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Hydrogen – Import Option Overrules Concerns

The necessary ambitious decarbonization is a major challenge for energy applications such as mobility and energy supply. Green energy resources are limited in many countries in terms of space, output and consistency. An essential part of the German energy transition, according to the new hydrogen strategy, is the import of green hydrogen. Concerns are often raised about availability, poor energy efficiency, and economic competitiveness. However, upon closer analysis, these concerns can be countered. The industrial production of hydrogen in climatically favorable countries and its export have the potential to make hydrogen a competitive alternative and an essential building block for the energy transition. The base conditions are attractive enough to make the use of green hydrogen in the mobility sector a realistic option.

An Arthur D. Little analysis shows that a solar module in an excellent location – in Africa or Saudi Arabia, for example – generates around twice the energy of an optimally positioned German solar module. Ideally, wind is also available at night in such a location. This higher production output absorbs a large part of the losses caused by transport and conversion. Converting solar electricity into green hydrogen on site, importing it to Germany with the help of transport technology (like tanker ships) and converting it back into electricity centrally on a large scale generates negligible well-to-wheel efficiency losses of about 2 % when compared to domestic green electricity production. Applying the hydrogen directly in a fuel cell of a vehicle, the efficiency compared to domestic green electricity and direct use in the BEV is still 76 %. On the other hand, if the domestic green electricity has to be buffered for a longer time

period, the import of hydrogen for central electricity production or fuel cells in the vehicle is the much more efficient solution. Thanks to the significantly higher location quality of sunny countries, disadvantages regarding efficiency can therefore be eliminated to a large extent. In addition, countries such as Namibia or Saudi Arabia have enormous areas of land that favor optimized mass production. Additionally, it can be expected that energy which is not produced purely regeneratively will experience a higher price.

Our economic-technical analyses assume that imported green hydrogen from Saudi Arabia along the entire energy chain will cost 6.36 euros per kg (excluding taxes) at the hydrogen filling station in 2025. By 2050, the price per kilogram will drop to 3.88 euros thanks to scaling and optimization in transport. If we assume that a passenger car can travel around 100 km on 1 kg of hydrogen, it becomes clear that the use of green hydrogen – also using the fuel cell in the vehicle – already represents an economical alternative to the internal combustion engine in the very near future. Although the calculation does not take margins and taxes into account, the potential is abundantly clear, especially since ecological tax burdens will not be put on green hydrogen while fossil energy, as well as not 100 % green electricity, would have to add on CO₂ prices on top.

Whether fuel cells or batteries ultimately play the defining role of the drive system of the future, the facts clearly indicate that imported green hydrogen will play a key role in tomorrow's European energy mix. Furthermore, the large number of possible locations for production prevents disproportionate dependence on individual countries in the future.