NATIONALER WASSERSTOFFRAT

STATEMENT **2024-11-22**

System-friendly electrolysis

1 SYSTEM-FRIENDLY ELECTROLYSIS CONTRIBUTES TO ACHIEVING THE TARGET OF 10 GW OF ELECTROLYSIS CAPACITY BY 2030

It is crucial that Germany achieve the target of 10 GW of electrolysis by 2030 in order to support the rapid ramp-up of hydrogen in this country. In addition, this target is important in order to successfully shape the energy transition and ensure security of supply in the energy system. The National Hydrogen Council (NWR) expressly welcomes this and supports the German government in its endeavours to achieve the target. From the perspective of the NWR, a central component of this is the promotion of system-friendly electrolysers.[1]

Without sufficient electrolysis capacity domestically, the ramp-up of the hydrogen economy in Germany will stall, placing the climate targets in jeopardy. The updated National Hydrogen Strategy stipulates that the construction of 3 GW of electrolysis capacity should be subsidised until 2030 through the tenders for system-friendly electrolysis, in accordance with Section 96(9) of the German Offshore Wind Energy Act (WindSeeG). The NWR believes that the construction of system-friendly electrolysers should be subsidised in order to work towards the target of 10 GW by 2030. The German government's planned funding guidelines for system-friendly electrolysers could be a suitable instrument for this.

The targeted expansion and operation of electrolysers can contribute to the stability, security of supply, economic efficiency and environmental compatibility of the entire energy system, in addition to the importance of domestic electrolysis for the ramp-up of hydrogen and the achievement of climate targets. It is therefore essential to incorporate suitable criteria into the design of funding guidelines for system-friendly electrolysers.

2. ELECTROLYSERS AS GRID- AND SYSTEM-FRIENDLY SYSTEMS

The basic prerequisite for connecting electrical systems of any kind to the power grid is grid compatibility, that is, compliance with technical connection rules and standards to ensure stable operation. The concepts of grid- and system-friendliness go one step further by utilising the flexibility of the systems. Grid-friendliness and system-friendliness are key concepts for the successful integration of electrolysers into the energy system. Their categorisation and differentiation are necessary for the development of a suitable support system, as they define different requirements for the electrolysis plants. However, it should be noted that it is currently difficult to categorise this in terms of serviceability for the overall energy system, as the energy system is undergoing dynamic transformation and the beneficial

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

operation of electrolysers is still undergoing technical development and depends on business models that have yet to be developed. Therefore, in terms of the transformation and the developing overall system, it will be crucial to explore and enable the sector coupling, linkage and interface function of hydrogen. Hydrogen can be used bidirectionally and brings together electrical and molecular energy supply.

Grid-friendliness describes the targeted integration of electrolysers into the electricity grid and is divided into two central aspects: grid-friendly location and grid-friendly operation.

- Grid-friendly location (electricity): The choice of location for an electrolyser can make a significant contribution to reducing grid bottlenecks, and even avoiding them in the best case. A grid-friendly location exists, for example, when electrolysers are installed in regions with a high feed-in of energy from renewable sources in order to utilise electricity directly that would otherwise be throttled due to grid constraints. A grid-friendly location can also enable additional expansion of renewable energies that would otherwise be impossible or only possible with restrictions due to grid bottlenecks and would have to be temporarily throttled. The choice of location alone is a necessary prerequisite from the point of view of the connection grid operator, but grid-friendliness is only achieved in combination with the 'right' mode of operation.
- Grid-friendly operation (electricity): This describes the flexible operation of the electrolysers depending on the current grid status. Grid-friendly operation exists either in cases to be defined before commissioning or in the possibility that the connection grid operator actively intervenes in the operation of the electrolyser if grid utilisation requires this. At the same time, it should be noted here that the grid operator's rights to intervene in operations must not discourage investments in an electrolysis project.

Together, these two aspects can help reduce grid operating costs and grid expansion costs for both the current and long-term configuration of the electricity grid with grid-friendly electrolysers. Without these two aspects or without the utilisation of flexibility, additional grid expansion would therefore be necessary in many cases.

System-friendliness is an overarching concept that describes the integration of electrolysers into the overall energy system. In addition to the location and capacity of the electricity grid, the availability of hydrogen and the corresponding infrastructure, storage systems and customers is of central importance here. Access to existing or planned hydrogen networks enables hydrogen to be purchased at low cost, which in turn increases the economic efficiency of the electrolysers.

It would also be conceivable, for example, to prove that a certain proportion of the planned quantity of hydrogen produced is purchased locally, which would allow some of the electrolysers to be located away from the hydrogen core network, if at the same time a further increase in grid bottlenecks is ruled out. Situating the electrolysers in a system-friendly location can not only reduce the need to expand the electricity grid, but also lower the overall costs of the energy system, particularly through intelligent planning and dovetailing of the electricity and hydrogen networks. In this respect, system-friendliness from the perspective of the hydrogen economy could be proven either by a connection to the H_2 core network or proof of purchase in information obtained prior to concluding the contract and a transport concept to the potential customer.

A complete definition and discussion of the above terms is not the aim of this paper. However, in the view of the National Hydrogen Council, system-friendliness in relation to the entire energy system is crucial in order to ensure the flexibility, resilience and economic efficiency of the entire energy system.

3. RECOMMENDED COURSES OF ACTION

It is necessary to introduce targeted funding instruments and maintain or introduce further incentives in order to effectively promote system-friendly electrolysis in Germany. This can support investment decisions in favour of system-friendly electrolysers. A prerequisite for funding must be the system-friendliness of the planned electrolyser, for which appropriate criteria must be developed. For this reason, the National Hydrogen Council expressly welcomes the fact that the German government is planning to introduce funding guidelines to incentivise system-friendly electrolysis in Germany and is committed to ensuring that, ideally, the expansion of the 10 GW of electrolysis capacity by 2030 is system-friendly.

A targeted system to subsidise electrolysers with system-friendly conditions for the location can be realised through a tendering model that creates competition and at the same time aims for efficient grid and system integration. The basis for this is a clear definition of the location criteria for system-friendliness, which are geared towards optimising support for the electricity grid and meaningful integration into the hydrogen infrastructure. Different classes based on electrolyser size should be subsidised at differentiated levels, as the location of large-scale plants in priority areas can also be well complemented by small electrolysers (for regional clusters[2], for example). Capacities for the construction of electrolysers are put out to tender annually or at other specified intervals based on a location definition for system-friendliness. The tenders should be designed in such a way that they promote competition among providers and stimulate innovation and cost efficiency in the choice of location and operational management. Potential operators of electrolysers would then apply for funding in a competitive process. Criteria such as proximity to renewable energy sources, integration options in existing or planned hydrogen infrastructures and flexible operating models for grid stabilisation should be given particular consideration. It is also conceivable to use this as a pre-qualification criterion for participation in tenders.

In addition to direct funding via a tendering model, further incentives for electrolysers can be continued or introduced. The electricity grid fees are an important cost component in the operation of electrolysers, for example. Incentives for electrolysers in the area of electricity grids therefore presuppose that electrolysers fulfil the criteria of grid-friendliness. The NWR recommends the following incentives for grid-connected electrolysers to accelerate the ramp-up of the hydrogen economy:

- An exemption from electricity grid fees beyond 2029. This would reduce the operating costs for electrolysers, thus increasing their economic efficiency and promoting the ramp-up of the hydrogen economy. However, this would place an additional burden on other grid users. A reduction in grid charges or permanent exemption beyond the existing statutory regulations must be linked to a measurable and, compared to other measures, more cost-effective contribution that is made to the operation of the grid.
- Construction cost subsidies (*Baukostenzuschüsse*, BKZ), which are paid for electrolysis projects, play a decisive role in the investment costs and thus in the economic efficiency and financing of electrolysers. On the other hand, the construction cost subsidies are the central control instrument of the grid operators, and are levied on all connectees in order to prevent inefficient over-dimensioning of the electricity grids. In the dialogue on the construction cost subsidies, it is essential to observe principles such as openness to technology, non-discrimination and cost-reflective pricing for all connectees. The discussion about the construction cost subsidies and the calculation methodology should be conducted in relation to the connection of all grid users in order to ensure that costs are distributed fairly in future.

[2] See NWR statement on 'Regional H_2 clusters: The hydrogen ramp-up needs domestic value chains' from 21 June 2024.

Therefore, the NWR recommends incentivising the grid-friendly location of electrolysers and other end consumers by means of regionally differentiated construction cost subsidies and clear guidelines on controllability at all grid levels.[3]

With regard to investment security for electrolysis projects, another crucial point is that subsidies and incentives are provided in such a way that they guarantee long-term planning security over the specified period. Long-term planning security can only be guaranteed if an electrolyser is categorised as system-friendly at the time of funding and if this status is maintained in the event of future changes in the energy system. For this reason, it is necessary to establish clear regulatory frameworks to ensure that electrolysers continue to make a positive contribution to system stability, even under changed conditions.

In addition to targeted subsidies for electrolysers, it is important for a successful market ramp-up for hydrogen that further incentives be created on the demand side.

4. SUMMARY

The development of significant electrolysis capacities with an output of up to 10 GW of electrolysis capacity by 2030 is important for the successful ramp-up of the hydrogen economy in Germany. Subsidies for domestic electrolysis capacities makes a contribution to this. Targeted support for system-friendly electrolysers can contribute to the stability of the energy system. Distinctions between grid compatibility, grid-friendliness and system-friendliness in this paper emphasise the specific requirements and possibilities that electrolysers have in the energy system.

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

THE GERMAN NATIONAL HYDROGEN COUNCIL

NATIONALER WASSERSTOFFRAT

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

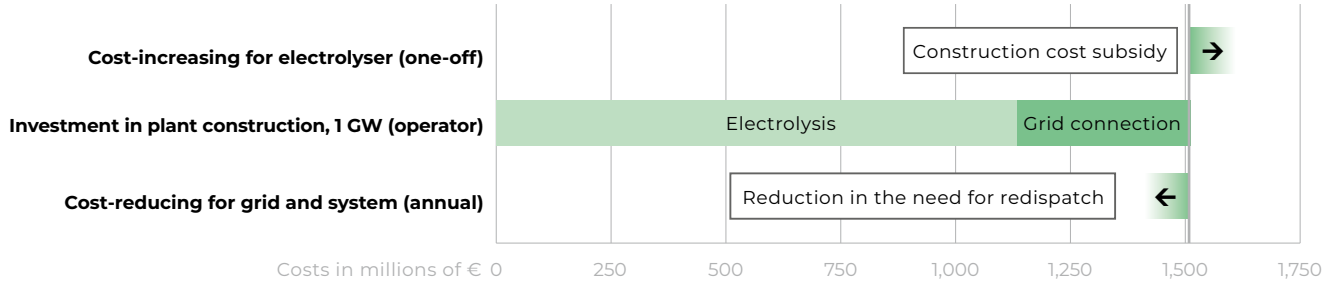
Prof. Dr. Michael Sterner (OTH Regensburg) on 'Using instead of reducing (redispatch)'

The throttling of wind and solar energy due to grid constraints and the balancing of this by fossil-fuel power plants (redispatch) leads to additional costs for electricity consumers of several billion euros per year and additional emissions of greenhouse gases, which unnecessarily burden both the climate and Germany as an industrial hub. Electrolysers can minimise the losses caused by negative electricity prices and redispatch and transform them into something beneficial and in turn reduce system and grid costs. In combination with gas storage systems (optionally via methanation and biogas) and reconversion to electricity, electrolysers are the only technical option for storing a sufficient amount of wind and solar power on a seasonal basis using existing technology, thereby bridging lulls in wind and solar power (the so-called *Dunkelflauten*, or 'dark doldrums') in a climate-neutral way and ensuring security of supply on a national scale using our own resources. In addition to this function, electrolysers enable the defossilisation of other sectors via power-to-X. They would not be considered end consumers, but they do have an important function regarding the stable operation of grids, the system integration of renewable energies and climate protection.

Prof. Dr. Michael Sterner (OTH Regensburg) on the 'Construction cost subsidy'

The current insolvencies in the hydrogen sector show that the cost burden for green, domestic hydrogen is too high. The construction cost subsidy (*Baukostenzuschuss*, BKZ) is a millstone, as it unnecessarily increases hydrogen costs. It is not objectively justified, as figure 1 illustrates: Electrolysers pay the grid connection. The construction cost subsidy is used to finance the downstream grid expansion. System-friendly electrolysers reduce the need for downstream grid expansion and they integrate surplus wind and solar power, reducing the cost of green hydrogen and improving its competitiveness. They contribute to a more efficient utilisation of the electricity grid. And as part of a long-term storage system, they secure the electricity supply (balancing capacity, long-term reserve) and maintain grid operation in the dark doldrums (guaranteed capacity). They strengthen the resilience of the electricity supply through domestic energy sources and, in so doing, they also strengthen national security. They are of great importance to the system in a climate-neutral Germany. They create regional energy ecosystems across sectors and strengthen regional value creation. This distinction to other controllable loads, which is grid- and system-friendly, justifies a separate treatment of electrolysers.

Figure 1: Investment costs of an electrolysis project in Germany. Numerous examples from the north of the grid show that redispatch costs can be reduced by millions by using large, system-friendly electrolysers. The closer these are to grid bottlenecks, the greater the effect. For this reason, it makes sense to favour such locations. Data source: Project planners, grid operators, simulations.[4]



[4] Joint statement released by the companies involved in the Norddeutsche Wasserstoffstrategie ('Northern German Hydrogen Strategy') from five federal states on construction cost subsidies (electricity) for electrolysis plants, September 2024.

The regional distribution of electrolyser expansion can be incentivised without investment limits, and system-friendly operation can be ensured via flexible grid connection contracts. The income from the construction cost subsidy is calculated as a cost-reducing revenue by grid operators, meaning that the financing of grid expansion does not fail due to an exemption from the construction cost subsidy for system-friendly electrolysers or other storage systems. In addition, the Higher Regional Court of Düsseldorf has ruled that the current practice of construction cost subsidies is unlawful and the calculations of the construction cost subsidy are not entirely transparent or understandable.[5]

For these reasons, it makes sense to grant electrolysers that reduce the need for grid expansion as well as that integrate renewable energies, reduce grid costs and contribute to security of supply a deduction of at least 95% of the construction cost subsidy and only use it to finance their own grid connection, but not the downstream grid expansion. This would maintain the steering effect of the construction cost subsidy and at the same time support the hydrogen ramp-up in this country.

[5] Joint statement released by the companies involved in the Norddeutsche Wasserstoffstrategie ('Northern German Hydrogen Strategy') from five federal states on construction cost subsidies (electricity) for electrolysis plants, September 2024.