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FACTSHEET

# $H_2$GIGA, $H_2$MARE AND TRANSHYDE

The contribution of the three German hydrogen flagship projects to the hydrogen market ramp-up.

## The flagship projects in the context of the German National Hydrogen Strategy

The production of hydrogen via electrolysis is a relatively new field of technology, which is not yet fully developed and especially not at the scale necessary for the energy transition. The three flagship projects $H_2$Giga, $H_2$Mare and TransHyDE by the Federal Ministry of Education and Research (BMBF) are meant to develop central technologies for the green hydrogen ramp-up in Germany and thereby aim to overcome the main hurdles for a successful and efficient hydrogen economy.

The German National Hydrogen Strategy (NHS) outlined the path forward for hydrogen production, transport, and application in Germany. It defined renewable hydrogen as the focus of hydrogen production in Germany, meaning hydrogen produced from electrolysis, which is powered by renewable electricity sources.

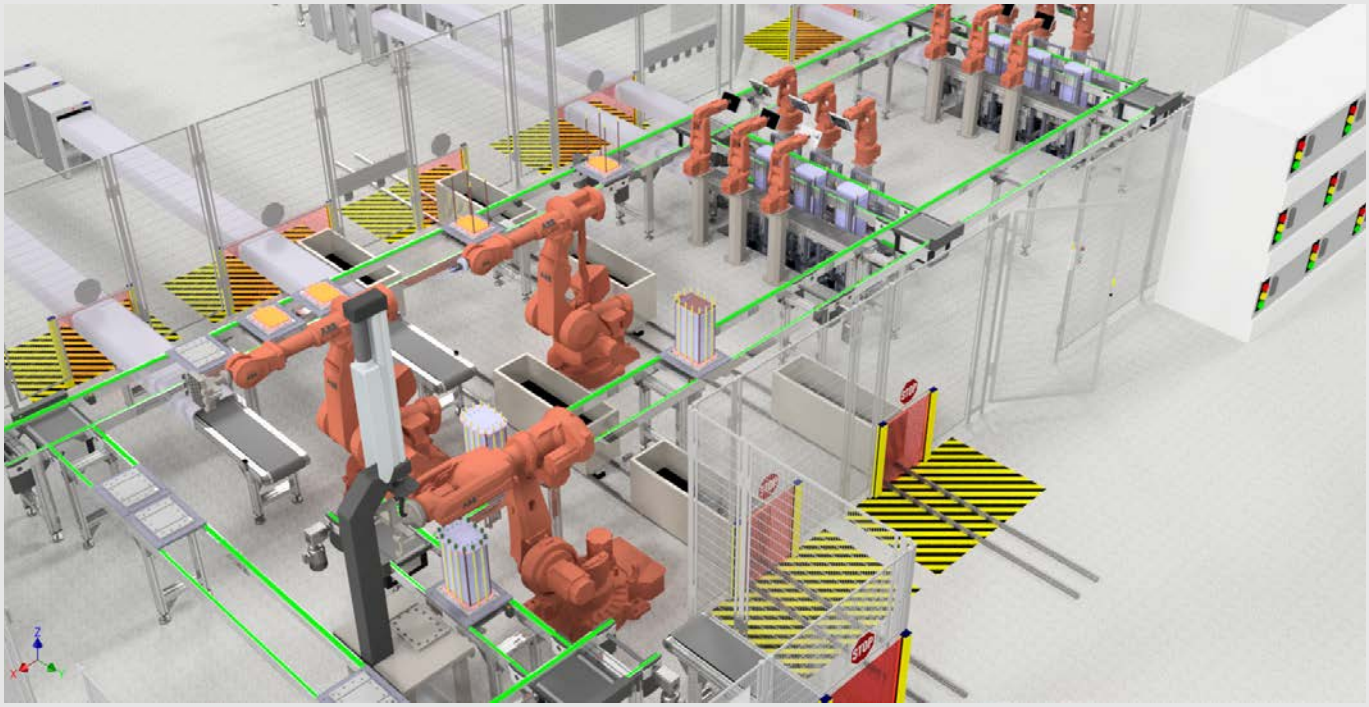
The flagship project initiative is constructed as an important contribution to the NHS as it aims to develop a domestic value chain for hydrogen and especially hydrogen technologies in Germany. The projects are the result of a competition of ideas, in which the ministry called for large-scale industry project plans in a cooperation between industry and science. The three flagship projects were condensed from 32 initial project ideas. As a result, these three initiatives will be developed by a total of more than 200 partners for four years with a total subsidy of 700 million euros.

## $H_2$Giga – the development of electrolysis technology and its ramp-up

Germany set the target of 10 GW of electrolysis capacity by 2030. Low-cost and scalable electrolysis plants are a necessary precondition for the successful implementation of the German hydrogen economy and for the accomplishment of this stated target. The electrolysers currently available on the market are still largely manufactured by hand. The $H_2$Giga flagship project therefore aims to develop the serial production of electrolysers. The idea is that established electrolyser manufacturers, suppliers from different technology areas as well as research institutions and universities join forces in order to accomplish this target. The $H_2$Giga consortium currently consists of 112 partners with DECHEMA as the consortium lead.

The focus is on polymer electrolyte membrane (PEM) electrolysis, alkaline (ALK) electrolysis and high-temperature (HTE) electrolysis. In addition, electrolysis with an anion-conducting membrane will be tested in research facilities. The flagship project intends to create a continuous exchange between industry and science.

Besides scalability, further objectives of $H_2$Giga are to address issues such as recycling, flexible operation and training of the work force.



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## $H_2$Mare – the development of offshore electrolysis technology

The German exclusive economic zones (EEZs) are prime locations for renewable electricity generation. Avoiding the electricity grid integration of offshore wind parks (OWPs) by producing hydrogen and other synthetic energy carriers at sea provides a possibility for a significant cost reduction while simultaneously speeding up installation processes regarding the transport of the produced energy to the mainland. Another argument for offshore electrolysis is that offshore wind resources are more reliable and therefore better suited for electrolysers than onshore wind. The $H_2$Mare project researches and develops the necessary technologies to produce hydrogen from electrolysis offshore as well as other PtX products powered by wind turbine generators (WTG) directly at sea. $H_2$Mare is a consortium of more than 30 partners with a budget of 150 million euros. The project consists of four subprojects – OffgridWind, $H_2$Wind, PtX-Wind and TransferWind.

OffgridWind aims to develop a WTG with an electrolyser directly integrated. The WTG will have a capacity of 15 MW powering three 5 MW PEM electrolysers. OffgridWind conducts a simulation and cost analysis.

$H_2$Wind's focus is on the electrolyser itself. For the offshore operation of an electrolyser, it must be extremely reliable under the harsh conditions at sea. Therefore, $H_2$Wind develops water treatment and supply processes. The cost analysis identifies the conditions for operating such an electrolyser profitably.

PtX-Wind explores the possibilities for PtX-production at sea – ammonia and methanol among others. Tests include producing the required $CO_2$ and nitrogen directly at sea by extraction from air or seawater. PtX-Wind furthermore researches HTE and seawater electrolysis, which would avoid the extra step of desalination.

TransferWind aims to connect the other three subprojects while developing answers to environmental and safety issues. A further task of TransferWind is the facilitation of discussion between science, industry, politics and civil society.

## TransHyDE – the development of hydrogen transport technology

The flagship project TransHyDE is addressing the comprehensive development of transport technologies for hydrogen. The approach is open to all technologies along various possible development paths. TransHyDE has four demonstration projects, each of which tests and scales up one identified transport technology. These transport options are the hydrogen transport in high-pressure containers; in existing natural gas pipelines; the transport of hydrogen bound in ammonia and the transport by means of so-called liquid organic hydrogen carriers (LOHC).

In the port Mukran on the island of Rügen, an innovative high-pressure spherical hydrogen storage facility is being developed, which will be integrated in $H_2$Mare's offshore facility to store the produced green hydrogen. In addition, the spherical storage tank is being tested as a transport container.

In the Get-$H_2$ sub-project, a test and demonstration field is being set up for an experimental hydrogen pipeline. The project partners run material safety and monitoring tests. The insights produced by those tests inform decisions on the repurposing of existing natural gas pipelines for hydrogen transport.

The Campfire sub-project is testing the potential of ammonia as a hydrogen transport option with subsequent re-extraction. Campfire is also testing demonstrators for the centralised and decentralised use of ammonia as well as logistics infrastructure for ammonia import and distribution.

On Helgoland, a hydrogen logistics chain via land and sea is being tested. A pipeline transports green hydrogen from $H_2$Mare's offshore facility to the island of Helgoland. For further transport, the hydrogen is bound to organic carrier fluids. In addition, a dehydrogenation plant is being set up in the port of Hamburg to separate the hydrogen from the LOHC again.

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