HYPAT

H_2 Potential

Global Atlas of H_2 Potential

Sustainable locations in the world for the green hydrogen economy of tomorrow:
Technical, economic and social analyses of the development of a sustainable global hydrogen atlas

Position paper

War in Ukraine: Implications for the European and German strategies for importing hydrogen and synthesis products

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Contents

1 Summary of the impulses

1. **Clear criteria should guide the evaluation of potential supplier countries and greater weight should be assigned to political risks:** In addition to technical availability and price, greater attention should be paid to supply sovereignty, and the evaluation of partner countries should consider their systemic and political resilience to a greater extent as well as their reliability. Geopolitical considerations and value-based trade relations should play a more important role in hydrogen strategies.
2. **New evaluation of supplier countries. A broad network of partner countries in different world regions could contribute to a diversified supply of hydrogen:** Possible candidates include the US and Canada, Chile, Brazil, Argentina, South Africa, Morocco, Egypt and Namibia. It is still unclear how large quantities of hydrogen could reach Europe in an affordable way in future.
3. **Diversifying the countries supplying hydrogen leads to higher import costs and takes time, but offers protection against economic risks due to dependencies:** Liquefaction and transport by ship raises the total costs by approx. 25 % compared to pipelines, and the construction of production and transport capacities takes time – but all this contributes to greater diversification, and protection against too few suppliers wielding too much market power.
4. **High potentials for producing and transporting hydrogen form a good basis for Ukraine's possible economic development:** The country has a high long-term potential for producing green hydrogen based on renewables – potentially up to 1400 TWh by 2050 – and a free, post-war Ukraine could therefore become a reliable partner.
5. **It is becoming more important for the EU to utilize its own potentials for producing hydrogen:** The EU expects the total demand for hydrogen to be 670 TWh in 2030 and 2250 TWh in 2050. This is compared to utilizable potentials for producing hydrogen of 5,000 to 6,000 TWh, especially due to photovoltaic and solar-thermal plants in the south and wind power plants in the north – in this way, the EU could largely meet its own hydrogen demand. Security of supply must be weighed against possible lower import costs.
6. **Synthesis products may become more attractive in the short- and medium-term for economic reasons and from the viewpoint of supply security:** Due to their higher transportation density, methanol or ammonia are cheaper and easier to transport than hydrogen. Synthesis products could be transported more quickly to Germany and the EU, and contribute to supply security there.
7. **High natural gas prices and supply concerns are increasing the uncertainties around developing a large hydrogen system in Germany and the EU:** So far, the transformation of the energy system has assigned an important role to natural gas and the gray hydrogen produced from it. In view of the uncertain price development and supply security issues, this could also complicate the planned expansion of the hydrogen system.
8. **The EU needs a coordinated approach:** In order to achieve a similarly strong network in Europe for hydrogen as for electricity or natural gas.

2 Motivation

Importing hydrogen and synthesis products such as methanol and ammonia forms an important pillar of the hydrogen strategies of both Germany and the EU. The majority of studies assume future import shares of more than 50% to Germany and the EU (see Wietschel et al. 2021b), and political measures including billions of euros of state funding in Germany are geared toward this. In addition to Russia, countries like Kazakhstan, Morocco, Saudi Arabia and Ukraine are potential relevant partners for German and European hydrogen strategies based on good economic conditions for production and delivery, among other things. Russia’s war in Ukraine has led many to realize that the formerly held certainty that close trade relations result in a stable energy supply should be called into question. In order to strengthen our resilience, key strategic assumptions must be critically reviewed. The future topic of hydrogen is particularly affected by this. The strategic decisions pending here will have long-term economic and political impacts. This position paper addresses individual aspects, discusses approaches for a possible new evaluation, and raises open questions. It is intended to trigger further discussion of this topic.

3 Impulses

3.1 Clear criteria should guide the evaluation of potential supplier countries and greater weight should be assigned to political risks

Hydrogen and hydrogen synthesis products offer the opportunity to actively redesign an increasingly important part of our energy supply, strategically and guided by criteria. The evaluation of potential partner countries should include a long-term perspective, particularly since the agreements and infrastructure investments made today create path dependencies. Weighting the individual aspects must take place within a political balancing and negotiation process that considers the costs and possible trade-offs between different objectives such as supply security, geostrategic considerations and normative requirements.

The first key criterion when selecting trade partners is the technical **availability** of the desired product or raw material at the lowest possible price, as well as favorable transport conditions. In addition, the evaluation of potential supplier countries should take into account the increased dependence of ever more complex and interlinked global value creation systems on the continuous availability of a wide variety of raw materials and intermediate products. This does not mean striving for raw material autarky in Europe, let alone in Germany, which is hardly realistic. In order to minimize Europe's vulnerability to short-term disruptions with potentially severe impacts and to strengthen our **supply sovereignty**, the criticality of trade relations should instead be assessed: What impacts would the short-term failure of a partner have on the domestic economy? How quickly could this be compensated for in other ways? Are dependencies one-sided or reciprocal? (see Edler et al. 2020). Established business relationships and joint investment projects should be evaluated positively here. In order to reduce potential damage in the event of a partner's failure, a greater diversification of supplier countries should be aimed at. In the past, this aspect was not assigned the weight that now seems necessary. The lack of direct import options for liquefied gas in Germany is one example of this.

The criterion of the **political reliability** of the partner countries is closely related to this. In the past, purchases were made where they were cheapest to optimize economic costs, with very few exceptions (e.g. sanctions against South Africa under the apartheid regime). This led to close trading relationships with numerous autocratic states, among others, in the Middle East and Africa, which were considered largely predictable. This was mainly based on the assumption that trade always induces mutual dependence, which, in case of doubt, was lower for the economically strong West than for its partners, for whom the inflow of foreign currency from trading commodities was essential. Last, but not least, even at the height of the Cold War, the USSR continued to reliably supply raw materials to the West. The longer such trade relations ran, the more the partners involved were classified as reliable.

Not only since the Russian invasion of Ukraine does it seem short-sighted to have ignored potential risks just because they had not materialized in the past. In terms of foresighted risk management, the exposure of partners to various types of risk should be taken into account, including whether a country is located in a politically unstable region and whether it is threatened by natural disasters. In addition, the country's systemic resilience should be assessed. Its ability to absorb different shocks and disruptions, but also to respond and adjust to longer-term challenges should be analyzed (e.g. demographic changes, impacts of climate change, social tensions). Indicators used for the ex ante assessment of a potential partner's resilience in terms of the systemic capacity to adapt and transform include the availability of financial and human capital, as well as a sustainable use of natural resources. For political resilience, the quality of institutions based on the rule of law, the performance of social systems and the state of civil society are especially important (Alessi et al. 2020). There should be an intensive debate on whether the aspect of political reliability is to be assigned greater weight in the light of current events.

Another aspect concerns the geopolitical significance of trading partnerships. For some years now, China, in particular, has been trying to assert its **geopolitical interests** by intensifying its trade relations, in which the raw materials and energy sector always plays a major role. This includes partnerships with African states and the Belt and Road Initiative. Therefore, integrating our energy policy more strongly into a general political strategy that also encompasses geopolitical interests seems unavoidable. This includes, among other things, strengthening the political and societal resilience of neighboring countries to the east and south (European Union 2016). At present, Germany's national and the European Union's security policy strategy are both being revised. The evaluation of potential partners for importing hydrogen should be closely coordinated with these strategy processes (see Impulse 8).

Finally, it should be assessed what implications a commodity partnership holds for fostering the rule of law and democracy, sustainable development, as well as promoting peace and the protection of human rights. In the past, commodity partnerships with autocratic countries often benefited mainly small elite groups surrounding the ruler, who were able to cement their status using the inflow of foreign currency. The wider population, on the other hand, often participated to a very limited extent in trade revenues, and, in some cases, even had to fear negative impacts, such as environmental destruction and distributional conflicts. Numerous recognized criteria already exist in the field of development cooperation that are used to assess whether a state is a reliable partner worthy of support. These aspects should also be integrated into the search for suitable partners for cooperation in the energy sector. In this respect, the future topic of hydrogen offers a major opportunity to put our trading relations on a new strategic footing that considers national interests and is **guided by values**. We need to be aware that this will inevitably lead to conflicting and contradictory goals. A systematic and honest assessment, however, can provide a valuable foundation for political decision-making.

3.2 New evaluation of potential supplier countries is due

The aspects described in Impulse 1 allow a transparent and comprehensible evaluation of potential supply countries for hydrogen. So far, Russia has played an important role as a potential partner under the aspects of technical availability and cost effectiveness, and because it can also deliver low-cost blue hydrogen as a transitional solution. The country has huge production potential for hydrogen and synthesis products and its close proximity also means good possibilities to export them to Germany and the EU using existing transport infrastructures. However, at present, Russia no longer seems like such an attractive partner for supplying hydrogen under the criterion of supply sovereignty.

Other countries, including some in North Africa, are also characterized by high availability and, in purely technical terms, could cover a relevant share of the hydrogen demand in Europe.

However, some of the necessary transport infrastructures would have to be constructed first. In addition to that, there are few structurally stable high-potential countries like Norway within "pipeline distance", i.e. it is likely that hydrogen would have to be transported by sea, which is associated with higher costs (see Impulse 3).

A broad network with partners in different world regions could contribute to a more diversified hydrogen supply. Possible candidates include North American countries, e.g. the US, Canada, several South American countries such as Chile, Brazil, Argentina or some African states like South Africa, Morocco, Egypt and Namibia as well as certain Asian countries. However, at the moment, it is hard to see how very large quantities of hydrogen could be brought over long distances to Europe in an affordable way (see Impulse 3).

With regard to the political reliability of partner countries, developed democracies such as the US, Canada or Australia appear particularly advantageous. Their political systems are considered resilient and adaptable, even during times of crisis and when undergoing transformation. On the other hand, several autocratic states in the Middle East, for example, have also shown comparatively high stability in the past, but it is questionable how adaptable these systems are with respect to societal changes or transformation processes in the wake of decarbonization. Excessively rigid political orders harbor the risk of fragility that should not be underestimated.

The conflict in Ukraine is simultaneously increasing the importance of geopolitical issues for the development of energy and hydrogen partnerships. It is becoming clearer that the EU should aim to specifically strengthen and further develop its geopolitical zones of influence through economic collaboration. This applies primarily to Europe's neighbors, but also to more distant regions where geopolitical competitors have already been attempting to exert their influence for some time. Morocco, for example, has recently shown itself to be a challenging partner for German hydrogen investments due to the Western Sahara conflict, but it could still be important for binding North African countries to Europe. Partnerships with other African states also appear to be important in order to strengthen Europe's influence in a region in which China has been trying to create one-sided dependencies through trade relations for some time. Furthermore, depending on further political developments, increased European engagement in Ukraine could also be important (see Impulse 4).

From a value-based perspective, partnerships with newly industrializing and developing countries generally seem worth exploring. Cooperation in the hydrogen sector can make a valuable contribution to growth and to improving the living conditions in these countries, as well as supporting knowledge carriers and, in turn, this can help to foster stability. However, care should be paid to how much such partnerships generate real value added in the partner country's development and climate policy. A specific goal in this context should be to support partner countries in accelerating decarbonization processes. Further, hydrogen and the associated green industry development could offer OPEC countries an alternative to exploration of their oil and gas reserves, and make an important contribution to sustainable development in this way.

Agreements with suitable supplier countries is therefore an important component of a strategy of resilience for the EU and Germany. However, resilience depends on a number of additional factors such as competitively organized markets in the importing countries (see Löschel et al. 2010). It is not possible to discuss these aspects in depth in this position paper.

3.3 Diversifying the countries supplying hydrogen leads to higher import costs and takes time, but offers protection against economic risks due to dependencies

Diversification increases security, and hydrogen, with its high potential for diversification, can become a key element in strengthening Germany's energy security. Before long, Germany could count on a wide range of partner countries from which it could import hydrogen. The diversification of the import countries and international partnerships is firmly anchored in its national hydrogen strategy and in the growing portfolio of hydrogen cooperation. Germany has already concluded agreements for hydrogen research and development projects in the Asia-Pacific region, Africa, North America and South America. Hydrogen partnerships have been launched in Africa, and a foreign policy dialogue about green hydrogen has been initiated with various countries. In this way, Germany is already building a strong framework of cooperation with potential hydrogen exporters that is intended to ensure greater diversification. Nevertheless, the transition to a strongly hydrogen-based energy industry is no easy task.

At present, the hydrogen industry is still a sector without significant trading activities. Only five percent of the globally produced hydrogen is currently transported and traded (see Monopolkommission 2021). The cheapest way to supply hydrogen is by pipeline over the shortest possible distance. To transport it by ship, liquefaction plants and receiving terminals would have to be constructed and operated, which have high energy requirements. According to SCI4climate.NRW (2021), large (and climate-neutrally operated) ships will only be available on a larger scale after 2035. Furthermore, so far, there are hardly any liquefaction plants for hydrogen. The situation is somewhat different for synthesis products (see Impulse 6).

It should also be noted that just the conversion losses from liquefying hydrogen make transporting it by ship significantly more expensive than transporting gaseous hydrogen by pipelines. However, even pipelines become more costly with increasing distance. The transport costs depend on whether new pipelines are built or existing natural gas pipelines can be converted. A study analysis (see Wietschel et al. 2021) indicates that, for a transport distance of 3,000 km, new pipelines have hydrogen transport costs of approx. 20 €/MWh, while the costs for using converted pipelines should be about half of this. For this distance, the transport costs would be five times higher if transport took place by ship including liquefaction instead of in converted pipelines. Due to liquefaction and transport by ship, the total costs of importing hydrogen would then be approx. 25% higher than the total costs of pipeline transport. However, these higher costs might be offset by high economic advantages of risk hedging through diversification compared to the market power of a few suppliers, as can be observed on the natural gas market in Europe at present. Generally, the question of the future pricing of hydrogen on markets is an unresolved one so far (see Wietschel et al. 2021a).

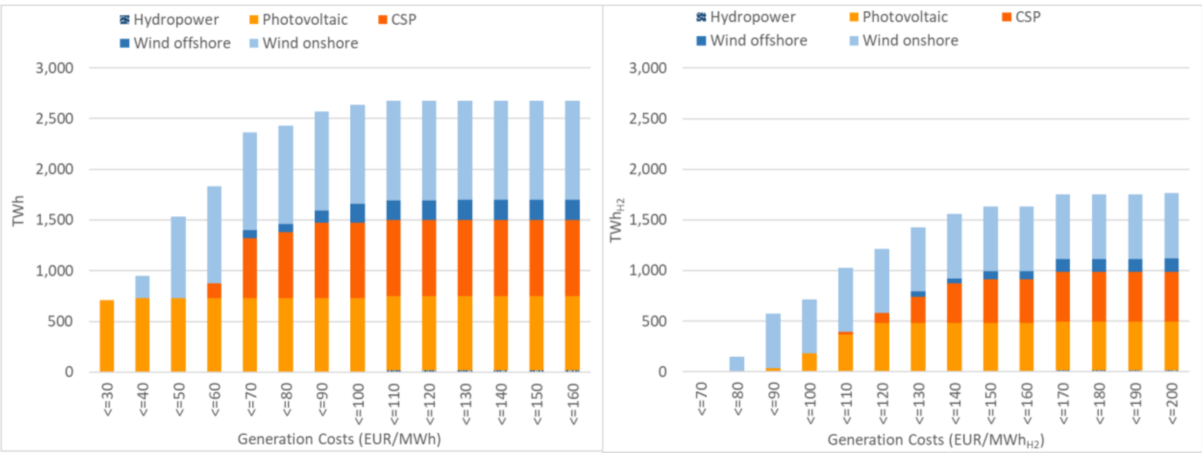
Interesting questions here include what an economically reasonable ratio of pipeline to ship transport would be, and how many and which supplier countries or trade relations are necessary for diversification. Furthermore, the planned construction of LNG terminals should directly explore the option of also preparing these for imports of liquefied hydrogen or synthesis products, especially ammonia (see Impulse 6).

3.4 High potentials for producing and transporting hydrogen form a good basis for Ukraine's possible economic development

If Ukraine remains a free, independent state, a mutually beneficial hydrogen partnership could be developed. Ukraine could become a good and reliable partner for producing low-cost hydrogen and could export this to the EU and Germany at low transportation costs using the well-developed existing gas infrastructure. In addition to foreign currency revenues, the benefits for Ukraine would be the transfer of know-how and modernization of the Ukrainian energy industry. This could be an important reconstruction aid for Ukraine. Currently, the German national and the EU hydrogen strategies are already focusing on Ukraine.

Ukraine has long-term, low-cost renewable potentials of around 2,400 TWh[1] with electricity generation costs of less than 80 €/MWh, mainly from onshore wind and solar parks (see Figure 1). To put this in perspective: Germany's electricity demand is currently 565 TWh and its longer-term potential of economically viable renewable generation is around 1,100 TWh at less than 80 €/MWh (see Fraunhofer ISI et al. 2021). Potentially, around 1,400 TWh of green hydrogen could be produced from Ukrainian renewables at a cost of less than 130 €/MWh (own rough estimate based on Lux et al. 2021).

Figure 1: Cost potential curves for green electricity (left) and for producing green hydrogen (right) in Ukraine in 2050 based on different RE technologies.



After it has been repurposed, the current gas pipeline infrastructure could be used to transport hydrogen. Additional costs of around 5 €/MWh are estimated for transporting hydrogen using repurposed pipelines. If new pipelines are required, these costs rise to approx. 8 €/MWh (see Wietschel et al. 2021a and Wang et al. 2021). The total costs are therefore competitive when compared to the costs of production in Germany. However, it should be emphasized here that other states, e.g. from the MENA region, have similarly favorable economic conditions for producing hydrogen and transporting it to the EU (see Lux et al. 2021).

[1] Based on technology and cost assumptions for 2050.

Even when Ukraine's own demand is taken into account (its total primary energy demand across all energy sources was 1040 TWh in 2019 according to Enerdata 2021), very relevant export amounts still remain for comparatively low-cost hydrogen. Even if Ukraine produced and sold only 100 TWh of hydrogen per year, this would mean roughly 15 billion euros of annual revenue, which corresponds to about 10% of the gross national product of the Ukraine in 2021.

3.5 It is becoming more important for the EU to utilize its own potentials for producing hydrogen

To mitigate risks, using the existing potentials for producing green hydrogen within the EU should be considered to a greater extent than planned so far. A recent study concludes that there is an exploitable potential for producing hydrogen of 5,000 to 6,000 TWh within the EU in the long term, especially due to photovoltaic and solar thermal plans in the south and wind power in the north (see Fraunhofer ISI et al. 2021). However, it must be noted that some of the renewable electricity production needed for this should be used directly for economic and efficiency reasons.

In its ambitious scenario for greenhouse gas reduction, the EU's Hydrogen Roadmap expects the total demand for hydrogen in the EU to be 670 TWh in 2030 and 2250 TWh in 2050. This means the EU could largely meet its own demand for hydrogen itself in the greenhouse gas-neutral scenario. Competition for land use in the EU, faster GHG mitigation through direct electrification of the energy sector within the EU, acceptance issues and economic aspects may be arguments in favor of imports from countries outside the EU. However, when taking into account the higher transport costs and risk premiums and the necessary diversification (see Impulse 3), the economic advantage of imports is only slight or non-existent, and must be weighed against the security of supply. When looking at Germany on its own, its high demand for hydrogen and limited low-cost renewable potentials mean it will have to rely on imports of hydrogen and synthesis products from EU or non-EU countries in the future, which range from 200 to 500 TWh in 2050, depending on the scenario (see Fraunhofer ISI et al. 2021 and Wietschel et al. 2021b).

The expansion of green hydrogen production and the development of a European transportation network for hydrogen are therefore key issues, which should be actively pursued. Solutions to critical infrastructure topics, such as the currently limited transport capacities of Spain, which has outstanding potentials for hydrogen production, to France need to be developed. However, development will take several years.

3.6 Synthesis products may become more attractive in the short- and medium-term for economic reasons and from the viewpoint of supply security

Important hydrogen synthesis products such as methanol and ammonia may become more relevant. Today, these are already produced using fossil fuels and traded internationally. This gives them the advantage of already established supply chains and a combination of high transport density with a relatively low energy demand for transport. Their transport costs over longer distances are lower than those for hydrogen (Wietschel et al. 2021a). This means that countries that are further away from Germany become interesting as potential suppliers, which increases the diversification possibilities (see Impulse 2). The fact that these products are usually transported by ship is advantageous from the perspective of flexibility. Even if capacity utilization of today's production sites and transport routes is relatively high, they can probably be scaled up quite quickly. The relevant analyses must be carried out here.

Distribution logistics to final consumers – a cost factor that is frequently underestimated– are also significantly cheaper for synthesis products than for hydrogen. The challenge will be rather whether the production sites have access to relatively low-cost CO_2 sources (in the case of products containing carbon), and how high the costs of the additional synthesis steps are. The cost differentiation for carbon-based and zero-carbon synthesis products will ultimately determine how attractive their use is in different markets. In the same way, the global development of demand in the different consumption sectors will make a decisive contribution to whether and what quantities of H_2 synthesis products will be used in the EU.

Generally speaking, synthesis products can be transported more quickly to the EU and Germany and contribute to the security of supply there. Importing ammonia could substitute about 22 TWh of natural gas (own calculation based on (VCI 2022, Neuwirth et al. 2022 and Dechema 2017), which is currently used energetically and as a feedstock for ammonia production in Germany. Currently, the high prices for natural gas are leading to reduced ammonia production in Europe or to imports from regions with a lower gas price (e. g. the US) (see Yara 2022, Reuters 2021 and BASF 2021). It is difficult to predict whether this will remain a reaction to a short-term price spike or is already the first step toward a long-term structural change in the value chain, as it depends heavily on the long-term price trend and the framework conditions created. Nevertheless, the import options for ammonia should be explored. In addition to substituting domestic ammonia, ammonia can be used as a hydrogen carrier. However, this is currently still the subject of various research studies. Producing methanol conventionally using catalytic process based on steam reforming of natural gas to synthesis gas results in a natural gas demand (as energy and as a material) of about 9.7 MWh/t methanol (see Neuwirth et al. 2022 and Pérez-Fortes et al. 2016). At 3 of 4 sites in Germany, methanol production is currently integrated into refinery production. Methanol is often produced there from petroleum residues (e.g. via partial oxidation), which is why it also makes sense to explore where this could be substituted by imports. In the context of the system transformation toward climate neutrality, demand for methanol could rise in Germany and Europe. In addition to the use of green naphtha and biomass, it is possible to produce olefins carbon-neutrally with hydrogen as the raw material using methanol as an intermediate product (methanol to olefins, MtO) (see VCI 2019).

A diversification of supplier countries will therefore lead to different supply options of hydrogen synthesis products in future. This can, but does not have to, result in higher overall import costs. This will depend on a mix of factors influencing production, the supply chain and the specific consumption market. It remains to be seen whether synthesis products will still have advantages over hydrogen in the long term.

It should be mentioned that importing synthesis products can also lead to shifts in value chains and this is therefore also an industrial policy issue. Evaluating the different aspects should also be discussed here.

3.7 High natural gas prices and supply concerns are impeding or slowing down the development of a large hydrogen system in Germany and the EU.

At first sight, the current high prices for fossil energy sources, especially natural gas, improve the competitive situation of hydrogen. Paradoxically, however, precisely these high prices and the uncertain supply situation could jeopardize the rapid ramp-up of hydrogen use in Germany in the coming years. The reason is that natural gas and gray hydrogen – i.e. hydrogen produced from natural gas – were assigned an important role in the transformation process, and the current uncertain price trend and supply security could complicate and slow down developments.

It is hardly feasible to operate large plants solely with green hydrogen right from the outset due to practically non-existent hydrogen infrastructures and economic considerations: Ultimately, this would require that a fully developed, large-scale and secure hydrogen system comprising production, distribution networks and large seasonal cavern storage is already available when the first consumers are connected.

In order to get around this problem, the approach pursued so far was to provide supply security in almost all the hydrogen applications that are considered priorities by using natural gas to a large extent in the short to medium term. In simplified terms, green hydrogen should be used in the hours it is available, and this use gradually ramped up as green production capacities expand over the years. In the other hours, the plants were to be supplied using gray (fossil-based) hydrogen or – depending on the process involved – directly using natural gas. Natural gas as a bridging technology is also important to exploit windows of opportunity presented by upcoming reinvestments (e.g. in the steel industry and basic chemicals industry), and to invest in transformation technologies at an early stage or to achieve initial emission reductions at the same time. It is not yet clear whether or how the strategy of supporting the ramp-up of the hydrogen market using natural gas will have to be adapted.

As an additional challenge, the currently rising gas prices and supply concerns are putting energy-intensive industries, which are intended to be the "anchor clients" in the hydrogen system, in an increasingly difficult situation. In view of high natural gas and electricity prices, the first companies are already cutting back production (see: Chemietechnik 2022). In ammonia production, but also in other sectors that are currently heavily dependent on natural gas, a permanent decrease in production in Europe in favor of imports appears possible; to what extent can hardly be predicted at present (see Impulse 6). In the current uncertain cost and supply situation, it seems doubtful that companies in the steel sector will be able to invest in constructing innovative direct reduction plants in the short term without further incentives; these will have to be operated partly with hydrogen, but also with natural gas, at least for a few years (see ZeitOnline 2022 and Handelsblatt 2022).

A hydrogen network, which acts as a backbone linking major industrial sites, had seemed to be a robust first step for developing hydrogen infrastructure. Now, however, new and non-negligible risks of structural change are emerging for both steel and ammonia, precisely those sectors often regarded as the priority first applications for using hydrogen, and thus as "the roots" of the hydrogen system. These uncertainties are also being transferred to planning the corresponding transport infrastructures for hydrogen and can therefore impede the development of the hydrogen system in Germany and the EU.

3.8 A coordinated approach within the EU is vital

The European energy system is already highly interconnected, and these interconnections will continue to grow. This is especially valid for electricity, but also natural gas, and must apply to hydrogen and its synthesis products in future. This requires a joint strategy for developing transportation and storage infrastructure able to ensure a resilient supply of hydrogen throughout Europe. This also includes ensuring that the development of partnerships for importing hydrogen are embedded in a common foreign policy for energy and hydrogen in line with the guidelines of Common Foreign and Security Policy (EC, 2016) and the Global Gateway Strategy (EC, 2021). Only in this way can the EU use its joint strength within the framework of a value-based and, at the same time, consciously geostrategic energy and hydrogen foreign policy, as described in Impulse 1. Otherwise there is the danger of different member states sending contradictory signals to respective partner countries based on their different starting points and interests within the framework of international cooperation. The new geopolitical challenges resulting from the crisis in Ukraine should therefore also be used to create a common foreign policy for energy and hydrogen.

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