NATIONALER WASSERSTOFFRAT

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Statement on the development of the German government's hydrogen import strategy

BACKGROUND, GOALS AND STRUCTURE

Hydrogen and hydrogen derivatives will play a decisive role in the transformation to climate neutrality. The hydrogen ramp-up will have to develop considerable momentum over the next few years in order to achieve the German, European and international climate protection targets. New development opportunities may arise in this context, particularly following the COP28 resolutions.

A number of very powerful instruments for initiating large-scale demand for hydrogen have been enacted or amended in recent months. These include CO_2 pricing (EU ETS, BEHG and ETS-2, CO_2 tolls) as well as the GHG quota (Section 37a BImSchG), the EU ReFuelEU Aviation Regulation and the first funding decisions for IPCEI projects, as well as the first bidding rounds of the H_2Global and European Hydrogen Bank platforms. Further large-scale incentive mechanisms such as climate protection agreements, further funding decisions for hydrogen-related IPCEI projects and instruments covered by the power plant strategy have also been announced for the coming months. This creates reliable demand for producers of hydrogen and hydrogen derivatives at home and abroad.

In addition, the decisions on the planning and financing of the hydrogen core network have set the initial course for the transport of hydrogen within Germany and for connecting the most important import points, thus establishing the key prerequisites for the development of a hydrogen market.

Furthermore, two delegated regulations on the definition of renewable fuels of non-biogenic origin and threshold values and calculation methods for greenhouse gas savings from recycled carbon-containing fuels have created a legally secure methodological basis for the certification of hydrogen and hydrogen derivatives, which have been extended to all areas of application with the amended Renewable Energy Directive (RED III) and are binding for both energy sources produced in the EU and imported into the EU. Measures have been initiated for the institutional and operational implementation of corresponding certification and for clarifying its application in the context of foreign production.

Even though there is still a need for action and supplementation in many areas (acceleration of approval procedures, market initialisation, infrastructure beyond the hydrogen core network, storage, certification of low-CO_2 hydrogen, standardisation and standard setting, international harmonisation of methods), the initial key prerequisites for the start of the hydrogen ramp-up have been established.

Based on demand for climate-neutral hydrogen and hydrogen derivatives produced from that according to expectations of the German National Hydrogen Council (NWR), a market with an annual wholesale volume of up to 18 and 22 billion euros can be created for the 2030 and 2035 time horizons. While domestic production and decentralised concepts will play an important role, it is foreseeable from today's perspective that imports will be necessary in terms of quantity and may be economically more favourable than domestic production. The volume of hydrogen derivatives is going to be characterised by high import shares even before 2030.

The NWR welcomes the development of an import strategy for hydrogen and hydrogen derivatives. In particular, it points out the importance of the import strategy for communication in the national and international arena and as a means of ensuring consistency between the various strategies relevant to the import of hydrogen and hydrogen derivatives (from the National Ports Strategy to the National Security Strategy) and instruments for realising the hydrogen ramp-up.

The creation of a hydrogen segment in the German and European economy and the establishment of a new segment for intra-European and international trade is breaking new ground in many areas. Practical effects and implications of many regulations relevant to cross-border trade are often difficult to assess ahead of time, as are the specific technical and economic prerequisites and market conditions. From the NWR's perspective, the import strategy should therefore firstly address the entire range of relevant stakeholders (both in Germany and abroad) and involve them as actively as possible. Secondly, the import strategy should also be process-based, so that practical experience can be gained from international trade in hydrogen and hydrogen derivatives.

In view of the timing and structures of ramping up hydrogen and hydrogen derivatives, the NWR believes it is necessary for the import strategy to not be limited to the 2030 time horizon, but to clearly take the period from 2035 to 2040 into account as well. The NWR recommends developing and communicating a transparent phase model for the development of imports of hydrogen and hydrogen derivatives as well as the corresponding infrastructure and regulatory requirements. Focusing on mature technologies is essential to import relevant quantities by 2030 to meet the climate protection targets. This only applies to some of the import paths.[1]

The import strategy will have to take various dimensions into account. Aspects that are decisive for the scale and speed of the import ramp-up, that is, the climate policy, energy industry and European policy dimensions, play a special role here. The economic policy dimension is of great importance for Germany as an industrial location and for the role of German companies as technology providers. From a geopolitical and resilience perspective, the import strategy must in particular take foreign and security policy aspects into account. Finally, the development policy dimension of the import strategy should play an important role with regard to geopolitical factors, but also sustainable development on a global scale and the necessary acceptance of societies in the exporting countries.

The NWR is aware that there are different priorities for different stakeholders with regard to the above-mentioned dimensions. Not only win-win constellations exist between the various dimensions, but also areas of conflict that may only be resolved partially or over time. It therefore considers it essential for the import strategy to clearly define the motives and strategic orientations for the aforementioned dimensions, and to make very transparent for specific measures which dimensions of the import

[1] See also the dissenting opinion of Michael Sterner (OTH Regensburg) at the end of the document.

strategy play a particular role in each case. Ideally, the import strategy in the relevant areas would also identify the respective areas of conflict and outline ways of resolving them. Systematic consultation and clearing procedures can be helpful here. The NWR is prepared to make an active contribution to this.

DIFFERENTIATING BETWEEN HYDROGEN AND HYDROGEN DERIVATIVES AND KEEPING AN EYE ON FLEXIBILITIES

In the first phase of the market ramp-up, demand will be characterised by the need for hydrogen for direct use in industrial plants (as a raw material and as an energy source for process heat), power plants, heavy commercial vehicles and so on. Hydrogen derivatives (ammonia, methanol, sustainable aviation fuels) for direct use will play a smaller but still relevant role in this market development phase. Hydrogen derivatives can also play an important role as carriers for hydrogen transport (ammonia, for example) and subsequent reconversion into pure hydrogen at an early stage of market development.

As a confidence-building instrument for the international market, the import strategy should clearly and transparently state the current status of demand expectations (or the corresponding corridors) for hydrogen and the various hydrogen derivatives as well as the availability and planning status for corresponding import infrastructures and establish a transparent update process.

The import strategy should prioritise the expected structure of demand in all its dimensions. Enabling hydrogen imports from regions accessible by pipeline is therefore of particular importance for the import strategy. Nevertheless, hydrogen derivative imports by ship and over long distances and also as a flexibility option for hydrogen supply should be addressed at an early stage. Even though the widest possible range of import options should be facilitated or kept open in this area, prioritisation of the various supporting measures will be necessary in view of the diverse import paths, particularly in terms of timing. For these prioritisations, the German National Hydrogen Council considers the rapid availability and thus technological maturity of the entire import chains and infrastructures, the demand structures as well as the sustainability and resilience of the volume (for example, with a view to social acceptance from the outset and 'colour theory' in the medium term), the greatest possible scalability, cost reduction potential, diversifiability, integration into the European and international frameworks and strategic approaches as well as the ability to fit in with the overarching transformation strategy towards climate neutrality (for example, with a view to lock-in effects or their avoidance) as key criteria. All direct and indirect prioritisation decisions should be derived and justified in a transparent manner.

SYSTEMATICALLY STRENGTHENING AND ACCELERATING THE DEVELOPMENT AND (RE)UTILISATION OF IMPORT INFRASTRUCTURES

The existing port and gas infrastructure can be used for the hydrogen derivatives SNG and LNG from methane. This enables the direct implementation of climate-neutral applications, for example, in industrial processes and immediately opens up an import path for hydrogen via reconversion using the standard process of steam reforming. This additional step does however come at the expense of efficiency and costs. The same applies to ammonia and methanol.[2]

[2] See footnote 1.

At the same time, the integration of the German hydrogen core network into the European backbone network is of central importance for the creation of new import infrastructures. Germany and Europe's key international projects (hydrogen pipeline to Norway, Delta-Rhine Corridor, SoutH$_2$ Corridor, Baltic Sea Hydrogen Collector, H2Med Pipeline, Sunshyne Corridor, and more) and the connection of Eastern European countries (Ukraine etc.), the Balkan region and North Africa also need to be expedited.

In addition to the corresponding planning and associated political agreements, Germany should actively participate in the development of financing models for these strategic pipeline projects. The NWR recommends examining the amortisation account model developed for Germany with regard to international transferability and European anchoring.

In the pipeline infrastructure sector, the conversion of gas infrastructure for hydrogen also has a strong international component. Ensuring security of supply in the natural gas sector under the new geopolitical framework conditions and increasing conversion for hydrogen transport require very careful planning processes and intensive international coordination.[3]

For the ship-based import of hydrogen derivatives (and possibly for hydrogen), the NWR believes that close integration with the National Ports Strategy is required. On the one hand, this concerns the availability of hydrogen derivatives for ship propulsion systems (methanol and ammonia) in the ports as an important future factor in competition between northern European ports. On the other hand, it must be possible to import hydrogen derivatives for direct use and for reconversion into hydrogen. Even through individual import infrastructures already exist or can be utilised (for SNG, LNG and ammonia, for example), it makes sense to specify the scope and time horizons for any necessary capacity expansion in more detail and communicate them to the market. The same applies to any infrastructure for the onward transport of hydrogen derivatives and for reconversion plants (such as LNG terminals and planned ammonia crackers). In addition to systematic planning procedures and measures to speed up approval procedures while taking environmental protection concerns into account, fundamental decisions will ultimately have to be made as to whether and to what extent funding measures are required for this infrastructure segment or can be provided through the budget or other mechanisms. The aim is to quickly build up the capacity of the import infrastructure, which forms the basis for early import activities. This requires the rapid development and application of clear, transparent, comprehensible and comprehensive criteria, which should be consulted in an appropriate process.

In addition to terminal infrastructures and shore-based infrastructures, the NWR considers systematic measures to support innovations in the areas of shipbuilding, ship propulsion and exhaust gas purification systems to be necessary in order to enable a sufficiently rapid expansion of capacity here as well.

PROMOTING THE IMPORT SUPPLY OF HYDROGEN AND HYDROGEN DERIVATIVES

The ramp-up of the market for hydrogen and hydrogen derivatives requires support on both the supply and demand side.

[3] See footnote 1.

The focus here is on climate policy goals. It is also important to consider export prospects and foreign trade promotion for German equipment companies and their technologies and technology leadership, as well as supply and energy security, diversification prospects and security policy requirements in a broader sense. The corresponding support measures would then have to be designed in this context as well. In addition to export credit and investment guarantees, direct investment funding or other hedging measures should be put in place. In view of intense competition and considerable time pressure to ramp up the import of hydrogen and hydrogen derivatives, regulations should be designed to be as simple and manageable as possible. When awarding funding to import projects in the context of auctions or project funding, the use of German or European technologies should be examined in the context of qualitative assessment criteria as well as commercial law, trade and development policy considerations.

Such support measures should however always ensure coherence in order to avoid double funding, deadweight effects or other inefficiencies.

The NWR has differing views on the role that state-funded central platforms such as H2Global or the European Hydrogen Bank can and should play in the various phases of the hydrogen ramp-up. However, there is agreement that strong *midstream* players[4] are needed to contract the large volumes of hydrogen or hydrogen derivatives and to market them with a view to customer requirements in terms of volumes and contracting periods (as well as their willingness to pay, possibly supported by funding measures).

EARLY CONSIDERATION OF GERMANY'S ROLE AS A FUTURE HYDROGEN HUB

Even though the import strategy initially addresses the supply of hydrogen and its derivatives for use in Germany, it is advisable to also plan hydrogen transits to neighbouring countries in the early stages. Germany can play a key role as a European hydrogen hub. Many large energy companies are currently working intensively with German infrastructure operators, among others, on the development of different import routes with the aim of establishing a procurement portfolio that is as diversified as possible in the years from 2030. If Germany succeeds in positioning itself as an important transit country at an early stage, this will become a central component of importers' project planning. Numerous hydrogen flows in and through Germany are expected to develop as a result. Additional hydrogen volumes resulting from transit not only increase flexibility but also have the potential to significantly improve national supply security. Hydrogen transit will also generate additional revenue for infrastructure operators. Thanks to the numerous hydrogen flows, a solid basis would also be established for a liquid hydrogen trading market to emerge over the long term in both Germany and Europe.

Simultaneous expansion of the hydrogen core network for the entire German territory is necessary in principle to enable hydrogen imports and exports to and from Germany via as many potential routes as possible. In this context, an early and systematic dialogue with relevant neighbouring countries is necessary so that corresponding conditions are also established in these countries, permitting an unhindered flow of hydrogen across several national borders in the best case scenario.

[4] See also NWR position paper 'Hydrogen supply – term transformation, coordination and product structuring as essential elements of an ambitious and efficient hydrogen ramp-up' of 19 January 2024.

ENSURING HIGH CLIMATE PROTECTION AND SUSTAINABILITY STANDARDS

With European regulations on the requirements for hydrogen and renewable energy sources of non-biogenic origin and, in future, those for low-CO_2 hydrogen and low-CO_2 hydrogen derivatives, a legally secure basis for the certification of hydrogen and hydrogen derivatives has now been created in a protracted (overlong) process. The NWR has received different assessments on the question of whether existing regulations hinder or significantly increase the cost of importing hydrogen and hydrogen derivatives, at least in some areas, or whether they provide a sufficiently practicable basis for the development of projects aimed at European imports. Differing opinions exist within the NWR on whether a fundamental change to the above-mentioned certification principles is legally or politically possible and how the associated phase of legal uncertainty should be assessed. Against this background, it makes sense to regularly scrutinise the applicable criteria with regard to their practical implementation and impact.

Various import pathways utilise carbon as a hydrogen carrier. Six options are permitted for this based on the current regulatory framework: CO_2 emissions from power plants (up to and including 2035), CO_2 emissions from other industrial facilities (up to and including 2040), biogenic CO_2 emissions, CO_2 emissions from certified RFNBOs, CO_2 from geological sources (if the CO_2 was previously released naturally) and CO_2 captured from the air using direct air capture (DAC) facilities. From a technical perspective, obtaining CO_2 from air using DAC systems is more elaborate and difficult due to the low CO_2 content and therefore more costly compared to point sources.[5] Europe's regulatory framework (RED III including the corresponding delegated acts, in future also the EU Gas Directive including the corresponding delegated acts) establishes the same requirements for imports into the EU as for production in the EU. For CO_2 emissions from power plants and industrial facilities, there is also a requirement that the corresponding CO_2 quantities are subject to effective carbon pricing in addition to the above-mentioned deadlines. Although a number of jurisdictions outside the EU have currently introduced CO_2 pricing systems, it is not yet transparent in any way whether or under what conditions these are recognised as 'effective CO_2 pricing systems'. The corresponding delegated act for the recognition of low-CO_2 hydrogen is still pending. On the one hand, the effective CO_2 pricing requirement is expedient in order to avoid problematic incentive effects that can arise in the comparison between CO_2 extraction from the air (DAC) and the use of sustainable biogenic CO_2 sources versus the industrial point sources that will remain in a transitional period. However, this legal situation and other existing uncertainties are currently making it more difficult for non-European suppliers to finance projects and thus import carbon-based derivatives into the EU. This can make climate protection targets and quotas more challenging, for example, in the aviation sector. That applies in particular to the transition phase, in which industrial CO_2 sources can assume a relevant bridging function.

The NWR therefore recommends working towards clarifying the legal situation and eliminating uncertainties so that the existing regulatory environment facilitates the import of carbon-based hydrogen derivatives while also complying with environmental and labour standards in the exporting countries and avoiding distortions of competition between EU and foreign producers.

[5] See footnote 1.

The German government should proactively define sufficiently ambitious, more far-reaching sustainability requirements for hydrogen imports as well (cf. current criteria of H2Global). These are implemented by project organisers and/or through accompanying development cooperation measures in order to ensure the acceptance, integrity and resilience of German projects in the partner countries and not to counteract, but ideally to promote the efforts for climate protection and sustainable development there. Such criteria were adopted by the NWR in its position paper of 29 October 2021. The update of the National Hydrogen Strategy also contains sustainability criteria that include environmental aspects (such as water scarcity), social aspects (land and participation rights, for example) and development policy aspects (including local jobs and value creation, reduction of energy poverty). Minimum requirements for governance structures (transparency, for instance) are important as well. These should be incorporated in the import strategy. The level of requirements and mechanisms for ensuring compliance should be specified in order to communicate them transparently and credibly to potential partner countries and project organisers.

However, there is conflict here between exemplary requirements that anchor Germany's high development policy standards and improve the social acceptance of large-scale imports of hydrogen and hydrogen derivatives in the process of transformation to climate neutrality, and the consequences of such criteria for import availability, import prices and project realisation.

Since these conflicts ultimately cannot be resolved in advance and on an abstract level, the NWR recommends an orderly monitoring process in which effects of the various climate protection and sustainability targets are systematically and promptly tracked and analysed. The German government should submit a corresponding report in good time before possible revision deadlines, especially for the European regulations, subject it to consultation and, if necessary, pursue constructive changes on this basis. In this context in particular, the unambiguous formulation of clear, transparent, comprehensible and comprehensive criteria and, on this basis, objectives and target hierarchies for the various dimensions of the import strategy (see above) is of considerable importance.

INTERNATIONAL COOPERATION AND PARTNERSHIPS

A successful import ramp-up with a high level of climate policy and sustainability integrity as well as good security of supply standards requires a significant strengthening of international cooperation.

Firstly, and with particularly high priority, this concerns cooperation within the European Union. The focus here is on the joint use of existing (import) infrastructures and development of new (import) infrastructures, along with the greatest possible convergence of instruments to establish a robust and ambitious demand for hydrogen and hydrogen derivatives. This is intended to prevent both asymmetrical competitive conditions and the emergence of inadequately designed or further utilised import infrastructures. Activities in potential export regions for hydrogen and hydrogen derivatives should be strengthened at the same time through a joint approach by the EU member states. Not least, the EU's neighbourhood policy and various rapprochement and accession processes provide a very interesting basis for the early integration of hydrogen import issues.

Secondly, numerous standards and standardisation issues and measures to avoid double counting of emission reductions need to be clarified with a view to the international arena, the methodological basis of emissions calculations (beyond specific climate protection requirements) for the certification of hydrogen and hydrogen derivatives, institutional issues of certification and mutual recognition in this area. In some cases, this relates to processes that are already underway or are to be established in forums that can be addressed and regulated with relative flexibility within smaller groups of countries. However, issues (inventorying emission reductions) are also in part affected that arise in processes (within the UNFCCC framework, for example) that are highly formalised and also characterised by considerations beyond technology-specific issues (for instance with regard to hydrogen). Thus they can only be addressed in the long term and with unclear prospects of success.

Thirdly, questions of investment conditions and securities for large-volume projects that are at least partially designed for export purposes must be clarified. Particularly for non-OECD countries, financing conditions and relevant opportunities offered by national and international financing institutions are crucial. Regulations under international law (from bilateral agreements to free trade agreements) are also of considerable importance for investment protection. However, the traditional instruments of development and climate financing should not be used for projects whose economic and emission reduction effects primarily benefit Germany itself.

Fourthly, the issue of value chain development in the exporting countries should be actively addressed. Accompanying measures in exporting countries and regions outside the OECD (also in the context of sustainability requirements) should always aim to achieve climate protection effects and increase value creation in the exporting countries. Ammonia, which can contribute to food security locally as a fertiliser and be used as a derivative or hydrogen carrier for export, is an example. Such measures simultaneously require careful strategizing in the context of German industrial policy (which may be negatively affected by the expansion of value creation in exporting countries).

Fifthly, particularly in countries where local value creation potential is low due to the low competitiveness of local companies or small market size, other forms of benefit-sharing should be supported in order to increase positive developmental effects and improve local acceptance. Depending on the context, this can include training programmes, cash transfers, the provision of electricity or water for local communities or opportunities for the local population to participate in energy parks.

Sixthly, the creation of platforms for the broad and intensive exchange of experience at the level of governments, but also of industry, civil society and science on questions of hydrogen strategies in general and import strategies for hydrogen and hydrogen derivatives is both an urgently needed instrument for the exchange and (general) development of knowledge and an effective instrument for creating confidence in the sales market for hydrogen and hydrogen derivatives in Germany and Europe.

Seventhly, the NWR sees the need to actively communicate activities in the different areas of action to various international organisations with sufficient resources. Nevertheless, it also seems sensible and expedient to focus more specific cooperation activities on a selection of countries and regions that are of special significance for the import of hydrogen and hydrogen derivatives as well as particular importance for the required intensity of exchange, cooperation and governance. The expansion and focussing of existing energy, climate and hydrogen partnerships as well as intensive liaison with hydrogen and security diplomacy are suitable starting points here. Active and systematic involvement of government, parliament, industry, civil society and academia can make a significant contribution to the development of robust and sustainable cooperation structures in this context.

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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APPENDIX

DISSENTING OPINIONS

PROFESSOR MICHAEL STERNER FROM OTH REGENSBURG ON 'BACKGROUND, OBJECTIVES AND STRUCTURE'

The recent past has shown that a domestic energy supply has many advantages such as sovereignty, resilience and local value creation. Germany has the technical renewable energy potential to cover its entire demand for hydrogen and derivatives with Power-to-X. However, not all technical potential can be utilised economically. In addition, politicians have not yet succeeded in establishing social acceptance for tapping this potential through communication and financial participation by the population. Germany therefore remains dependent on imports. Realistically, imports are necessary and also have advantages. By tapping into favourable renewable energy sources, large quantities of hydrogen and hydrogen derivatives can be imported from various countries at presumably lower costs compared to domestic hydrogen. Furthermore, the more than 30 value-based energy partnerships support a diversification of the energy supply and new value creation in countries of the global South. Social acceptance and environmental compatibility has to be ensured in these exporting countries as well.

Only a few technologies and import paths are technically mature enough for imports on a relevant scale up to 2030. Building a new infrastructure for pure hydrogen, including storage facilities, terminals, pipelines and applications, will cost billions. The state can provide start-up funding but cannot subsidise this on an ongoing basis. Competitive instruments help minimise costs for the state. It is therefore advisable to focus the measures for the market ramp-up in this period primarily on the technologies and import paths available today. This would utilise the limited financial resources as effectively as possible, thus maximising the contribution to supply security, resilience and climate protection targets. Irrespective of this, all promising technologies must be brought to market maturity through research and development.

PROFESSOR MICHAEL STERNER FROM OTH REGENSBURG ON 'SYSTEMATICALLY STRENGTHENING AND ACCELERATING THE DEVELOPMENT AND (RE)UTILISATION OF IMPORT INFRASTRUCTURES'

Import paths cannot be considered independently of Germany's existing infrastructure. It includes waterways, the rail network, oil pipelines and gas infrastructure. All of this infrastructure can be used for hydrogen derivatives. With a CO_2 molecule as a hydrogen carrier, green methane (SNG) can be imported and replace fossil natural gas in all existing gas infrastructures without further investment. However, there are currently no approved import infrastructures for pure hydrogen apart from blending in the gas network. The conversion of existing gas storage facilities at 200 bar operating pressure to pure hydrogen reduces the national storage capacities to a quarter. Particularly with regard to achieving the climate targets in 2030, using existing import infrastructures for suitable hydrogen derivatives or the admixture of hydrogen offers great advantages because no new and time-consuming approval procedures or safety tests are required. The storage infrastructure and all application technologies in transport, industry, buildings and the energy sector can be used directly. Implementation of the power plant strategy is also crucial for 2030, since existing gas-fired power plants and CHP plants with 36 GW are not sufficient to cover the technical security of supply in winter with steadily increasing loads from electromobility, heat pumps and other direct electrification applications, thus avoid blackouts. This is inevitably linked to achieving the coal phase-out and the defossilisation of other sectors, which is why the reconversion of hydrogen and hydrogen derivatives such as SNG is highly relevant to climate policy alongside industry and transport. It is therefore advisable to equip the existing infrastructure for a climate-neutral energy supply with hydrogen and its derivatives via planning and implementation projects such as network development plans.

PROFESSOR MICHAEL STERNER FROM OTH REGENSBURG ON 'ENSURING HIGH CLIMATE PROTECTION AND SUSTAINABILITY STANDARDS'

European regulations impede the import of carbon-based hydrogen derivatives, making the EU an unattractive export region for partner countries compared to other world regions. This is a disadvantage for Germany in global competition. However, a climate-neutral Germany is not possible without carbon. In addition to carbon-based derivatives for aviation, shipping and the basic materials industry, even climate-neutral steel requires carbon. Accordingly, the term 'defossilisation' is more appropriate than 'decarbonisation'. The demand for climate-neutral gas (SNG) is high in some industrial sectors and municipal utilities. There are plans for a CO_2 circular economy including networks and hydrogen derivatives via CCU. Germany's import strategy should therefore take into account the development of a sustainable carbon strategy (carbon management).

It is important to assess CO_2 sources differently according to physical climate, technical and financial criteria. As long as point sources without CCS exist, it is irrelevant for the greenhouse gas effect whether carbon from a point source or a direct air capture (DAC) plant is used and subsequently released into the atmosphere when the derivative is burnt. The CO_2 would be released into the atmosphere anyway; intermediate use as a hydrogen carrier does not add any additional CO_2 to the air. However, large quantities of fossil point sources are only available to a limited extent in the medium to long term due to the fossil fuel phase-out and CO_2 pricing to avoid lock-in effects increases the costs of these carbon sources. Biogenic point sources can also be used as hydrogen carriers for closed carbon cycles. Technically, point sources are much easier and cheaper to tap than CO_2 from the air. DAC systems still face numerous technical development challenges in their upscaling, such as corrosion, thermal management and space requirements. How far in the future economical DAC systems will be commercially available therefore remains to be seen.