B E T

Energie. Weiter denken

IMPULSE PAPER

On behalf of E.ON Hydrogen GmbH

for

Further development of the H2Global funding mechanism

Aachen,
published 13.04.2023
updated 25.07.2023

Editors:

Dr. Alexander Kox
Dr. Carsten Bode
Lukas Wammes
Sebastian Seier

B E T Büro für Energiewirtschaft und technische Planung GmbH | **Aachen**, Berlin, Leipzig | Alfonsstraße 44 | D-52070 Aachen
Telefon: +49 241 47062-0 | www.bet-energie.de | info@bet-energie.de
Geschäftsführer: Dr. Alexander Kox | Dr. Olaf Unruh || **Generalbevollmächtigte:** Dr. Michael Ritzau | Dr. Wolfgang Zander
Sitz der Gesellschaft: Aachen | Registergericht: Aachen | Handelsregister: HRB 5731 | USt-IdNr.: DE161524830

1 Introduction

As part of the National Hydrogen Strategy, the German federal government had already set out in June 2020 to achieve a rapid and efficient market ramp-up of green hydrogen and its downstream products. Private investment in the production, transport and use of green hydrogen is to flow in order to stimulate long-term demand for emission-free hydrogen and its downstream products in Germany. Another goal is to establish hydrogen supply chains in Germany.

As a result, the H2Global Foundation was established in June 2021. The foundation has set itself the goal of promoting environmental and climate protection by supporting the production and use of green hydrogen and other climate-neutral energy sources on a national and international level. To implement this concept, HINT.CO, as a future intermediary for the import of hydrogen and other climate-neutral energy sources, received an earmarked grant of €900 million from the German Federal Ministry of Economics and Climate Protection (Bundesministerium für Wirtschaft und Klimaschutz, BMWK).

1.1 Goals of this Impulse Paper

This impulse paper is intended to contribute to the discussion on how the hydrogen ramp-up can be further accelerated. To this end, the paper is intended to answer the following key question in particular:

„How can the funding mechanism of H2Global be further developed,
to efficiently **accelerate** the **ramp-up** of the hydrogen economy and to
increase planning security for all players in the value chain?

This question is extremely topical, as the drafting phase for the update of the National Hydrogen Strategy[1] already focuses on promoting European and non-European hydrogen imports and the international market ramp-up. In addition to establishing further funding instruments, existing mechanisms are also to be further developed in the short term. In this context, H2Global is mentioned, with the creation of bilateral funding windows being considered as a possible focus of further development.

This impulse paper therefore first identifies potentials for the further development of the H2Global funding mechanism. Based on this, impulses are developed, which should lead to the concrete further development of the current mechanism in further discourse with all stakeholders.

1.2 Need for further development of H2Global

On the way to a climate-neutral future, Germany and Europe will depend to a considerable extent on green hydrogen and its derivatives. In this context, many system studies deal with the question of the extent to which Germany or Europe can cover their future demand for hydrogen (or hydrogen derivatives) by domestic electrolysis or by import.

For example, system studies were commissioned by the BMWK under the title "Long-term scenarios T45", which also examine the hydrogen ramp-up in Germany and in Europe. Figure 1 compares the forecasts for hydrogen demand in Germany from the long-term scenarios with those from the National Hydrogen Strategy 2020. In 2023, a revision of the National Hydrogen Strategy is to be adopted, which will set even more ambitious targets. For example, the coalition agreement of the current German government has already specified a doubling of the electrolyzer target to 10 GW by 2030.

[1] Not published at the current time

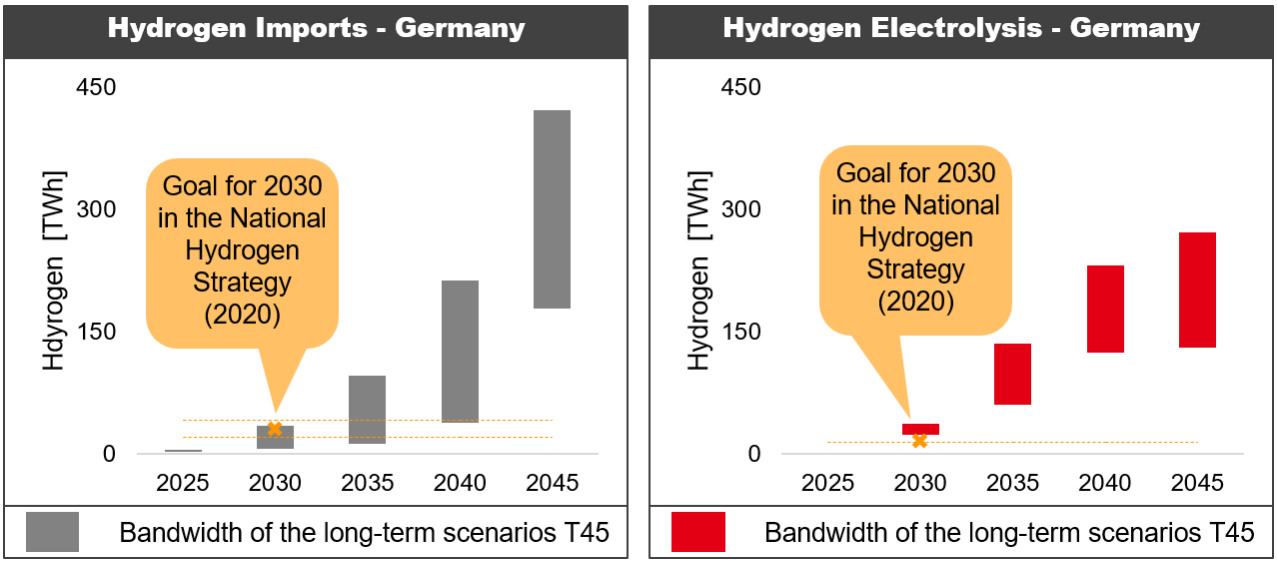

Figure 1: National hydrogen demands according to the long-term scenarios T-45

Figure 2 compares the forecasts for hydrogen demand in Europe from the long-term scenarios with those from REPowerEU.[2].

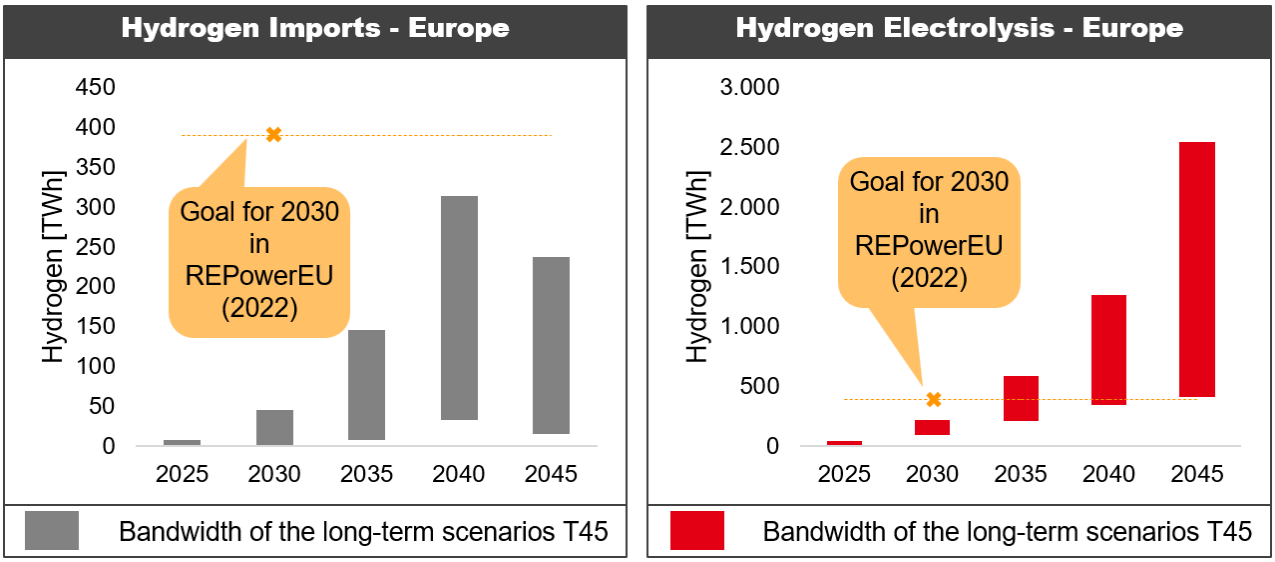

Figure 2: European hydrogen demands according to the long-term scenarios T-45

A look at the two figures makes it clear that, depending on the scenario selected, enormous quantities of hydrogen will be needed in Germany and also in Europe in the future. While Germany will import more hydrogen in the future than it will produce itself through electrolysis, this ratio is reversed in the European comparison. Due to the, from the point of view of the authors of the long-term scenarios, large potential for electrolysis in the European Union (EU) comparatively little hydrogen is foreseen to be imported from non-European countries. It can be deduced from this that Germany could, in the long term, rely to a considerable extent on hydrogen imports from other European countries. For hydrogen imports from outside Europe, the REPowerEU targets specify very large quantities as early as 2030, which require a very rapid ramp-up of hydrogen imports.

In the status quo, the production, transport and consumption of hydrogen are only really established in a few selected sectors, both in Germany and in Europe. In order to initiate the system transformation, which must take place for a climate-neutral future on the basis of hydrogen, as quickly as possible, further subsidies are

[2] Titled "REPowerEU", the European Commission presented a plan on May 18, 2022, to rapidly reduce dependence on Russian fossil fuels and accelerate the green transformation. Green hydrogen will play a key role in this.

urgently required. For this reason, a targeted further development and supplementation of existing funding mechanisms such as H2Global as well as the establishment of further measures is necessary.

2 Current functionality of H2Global

Unlike in an ideal-typical market, in which the price results from the intersection of the supply and demand curves, such price formation is not possible during the ramp-up of the emerging hydrogen market, as the prices on the supply and demand side are too far apart and the price curves do not intersect. Therefore, the concept of H2Global is to compensate the differences between the lowest supply prices and the highest demand prices by subsidies to enable a market-based matching of supply and demand. The general functionality is shown in Figure 3.

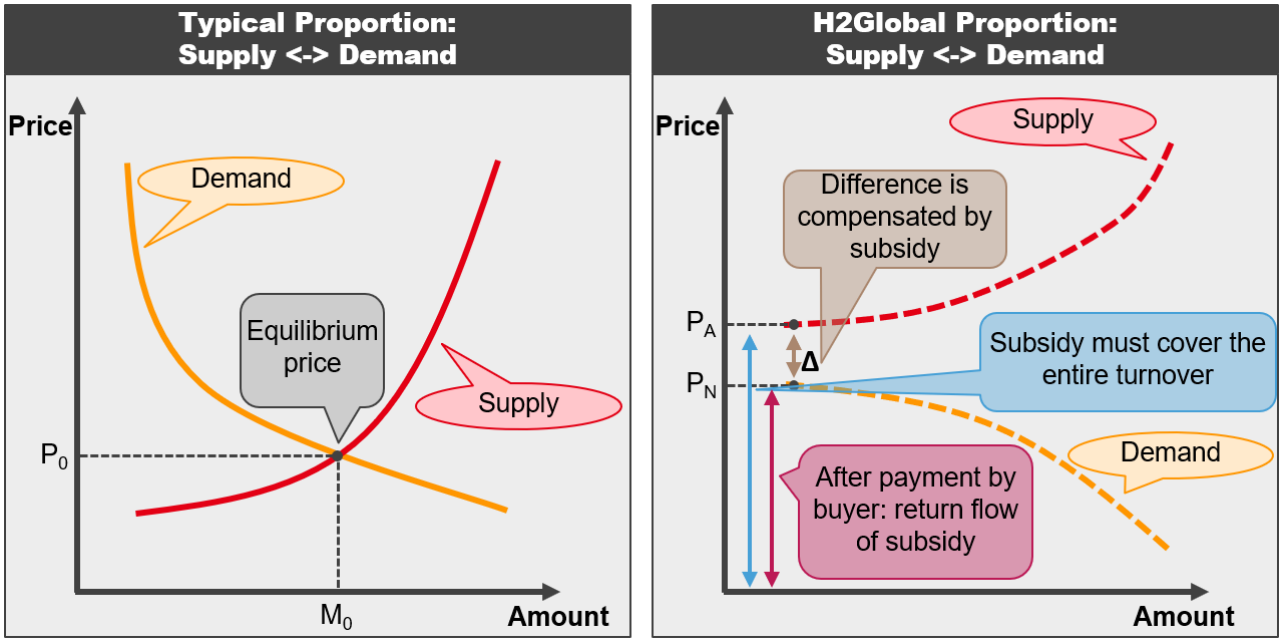

Figure 3: Current functionality of the H2Global mechanism

First, the best offer (largest quantity) for a defined value (€) of green hydrogen or a derivative is sought via competitive procedures. In this process, to minimize the risks at the intermediary HINT.CO, the subsidies must first cover the entire turnover on the supply side. On this basis, long-term (10-year) purchase agreements (Hydrogen Purchase Agreements - HPA[3]) are concluded with the most favorable supplier (or suppliers, until the funding volume is exhausted), with the first delivery to take place between 2024 and 2026.

Shorter-term sales agreements (Hydrogen Sales Agreements - HSA) are concluded with customers at a much later stage. Initially, terms of one year are offered. Since the offer price will still be significantly higher than the maximum willingness to pay on the demand side for the foreseeable future, subsidies are necessary to compensate for the price difference. The proceeds from the sales contracts will gradually flow back to the subsidy provider (BMWK) after completion of the deliveries, so that the subsidy volume originally provided will only be used in part to bridge the price difference between the supply and demand side and thus for the ramp-up of the hydrogen economy.

HINT.CO GmbH was founded to carry out the auctions and ensure deliveries. This company is the recipient of the earmarked grant of €900 million from the BMWK, which is available for the implementation of the H2Global concept.

[3]The HPA's version of the first ammonia tender can be downloaded here: https://exchange.exficon.de/public/download-shares/CvTVnejwe0dimn8kShSxh9R4dAdJpl2l

This budget is divided among three different products and over a maximum delivery period of 10 years (2024-2033), so that a sales volume of €30 million per product and year can be funded. The products are initially the hydrogen derivatives ammonia, methanol and e-kerosene. These are to be produced outside the European Union and the European Free Trade Association (EFTA) and, above all, meet the requirements of RED II (Renewable energy directive II) for green fuels.

The product must be delivered to a port in Germany, Belgium or the Netherlands, where it is handed over from the producer to HINT.CO and directly to the customer. Thus, the market actors on the producer side are both the actual producer of the product and the logistician who takes care of the ship transport, the dispatch and the port logistics. All in all, the producer is responsible to HINT.CO for this. Both large consumers, who organize the logistics from the port to their own place of consumption, and aggregators, who purchase larger quantities and distribute them to storage hubs or directly to various end consumers, can be expected as buyers.

3 Potentials for further development of H2Global

H2Global is a central instrument for promoting the ramp-up of hydrogen. However, the above comments show that the H2Global mechanism has potential for expansion, both in terms of funding volume and conceptual implementation. The draft bill for the update of the National Hydrogen Strategy therefore expresses a clear commitment to the further development of H2Global, also with regard to the possibility of bilateral contracts. In addition, an increase in funding of €3.5 billion[4] and the involvement of the Netherlands[5] were announced. Based on these fundamentals, potentials for the further development of H2Global will be identified and discussed in the following.

3.1 Low volume of subsidized imports

The quantities of hydrogen or its derivatives that can be imported with the current H2Global funding mechanism are limited both by the limited funding volume and also by the specific design of the mechanism. In order to make HINT.CO risk-free as an intermediary in the supply chain between producers and buyers, the funding volume must cover the entire turnover on the producer side. This means that initially, significantly more specific production volume is needed per imported product quantity than if only the price difference between the supply and demand side had to be compensated. This secondary condition means that after delivery to and payment by the buyer, there is always a return flow of subsidies, the subsequent use of which is still open. These subsidies initially flow back to the BMWK unused.

This approach limits the impact of the program. With the €30 million per year from the ammonia support program, for example, it would only be possible to import around 3-9 % of the annual German ammonia production in the status quo, according to rough estimates.[6] However, until climate neutrality is achieved, a strong increase in additional demand for green ammonia, hydrogen and other climate-neutral energy sources is to be expected.

[4] https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2022/12/20221208-bundesministerium-fur-wirtschaft-und-klimaschutz-startet-erstes-vergabeverfahren-fur-h2global.html

[5] https://www.rijksoverheid.nl/documenten/kamerstukken/2022/12/02/voortgang-waterstofbeleid

[6] German ammonia production in August 2022 (https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Industrie-Verarbeitendes-Gewerbe/Publikationen/Downloads-Konjunktur/produktionsdaten-monat-5421201221094.pdf?__blob=publicationFile) extrapolated to one year results in 1.1 million t of ammonia; price of climate-neutral ammonia approx. 300-1000 €/t (https://iea.blob.core.windows.net/assets/9e3a3493-b9a6-4b7d-b499-7ca48e357561/The_Future_of_Hydrogen.pdf, p. 107); subsidized importable amount: 0.03-0.1 million t

3.2 Lack of planning security for buyers

The current design of the H2Global funding mechanism is strongly characterized by high financing security on the producer side and minimal risks for HINT.CO. However, this leads to strong restrictions on the side of the buyers, especially with regard to planning security.

The concept of annual auctions on the buyer side means that there is no long-term planning certainty for buyers with regard to the availability and price of the product to be imported. In extreme cases, very high prices would have to be offered in order to win the auction with a high degree of certainty. Buyers would outbid each other, which would reduce the competitiveness of the products for the end user. Moreover, neither the quantities nor the delivery dates can be planned more than a year in advance, as these are only fixed between the producer and HINT.CO in the previous year.[7] Investments in the hydrogen infrastructure cannot be refinanced on such a risky planning basis.

In addition, even if a bid is accepted in the auction, there is no complete certainty that the product will be delivered. In the current Hydrogen Purchase Agreement, the producer is obliged to make replacement deliveries[8] in the event that, for example, his production plant breaks down. In the final instance, however, there is only a compensation payment[9] from the producer to the buyer in the event of non-delivery.

Another uncertainty arises because there is no long-term plannability even with regard to the delivery point, since the producer can change the delivery port and thus the delivery point in agreement with HINT.CO.[10] This makes it more difficult to set up logistics chains, as no long-term investments can be secured through a plannable capacity utilization.

Overall, the current H2Global mechanism thus offers insufficient planning certainty for all actors behind the product delivery point, making the investments in logistics chains, conversion plants (e.g., ammonia crackers) and production conversions urgently needed for the ramp-up of the hydrogen economy much more difficult from an economic point of view.

3.3 Strict framework conditions in contracts

In addition to the lack of planning certainty, other partly strict requirements within the framework of the H2Global funding mechanism reduce the attractiveness and thus the reach of the program. The REPowerEU goals and the long-term scenarios of the BMWK show: there is enormous potential for hydrogen production within Europe, which cannot be exploited by limiting H2Global to production countries outside the EU and EFTA. It also seems contradictory that, for example, production in and import from Great Britain or Bosnia-Herzegovina would be eligible for funding, but not from Italy or Spain.

In addition, the Hydrogen Purchase Agreement lays down strict specifications regarding the place of delivery (port) and the procedures for the individual steps during delivery. For example, the port must have as many options as possible for onward transport.[11] In addition, the transport to the delivery point is the responsibility of the producer and the onward transport of the product is the responsibility of the buyer. The transport itself, however, is classically the task of a midstreamer. Thus, the producer and the buyer have to take on tasks that do not necessarily correspond to their core competence.

In addition to the restrictive requirements for subsidies, the application and prequalification process is already costly and time-consuming. In particular, the requirements for references and the consolidated total annual

[7] HPA – ANNEX 4.1

[8] HPA 4.4

[9] HPA 12.2

[10] HPA 5.2

[11] HPA 5.2

turnover pose a considerable challenge for new market participants, which means that companies already established in the fossil fuel market are given preference, thus significantly limiting the number of potential bidders. It is also problematic that only very little preliminary work is allowed before the funding decision is issued. This means that important time is lost before the hydrogen ramp-up can gain momentum.

4 Impulses for the further development of H2Global

In order to further accelerate the hydrogen ramp-up in Germany and the EU, to use the available subsidies more efficiently and thus to increase the subsidized import volumes of hydrogen and its derivatives, the attractiveness of the subsidy mechanism must be increased, especially on the buyer side. To this end, the following sections present various approaches, based on the potentials identified in section 3, which can eliminate the various disadvantages of the current mechanism.

4.1 Increase in funded import volumes through bundling of promotion funds

An increase in funding for H2Global and the inclusion of other European countries is already planned,[12] which is very much welcomed. In order to ensure that the funding is also used efficiently, the funding returns unused under the current H2Global concept in particular could be reallocated to the promotion of the hydrogen ramp-up. The various funding pots, e.g., from the German Federal Ministry for Digital and Transport for renewable fuels[13], should be better coordinated and at least partially used to supplement H2Global.

By bundling all efforts related to the promotion of hydrogen ramp-up in Germany and the EU through the H2Global mechanism, it becomes even more attractive. This leads to more efficiency in the medium term, i.e. larger quantities can be promoted with the same funding budget (€). To achieve this, the central H2Global mechanism must unite as many competitive offers as possible (both on the producer and buyer side).

4.2 Improving planning security on the buyer side through long-term contracts

In order to take into account the wishes of those potential buyers who do not wish to enter into a long-term contractual commitment, the current H2Global mechanism only provides for one-year sales auctions on the buyer side, unlike on the producer side. However, this does not meet the requirements of all potential buyers. Especially aggregators, who play an essential role in the distribution and sale of imported products behind the transfer point of the H2Global mechanism, and companies that want to and have to invest in new production processes have a strong interest in long-term contract security and thus in planning reliability.

A simple option to increase the planning security for all actors behind the delivery point of the product is the introduction of long-term contracts also on the buyer side in addition to the existing annual contracts. Analogous to the contracts on the producer side, 10-year contracts (or longer terms of e.g., 15 years on both sides) could be offered and concluded at a fixed price on the buyer side.

In order to further increase planning security on the buyer side, the obligation to deliver the agreed product in the agreed quality by the producer must be further strengthened. Especially in the case of an extension of the contract period on the buyer side, the current penalty regulation is not sufficient. In the event of problems in the supply chain on the producer's side, there must therefore be fallback mechanisms to ensure the physical fulfilment of the agreed product in the agreed quality, such as the establishment and provision of storage facilities close to the place of delivery.

[12] https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2022/12/20221208-bundesministerium-fur-wirtschaft-und-klimaschutz-startet-erstes-vergabeverfahren-fur-h2global.html

[13] https://www.now-gmbh.de/foerderung/foerderprogramme/regenerative-kraftstoffe/

Alternatively, the need for long-term planning security on the buyer side can also be met by offering and promoting contracts for differences (CfDs) in addition to the annual HSA auctions, with the help of which a buyer can convert the price risk from the annual auctions into a fixed price that can be planned with in the long term.

4.3 More flexibility in contract design by integrating bilateral contracts into the H2Global funding mechanism

4.3.1 Bilateral contracts with fixed specific funding

The contract parameters of H2Global are very strict in order to enable an anonymous auction mechanism that decouples the producer and buyer side and at the same time makes HINT.CO as risk-free as possible. However, this is associated with relatively large restrictions for interested parties on both the supply and demand side and thus reduces the attractiveness of the mechanism. There is an interplay between the demands on market participants and the prices offered: The more attractive or flexible the contract conditions are, the better prices are offered, both on the producer side (lower prices) and on the buyer side (higher prices). It would therefore make sense if the specific requirements could at least partly be negotiated individually and thus become part of the competition.

In order to make the contractual conditions more flexible and thus more attractive for all participants, as described above, it makes sense to include bilateral contracts in the H2Global funding mechanism. With bilateral contracts, coordination between producer and buyer could be regulated bilaterally to simplify the supply chain. It would then no longer be necessary for HINT.CO to be part of the supply chain for these contracts, which could simplify processing and logistics and would also be welcome from a risk perspective.

It is also possible to expand the countries of origin to include the EU and EFTA, so that intra-European production with a flexible delivery/transfer point or on-site production can also gain access to the H2Global funding framework in order to maximize the circle of interested parties and leverage the enormous potential from European production. This requires bilateral contracts, which are not met by the rigid contractual framework of the current H2Global mechanism with its fixed transfer points at seaports.

For the contractual implementation of such a complementary bilateral funding mechanism, a contractual framework could be drafted that consists of fixed and freely negotiable contractual components (possibly with certain guard rails). Points that are particularly critical under procurement law or other mandatory requirements would have to become part of the fixed part of the contract. Contents for the bilaterally negotiable contract elements are, for example, contract duration, place of delivery and the concrete design of the logistics chain. HINT.CO could serve as a control body for the eligibility of the contracts, ensuring that EU requirements and ancillary conditions of the funding agency are met.

Certification of the products supplied can ensure that the requirements of the funding agency are met and, in particular, that both the regulations of EU procurement law and the product quality requirements of RED II are complied with. In this model, HINT.CO would not assume any further commercial risks.

The design of the mechanism would then be as follows: In additional auctions (supplementing the existing H2Global mechanism), various projects consisting of fixed contracting parties on the producer and consumer side (possibly including midstreamers) could bid for a fixed specific subsidy, e.g., in €/t, over a standardized contract period, e.g., 10 or 15 years. The projects (bids) with the lowest specific funding requirement in each case would be awarded a contract (pay as bid) until the maximum funding volume for the respective auction round is exhausted. To ensure a link with the existing H2Global mechanism, the maximum specific funding amount per project could be limited to the funding based on the annual H2Global HSA auctions (specific in €/t). Bilateral contracts would then not receive higher funding than contracts in the existing mechanism in a reference year. Also, by further limiting the max. specific funding level for bilateral projects, e.g., a cap on 90% of the annual H2Global auction result, the fact that bilateral contract design simplifies the logistics chain and thus further increases the economic efficiency of the funding mechanism as a whole could be taken into account.

However, it must always be ensured that the H2Global auction mechanism comprises a minimum volume so that this mechanism (or the resulting specific production volume) can serve as a reliable and robust benchmark or "lead index" for the bilateral contracts.

4.3.2 Promoting bilateral contracts through CfDs

A further addition of contracts for differences (CfDs) to the funding mechanism for bilateral projects proposed in section 4.3.1 can also further increase planning security for the project partners involved. In the auctioning of (two-sided) contracts for differences, the contracting parties would bid on a compensation payment between a fixed price (the bid price) and a market-based price that varies over time. The bids with the lowest funding requirement in each case would be accepted one after the other until the funding volume is exhausted.[14]

In this model, HINT.CO would assume the price risk from these contracts, which would improve the "bankability" of green hydrogen projects. Since the funding volume can fluctuate annually, additional liquidity reserves are necessary on the part of the funding agency. If necessary, the specific funding volume (in €/t) can therefore be additionally limited by a cap. On the other hand, however, there is also the possibility that HINT.CO receives payments from the contracting parties via the CfD if the market-based price should rise above the bid price.

There are two possible options for a market-based price:

a) CfDs on annual H2Global result

In this case, the CfD compensates the difference between the annual H2Global HSA auction result and a fixed price bid by the parties (in both directions). If the HSA price from the H2Global auction is higher than the bid price of the bilateral parties, the partners are paid the difference. Conversely, the partners pay the difference back to HINT.CO if the HSA price turns out to be lower than the bid price. With this instrument, project partners could secure their competitiveness, especially vis-à-vis other import projects.

b) CfDs on commodity index

As an alternative to a), instead of referencing the H2Global HSA auction result, such a CfD could reference a price formula that maps the cost structure for an alternative purchase of the corresponding green or CO_2-free product from intra-European sources (e.g., through a combination of natural gas price, electricity price and EUA price[15]). With this instrument, consumers who compete with on-site or domestic production (currently mainly conventional production via steam reforming) could secure their competitiveness.

Any kind of CfDs would be seen as a complement to the existing annual H2Global mechanism, which can give buyers the opportunity to increase planning certainty.

An overview of the proposed approaches to expand and complement the existing H2Global funding mechanism is provided in Figure 4.

[14] An editorial correction has been made in this sentence. The version originally published did not refer to the bid with the lowest funding requirement, but to the lowest bid. This has now been corrected.

[15] A similar approach is currently being discussed in the United Kingdom. Depending on the production technology, indexation on the basis of the price of natural gas and/or the consumer price index as well as a pass-through of the CO_2 price are envisaged. The "Agreement for the low carbon hydrogen production business model" can be downloaded here: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1125173/Low_Carbon_Hydrogen_Production_Business_Model_Heads_of_Terms.pdf

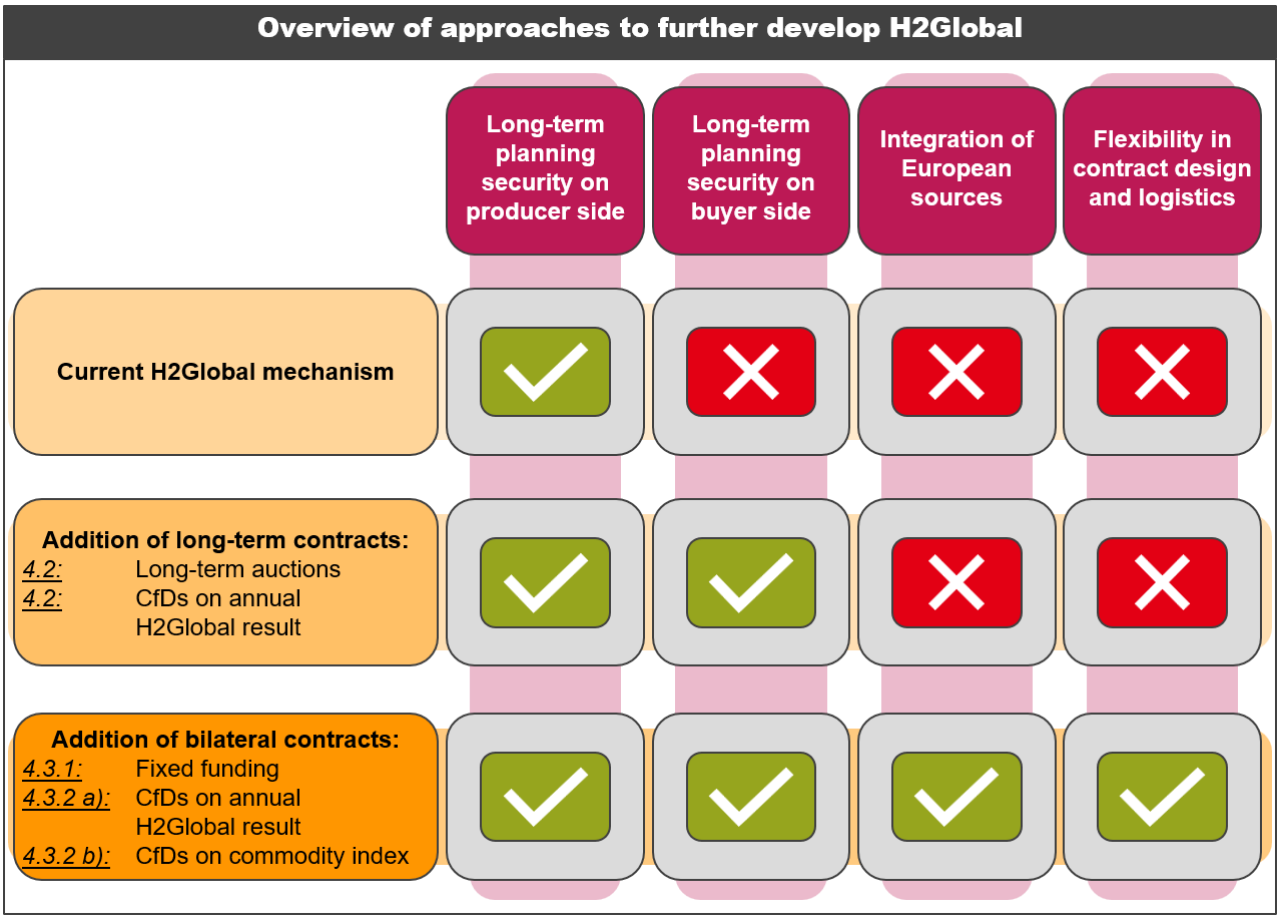

Figure 4: Overview of the different approaches to further develop the H2Global mechanism

5 Joint further development of the H2Global mechanism

With H2Global, an instrument was created to promote the ramp-up of hydrogen, which has the potential to develop into the central import mechanism for green hydrogen and its derivatives in Europe. However, the above-mentioned explanations show that the H2Global mechanism needs to be further developed in terms of both the funding volume and the conceptual implementation. The further development options for H2Global outlined above are initial ideas that could significantly improve the attractiveness of the instrument on the consumer side.

Based on the approaches described above, concrete proposals should be developed in the further discussion process to further increase the attractiveness of the H2Global mechanism for all participants in the value chain of hydrogen and its derivatives, to extend its reach and to increase the efficiency of the subsidies. By extending the promotion mechanism to bilateral contracts, H2Global has the potential to become the central promotion mechanism and the leading index for the promotion of hydrogen in Germany and Europe. A concrete concept for the further development of H2Global should include the aspects shown in Figure 5.

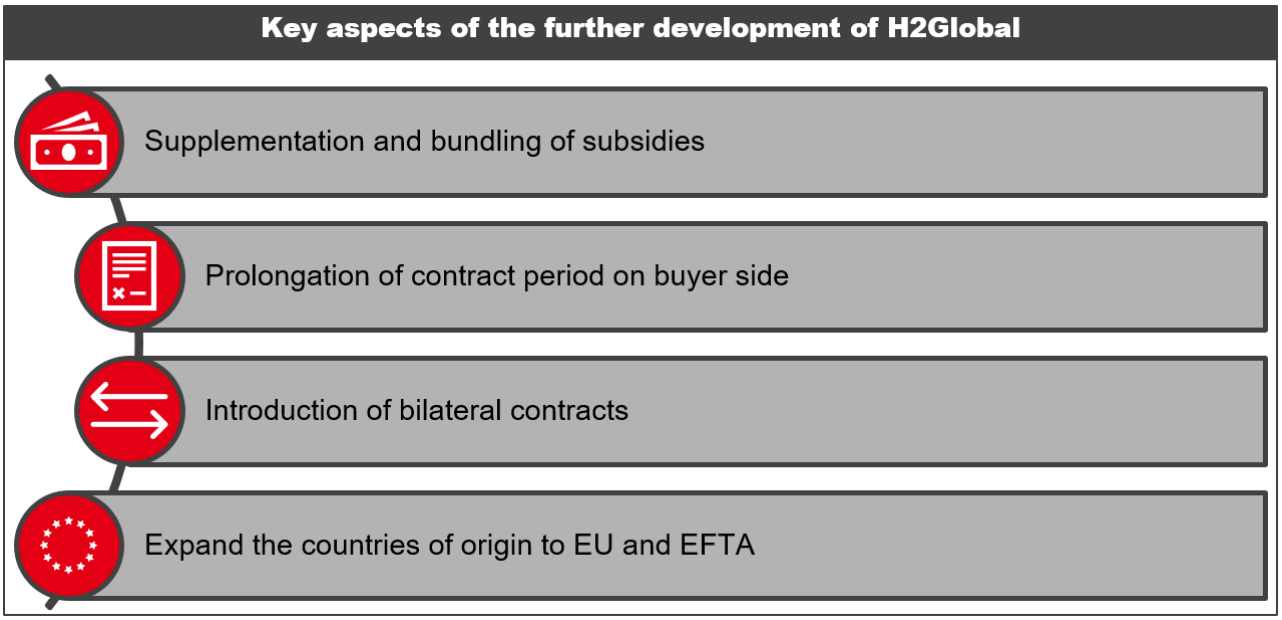

Figure 5: Key aspects of the further development of the H2Global mechanism

E.ON Hydrogen GmbH and B E T offer their services as initiators and discussion partners for the further concrete design.