation process is being assessed together with the stakeholders and a report compiled, complete with recommendations for action. This means that the possibilities for using existing structures (dedicated hydrogen infrastructure as well as hydrogen readiness of parts of the natural gas infrastructure), from the supplier to the consumer, need to be discussed and initiated in good time. The same applies for possibilities to re-dedicate and re-use pipelines, etc. The necessary regulatory basis for a hydrogen infrastructure will be prepared swiftly. For this purpose, a market exploration procedure will take place shortly.

Implementation status

The revision of the Energy Industry Act has established a regulatory basis for operators of hydrogen networks in order to give them a secure basis for planning and investment until a European framework is rolled out. In addition to optional rules, e.g. on unbundling, grid connection and access, and cost-based fee formation, the revision also includes transitional rules, especially on the transfer of existing permits when gas pipelines are switched to hydrogen. The national implementation of the EU’s Gas and Hydrogen Market Decarbonisation Package, which has been announced for the end of the year, is likely to replace the first national regulatory framework in the mid-2020s. →

NHS Measure 20**NHS Measure 21**

Efforts to better link up the electricity, heat and gas infrastructure will continue. Planning, financing and the regulatory framework are to be shaped in a way that makes it possible to coordinate this infrastructure and develop it as required in line with the needs of the energy transition and in a cost-efficient way. In this context, it is necessary to consider existing hydrogen infrastructure whilst also ensuring its connectivity in the EU context.

The long-distance grid operators are conducting the market exploration procedure in the context of the 2022 Gas Network Development Plan, in order to gain an understanding of the need for hydrogen infrastructure.

Implementation status

The interlinkage of the various forms of energy infrastructure is being studied in the AIRE study (“AIRE” stands in German for “Demands to be met by infrastructure in the context of the energy transition”) on behalf of the Federal Ministry for Economic Affairs and Energy; the final report has yet to be published. The dena Grid Study III discusses possibilities for integrated planning of the energy infrastructure in the context of a system development strategy. The revision of the TEN-E (guidelines for trans-European energy infrastructure) presented by the European Commission at the end of 2020 also addresses cross-border hydrogen networks for the first time. Further to this, funding is going towards specific investment in measures in the field of industry and transport and within the integrated projects (especially in the context of the IPCEI on Hydrogen, cf. comments on integrated projects I.1).

I.7 Research, education, innovation**NHS Measure 23**

A joint hydrogen roadmap that is to serve as guidance: Germany wants to position itself as a lead provider of green hydrogen technology on the global market. For this purpose, a roadmap for the German hydrogen industry will soon be developed together with the science and business communities and civil society. This roadmap is designed to have international ripple effects.

Implementation status

In June 2021, the Federal Ministry for Economic Affairs and Energy and the Federal Ministry of Education and Research gave the green light for the H2-Compass project, which will serve as the basis for the development of a hydrogen roadmap to ascertain the R&D priorities. The project is receiving €4.2 million in funding and will run for two years.

The recommendations from the members of the Energy Research Network Hydrogen (cf. Measure 25), and the results of other strategic projects being pursued by the Federal Government and the National Hydrogen Council will feed into the roadmap.

NHS Measure 24

In the short term, demonstration projects on green hydrogen will be set up with the help of research being conducted into international supply chains in order to answer fundamental questions: ideal and typical supply and technology relations are to be developed; robust and modular solutions are to be tested globally. Production sites located in our development cooperation partner countries are to be included in this (launch: 1st half of 2020).

NHS Measure 25

A new interministerial research campaign entitled Hydrogen Technologies 2030 will see a strategic bundling of research activities into hydrogen-related key enabling technologies (implementation from Q2 2020). Key elements of the research campaign include:

- Living Labs for the Energy Transition
- large-scale research projects – Hydrogen in the Steel and Chemical Industries
- projects in the transport sector
- feasibility studies and atlases of potential
- international networks and cooperation on R&D
- the establishment of a new Hydrogen Technologies research network

The research campaign also supports the National Innovation Programme for Hydrogen and Fuel Cell Technologies (cf. Measure 6).

Implementation status

The Federal Ministry of Education and Research is currently developing an instrument to promote and coordinate German-Australian projects for innovation in green hydrogen technologies along the entire value chain via HyGATE in the context of the German-Australian Hydrogen Alliance. The aim is to conduct joint demonstration projects involving both the scientific and the business communities to develop green hydrogen technologies and test them in real-life conditions (cf. also Measure 34).

Implementation status

Particular mention should be made of the following activities to implement this measure:

- The Research Ministry's Hydrogen Republic Germany competition for ideas covers both the lead projects mentioned above (cf. I.1) and basic research projects. At present, projects along the entire value chain are receiving around €123 million in funding. 71 projects in the first selection round for the basic research module have already been approved for funding.
- The Federal Ministry for Economic Affairs and Energy has called for proposals for numerous projects of applied energy research in the context of the Hydrogen Technology Campaign call for funding. Further to this, in the context of the Living Labs for the Energy Transition, energy technologies are being demonstrated and tested on an industrial scale. By June 2021, four Living Labs dedicated to hydrogen had been launched; two more are to begin in the autumn of 2021. In the newly established Energy Research Network Hydrogen, experts discuss the production, storage, distribution and cross-sectoral use of hydrogen.
- Since December 2020, the Federal Ministry of Education and Research has provided around €58 million in funding to the CatLab Catalyser Centre in Berlin.

NHS Measure 25

- In the research initiative “Energy Transition in the Transport Sector: Sector Coupling via the Use of Electricity-based Fuels”, 16 research projects are being funded focusing on the production and use of electricity-based and synthetic fuels.
- Via the International Future Labs for Green Hydrogen, the establishment of joint research facilities in the Asia-Pacific region and the announcement about international cooperation on green hydrogen, the Federal Ministry of Education and Research is driving excellence-oriented international research cooperation, not least in order to develop the hydrogen industry. Calls for funding for cooperation with research partners in various countries have already been launched, and more are under preparation.
- In the Twenty20, WIR! and RUBIN programmes, the Federal Ministry of Education and Research is spending nearly €85 million on funding five regional alliances working on innovative hydrogen projects.
- In the Clusters4Future Research Ministry competition, the Hydrogen future cluster is addressing the transfer of hydrogen technologies into application via cooperation between stakeholders in the hydrogen value chain in the Aachen/Jülich region; up to €45 million is available for this.
- In the Carbon2Chem research project, the Federal Ministry of Education and Research has so far spent roughly €145 million on promoting solutions for climate-friendly steel production under the 7th Energy Research Programme.
- The Kopernikus projects for the energy transition have been tackling key issues relating to the hydrogen economy since 2016. In particular, the P2X Kopernikus project is preparing innovations for selected hydrogen-based value chains. At the same time, the Ariadne Kopernikus project is studying how hydrogen can best contribute to the goal of climate neutrality, and what policy instruments are required for this.

NHS Measure 26

A lead project for scientific policy advice is being set up to assess whether and what measures (such as research and experimentation clauses) could help test the market entry of hydrogen technologies and facilitate their transfer into practice. The project is to lay the basis for practical work to further develop the national and European legal framework to allow for a large-scale roll-out of applications for the production, storage, transport and use of hydrogen and for related business models that are economically viable. This includes the ongoing development of the quality infrastructure. Any obstacles existing under the national or European legal frameworks must be identified and proposals made for the further development of these frameworks (launch: Q2 2020).

Implementation status

In order to implement this measure, the Energy Systems of the Future academies project will produce a scientific analysis of the need for regulatory action. The Hydrogen Working Group commenced its work on this in November 2020.

NHS Measure 27

The targets set out in the European Flight-path 2050 document are supported by Germany's Aviation Research Programme. This programme will continue with new funding for hybrid electric aviation. For the period from 2020 to 2024, a total of €25 million from the Aviation Research Programme has been earmarked for hydrogen technologies (measure has started):

- developing overall systems capabilities in the new field of hybrid electric aviation, e.g. on the basis of disruptive engine technology
- flight tests with hydrogen-powered and hybrid electric technologies for regional aircraft and preparation of these technologies for commercial wide-bodied aircraft

Implementation status

2019 saw the launch of the sixth national civil aviation research programme, with three calls for proposals. The latest call, from September 2020, also cites hydrogen technologies and (hybrid) electric aviation as being eligible for funding. These include fuel cell (hybrid) electric drivelines and the use of sustainable alternative fuels. This has initiated the implementation of this measure.

NHS Measure 28

Continuation of the funding instruments for the cross-cutting sector of green shipping (Maritime.Green) as set out in the Maritime Research Programme. At EU level, a partnership initiative for Zero-Emissions Waterborne Transport is under preparation for the new HORIZON Europe programme. The target here is to develop a zero-emissions vessel with a closed cycle of substances. Approx. €25 million has been earmarked for the Maritime Research Programme from 2020 to 2024, a portion of which can be used for hydrogen-related work (measure has started).

NHS Measure 29

We are supporting and further developing vocational and scientific training and continuing education so as to pave the way for individual workers and companies to be able to handle hydrogen technologies efficiently and safely. There is also a need for outstanding scientists and talented upcoming scientists. This is why we are venturing into new forms of cooperation to link up training and research, for instance by setting up centres of excellence at non-university research institutions and institutes of higher education. We are also working with export markets to foster cooperation on vocational training and are strengthening our efforts for capacity building with special programmes, for instance for PhD students (implementation starts in 2021).

Implementation status

The implementation of this measure is made possible by the Maritime Research Programme, which was initiated in 2018. This addresses marine technology, production of maritime systems, shipping and marine engineering. A total of €215 million is available in the current funding period. The sub-programme Maritime.Green Propulsion is particularly strongly focused on hydrogen. It addresses green propulsion technologies and measures to reduce emissions of pollutants from ocean-going and inland waterways vessels.

Implementation status

The Federal Ministry of Education and Research is supporting the establishment of a masters graduate training programme for green hydrogen technologies, together with research institutions in Germany and the WASCAL graduate schools in West Africa. The launch of the programme with students from all 15 ECOWAS countries is scheduled for September 2021.

Measures of the National Hydrogen Strategy (abridged version)

Implementation status (as at: 31 August 2021)

Part II: Measures at international level

II.1 Need for action at European level

NHS Measure 30

There is a need for reliable sustainability standards and for a sophisticated quality infrastructure, proof (of origin) for electricity from renewable energy and for green hydrogen and its derivatives. At European level, we want to set sustainability and quality standards in the field of hydrogen and PtX products. This includes support for the development of European regulations, codes and standards in the various fields of application. In parallel to this, Germany will also intensify the dialogue with other countries in order to pave the way towards a universalisation in international organisations.

Implementation status

The Federal Government is working on a concept for sustainability standards and the implementation of accounting and certification systems, and is feeding this into the discussions at European level. In view of the technical complexity, numerous regulatory factors (e.g. RED II) and the need for multilateral cooperation, only the very first steps have been taken so far. Participation in the establishment of corresponding proof and certification standards at German, European and global level will be a major task for the next legislative term.

NHS Measure 31

At EU level, we wish to intensify investment in research, development and demonstration of green hydrogen. One option is the creation of a new Important Project of Common European Interest (IPCEI) for the field of hydrogen as a joint project with other Member States. The focus here is to be on the entire value chain for hydrogen (production, transport, distribution, use). To this end, the Federal Government is proactively approaching the European Commission and EU Member States in order to gather support for such a project and to initiate its realisation.

Implementation status

During the German EU Council Presidency, the Federal Government joined with 21 other EU Member States and Norway at the end of 2020 to adopt a manifesto on the IPCEI on Hydrogen (cf. I.1 re the implementation of the IPCEI; there are currently 24 signatories). In total, more than €8 billion from the Federal Government and the Länder is available under the Important Project of Common European Interest (IPCEI) on Hydrogen. This funding will help 62 selected projects along the entire value chain of the hydrogen market.

Further to this, the Federal Ministry of Education and Research initiated a Member-State-led agenda process on research and innovation for green hydrogen during the German EU Council Presidency, and confirmed it in the context of Council conclusions on the new European Research Area. →

NHS Measure 31

In the course of 2021, urgent research and innovation questions will be identified in a public pan-European dialogue process, and results will be collated in a Strategic Research and Innovation Agenda for the European Research Area.

NHS Measure 32

The Federal Government is working towards an accelerated implementation of the EU hydrogen initiatives. Further to this, it is supporting the drafting of a Green Paper by the Commission mapping out the prospective content of an EU Hydrogen Strategy.

Implementation status

In the context of the European Green Deal, the Federal Government is not least working towards an accelerated implementation of the EU hydrogen initiatives. The political positioning is ongoing in the context of the EU's Fit-for-55 package.

NHS Measure 33

The establishment of a European hydrogen company to promote and develop joint international production capacities and infrastructure is being explored and will be progressed if there is sufficient European backing.

Implementation status

Germany advocates the establishment of a European hydrogen company; further steps will be decided on the basis of experience with European cooperation, particularly in the context of the IPCEI on Hydrogen (cf. Measure 31) and of international cooperation (cf. Measure 35).

II.2 International hydrogen market and external economic partnerships

NHS Measure 34

The integration of hydrogen into existing energy partnerships and the establishment of new partnerships with strategic exporting and importing countries create important new prospects. For example, use is to be made of existing energy partnerships in order to develop sustainable import potential for hydrogen-based fuels and sales markets for German hydrogen technologies. This also takes account of the development of domestic energy requirements and the availability of natural resources such as locally available water. The energy partnerships will also be contributing to the decarbonisation and economic development of the countries exporting the hydrogen.

Implementation status

Working groups have been set up and high-level declarations of intent have been signed in the context of the energy partnerships and dialogues of the Federal Government and of scientific and technological cooperation. The partner countries include Namibia, Morocco, Ukraine, Tunisia, Saudi Arabia, Canada, Russia, Chile, Australia and the U.S.

In the context of the H2 Atlas Africa project, funded by the Federal Ministry of Education and Research, a hydrogen partnership with Namibia was agreed in August 2021. The Federal Ministry of Education and Research will provide up to €40 million for the cooperation.

NHS Measure 35

We will rapidly progress the cooperation with partner countries in the context of a hydrogen alliance in coordination with EU initiatives. A focus will be placed on collaboration along the entire value chain. A platform for German companies to position themselves on foreign markets will be created. Also, the aim is to help German firms to obtain climate-neutral hydrogen more easily (initiative launched in 2020).

Implementation status

Cooperation with partner countries was launched or expanded in order to implement this measure (cf. Measure 34). Further to this, new funding measures were developed for the international sphere:

- H2Global is to incentivise investment in hydrogen production on an industrial scale outside the EU and in the relevant supply chains to Germany. The Federal Government is providing €900 million in funding for this.
- A funding guideline for international projects along the entire green hydrogen value chain outside Europe is to be published in September 2021.
- H2-Uppp project to support smaller private-sector projects or initiate such projects in coordination with the Energy Export Initiative
- In addition to this, the following is in the planning process: P2X growth fund with KfW for new financing options for bilateral projects.
- The International PtX Hub of the International Climate Action Initiative is engaged in a dialogue with several partner countries, e.g. on sustainability criteria. The focus is particularly on sectors which cannot use renewable electricity directly.
- In order to ensure the commercial operation of PtX value chains, the Federal Ministry for Economic Cooperation and Development initiated the Business Alliance on Energy in 2019. The Alliance consists of more than 80 companies and makes it possible to involve the business community at an early stage and to clarify the key aspects from production in partner countries through to final receipt of the product.

NHS Measures 36 and 37

Measure 36: We will strengthen the existing international activities, particularly in the context of the energy partnerships and of multilateral cooperation, such as the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), the International Renewable Energy Agency (IRENA) and the International Energy Agency (IEA), and we will make use of them to progress the supra-regional aspects of hydrogen. Atlases of potential for the production of green hydrogen and its derivatives will help with the identification of future supplier countries and opportunities to export installations (cf. Measure 25). A focus will be placed on countries with active German development cooperation. Account must also be taken of the growing need for energy and the availability of natural resources like water.

Atlases of potential for selected German development cooperation partner countries will be produced in time for the German EU Council Presidency (implementation from 1st half of 2020).

Measure 37: Pilot projects in partner countries are to show whether and how green hydrogen and its derivatives can be produced and marketed there on a sustainable and competitive basis. Concepts for this are to be developed, and specific implementation options drawn up. Here, attention will be paid to ensuring that an import to Germany takes place on top of domestic energy production in the respective partner countries and does not impede the supply of renewable energy, which is inadequate in many cases, in the developing countries.

Implementation status

Specific hydrogen projects have been launched with the support of the Federal Government in the following countries:

- In 2021, six new network and exploration projects on green hydrogen were launched with Canada.
- In Morocco, the development of the Moroccan hydrogen strategy was assisted via the energy partnership. Also, hydrogen and PtX production is to be built up, with a total of €88.5 million in grants for projects so far, and particularly the construction of a large-scale reference installation with an electrolysis capacity of at least 100 MW (implementation is delayed).
- In Tunisia, €31 million is going towards the establishment of a PtX sector; this will fund advice on the drafting of a national hydrogen strategy and the construction of a demonstration facility.
- In Algeria and Jordan, the drafting of national hydrogen strategies is being supported e.g. via analyses of potential and the consideration of pilot projects.
- In December 2020, a funding commitment for €8.23 million was handed over to Siemens Energy for the Haru Oni project in Chile.
- In Saudi Arabia, Thyssenkrupp Uhde Chlorine Engineers has received federal funding for the Element One project in the planned NEOM future region.
- The HySupply project to conduct a feasibility study into the export of green hydrogen from Australia to Germany was launched in November 2020, with approx. €1.7 million in funding from the German side.

Also, the sustainable supply of water in arid regions of these countries must not be impaired by the production of hydrogen. The aim is to achieve sustainable production along the entire supply chain. This project is to make use of the opportunities offered by the hydrogen market as a key component of partnership-based development cooperation, and thus to give the partner countries fresh opportunities for sustainable value creation, energy and jobs, as well as incentives for a decarbonisation of their economies and the establishment of sustainable supply chains (implementation from 2020).

- In the Gulf states, several hydrogen projects have been given active political backing via bilateral studies, e.g. with the UAE and Saudi Arabia, workshops and the establishment of interministerial working groups; in particular: innovative approaches to the production of aviation kerosene in the UAE, Oman and Saudi Arabia.
- Egypt's planned hydrogen projects are being supported via the dialogue with the government.
- In the Asia-Pacific region, seven German research projects are being built up in the field of green hydrogen technologies with partners in Australia, Japan, New Zealand and South Korea. Funding of up to €760,000 in each case is being granted towards joint research infrastructure in a three-year initial phase.
- The programmes entitled H2SouthAfrica and H2Brasil are to establish the framework conditions for a PtX ramp-up in South Africa and Brazil. In each case, funding of €40 million is available for the implementation.
- Work started at the beginning of 2020 on an atlas of green hydrogen potential for Africa. The first results for West Africa were presented in early May 2021.
- At present, the funding of a German-Russian science network for cooperation in the field of hydrogen is being prepared.

In the context of the Environmental Technologies Export Initiative, further pilot projects abroad are being funded by the Federal Government, with the focus being placed on supporting the internationalisation of German SMEs by ensuring the establishment of suitable infrastructure via the transfer of knowledge and the involvement of local stakeholders. →

NHS Measure 37

Germany is participating in the International Partnership for Hydrogen in the Economy (IPHE) in several working groups on the issues of carbon footprints, regulations and international trade rules. Also, Germany is supporting the networking of international research and development activities via the International Energy Agency's Hydrogen Technology Collaboration Partnership (TCP). During the 11th Clean Energy Ministerial (CEM) in October 2020, Germany joined the CEM Hydrogen Initiative (H2I). Since 2 June 2021, Germany has also been a member of the Clean Hydrogen Mission. Measure 36 is being constantly implemented via active participation in multilateral cooperation.

NHS Measure 38

In relations with the current exporters of fossil fuels, the Federal Government will intensify the dialogue with a view to a gradual global energy transition including hydrogen. Fresh opportunities are to be taken which are offered by an at least partial substitution of fossil fuels by hydrogen, not least involving important energy policy stakeholders.

Implementation status

The Federal Government is using the H2Diplo project to intensify the dialogue with the current exporters of fossil fuels with a view to a gradual global energy transition including hydrogen. To this end, the Federal Government is setting up hydrogen offices in Saudi Arabia, Russia, Nigeria and Angola.

