LIHYP

Linking Hydrogen Power Potentials

January 2024

Uniting Stakeholders to build a regional hydrogen economy in the North Sea Region

Interreg North Sea
Co-funded by the European Union
LIHYP

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LIHYP IN A NUTSHELL

LIHYP WILL REALISE

1. A NSR H2 platform-marketplace linking H2 relevant stakeholders.
2. Data mining for demand, production and supply of H2 from now till 2030.
3. Steps towards managing shortages and surpluses of H2 production.
4. Steps to system integration for H2 infrastructures, harmonisation and standardization.
5. Promote incentives for H2, contribute to level playing field with fossil fuels.
6. Commit LIHYP partners and her associates (about 2000 SMES) to Fit-for-55 targets by drawing up and communicate local-regional-NSR (H2) roadmaps/strategy plans till 2030, based on predictive data analysis.
7. Entrepreneurs, investors and public authorities using roadmaps for business modelling to plan NSR investments and capacities.
8. H2 demonstrators to learn from, showcase and promote H2 applications.

TRANSNATIONAL DEVELOPMENT IN WORKSTREAMS
WP 1: H2 platform-HUB
WP 2: Pilots
WP 3: Legislative Frameworks
WP 4: Roadmaps

2026

- Running features like heatmap
- Supply Demand data
- Fit-for-55 strategy tools
- H2 1.0 trial Market-trading place

Workstreams get input from demonstrator daily H2 challenges

2022
H2 HUB (PLATFORM expert centre)
Supporting members and demonstrators testing funcionalities

Workstreams transnational support demonstrators

PLATFORM MEMBERS

DEMONSTRATORS
- H2 Pilots
- Production-Supply-User coalitions test and demonstrate HLP building blocks in their logistic ecosystems

LIHYP REGION & PARTNERS

The LIHYP project connects various partners from France, Belgium, the Netherlands, Germany and Denmark in the North Sea Region.

The North Sea Region strategically promotes green hydrogen for vital energy sector decarbonization.
With offshore hubs and recent agreements among the North Sea countries for hybrid offshore cooperation projects, aiming to become the "Green Power Plant of Europe," the region seeks to supply the EU with green electricity, reducing import dependency.

Despite numerous European initiatives for regional H2 development, supported by national and EU programs, few focus on knowledge exchange and interregional optimization.

LIHYP bridges this gap by fostering intensive cooperation among the regional players along the North Sea, connecting them across the hydrogen value chain for know-how exchange and collaboration among decision-makers, implementers, and investors.

Leadpartner:

New Energy Coalition
Drivers of Change

aconium
BENTHEIMER EISENBAHN AG
BMÖ clever versorgt
CIRCOÉ Conseil & Innovation en Logistique
DLR Institut für Vernetzte Energiesysteme
Eurowind Energy
Groningen Airport Eelde Luchthaven van het Noorden
H2Region Emsland
HYDROGEN VALLEY
IDIT
kiwa
OLEC Energie bewegt den Nordwesten
P&E Lowlands BV
provincie Drenthe
university of groningen
Carl von Ossietzky Universität Oldenburg
Urban Waterway Logistics
WaterstofNet

LIHYP ACTIVITIES

LIHYP brings hydrogen demand-supply and stakeholders together and raises potential for future aligned collaboration. The project initiates opportunities to accelerate market introduction of hydrogen applications, leading to regional hydrogen value chains connected in the North Sea Region.

The project will realise different pilots for the use of hydrogen such as hydrogen cargo bikes, hydrogen driven freight train, hydrogen bus station and living labs in the Netherlands, Belgium, Denmark, France and Germany.

A North Sea Region hydrogen platform marketplace will be held up for linking relevant stakeholders and a solid database for demand, production and supply of hydrogen will be created.

Different Roadmaps for business modelling will help entrepreneurs, investors and public authorities to plan hydrogen in the North Sea Region.
Together all partners will take first steps for cross-border system integration for hydrogen infrastructures, harmonization and standardization.

Work Packages

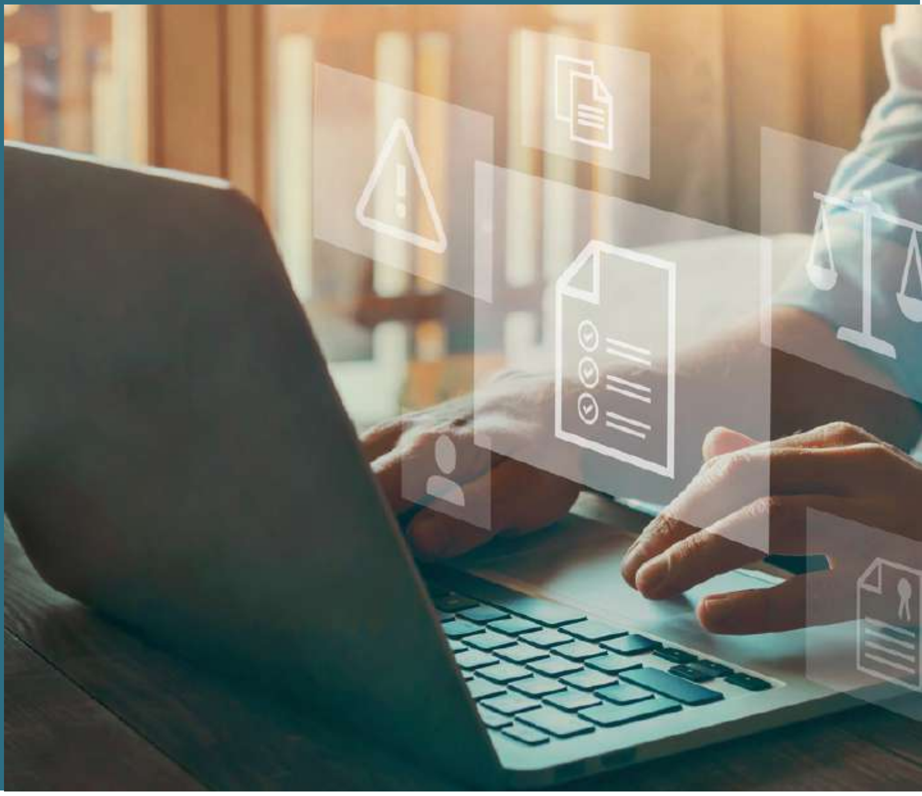
WP 1 - Pioneering Hydrogen Collaboration: Launching the NSR Platform

WP 2 - LIHYP Pilot Activities: Fueling Innovation with H2 Demonstrators

WP 3 - Harmonizing Regulations for Green Hydrogen Integration

WP 4 - Realizing interregional H2 dynamic roadmaps

PIONEERING HYDROGEN COLLABORATION: LAUNCHING THE NSR PLATFORM



Objective

In Work Package 1, our focus is on establishing and implementing the NSR Hydrogen Triple Helix Platform – a dynamic marketplace for 2,000 associates. This platform serves as a hub for contact, information sharing, and collaborative planning, supporting members in informed decision-making for hydrogen applications.

Communication Objectives and Target Audience

Committed stakeholders utilize the platform for their plans and activities, guided by data on hydrogen production, demand, supply, and usage. The goal is to expand regional networks across the NSR, initiating knowledge transfer and collaborative activities, and fostering bilateral communications.

Key Activities

Our strategic approach involves developing a user-friendly digital platform through agile methods, incorporating features like interactive web maps and a hybrid application. An expert advisory committee contributes to prioritizing and rating features.
We create the database structure and platform architecture, implementing optimization through agile sprints. Datasets from around 250 projects are collected, including project details and hydrogen-related information. Stakeholders are identified, and their know-how is integrated into the platform, bridging project activities.
Our analysis extends to optimizing pilot value chains by assessing implementation possibilities using platform data. Stakeholder user analysis informs external communication enhancements, addressing features and overall platform perception through technical analysis and surveys.
A dedicated communication campaign is launched through various channels, raising awareness of the platform's capabilities as a solution provider. NSR stakeholder involvement is facilitated through hydrogen stakeholder events, fostering connections, and enabling cross-border hydrogen value chains.

WORK PACKAGE 2

LIHYP PILOT ACTIVITIES - FUELING INNOVATION WITH H2 DEMONSTRATORS

Objective
In Work Package 2, we focus on H2 Demonstrators to showcase and develop solutions, demonstrating the feasibility and acceleration of hydrogen use. Our aim is to provide practical insights into local system integration, generate essential data, and present innovative logistic concepts.

Communication Objectives and Target Audience
The primary audience for this initiative includes external governmental and business partners as potential platform members. By engaging with LIHYP demonstrators, they can learn and adopt tested hydrogen solutions, contributing to the acceleration of market adoption.

Key Features
We plan to establish five H2 local demonstrators, each playing a pivotal role in leading to the development of regional hydrogen value chains. These pilots serve as practical examples, generating a wealth of technical, economic, and legislative knowledge specific to regional value chains. This valuable data and insights will not only inform an interregional database but also play a crucial role in shaping and supporting regional roadmaps. Additionally, it will contribute to the development of a comprehensive North Sea Region (NSR) roadmap for regional hydrogen value chains. This holistic approach ensures that the knowledge gained is utilized at both the local and regional levels, fostering innovation and sustainable hydrogen integration.

WORK PACKAGE 3

HARMONIZING REGULATIONS FOR GREEN HYDROGEN INTEGRATION

Objective
In Work Package 3, our focus is on harmonizing regulations to fulfill Fit-for-55 targets and maximize the impact of LIHYP beyond the consortium. We strive to identify and address regulatory barriers hindering the implementation of a cross-border clean hydrogen economy, fostering awareness and harmonization. This includes the comprehensive consideration of "fit for purpose hydrogen" and "demand-supply planning of hydrogen" until 2030.

Communication Objectives and Target Audience
Our communication activities target decision-makers in the North Sea Region, engaging national energy agencies, ministries, and branch organizations. This broader engagement aims to establish new cross-border hydrogen value chains, providing solutions and recommendations at both national and EU policy levels. Work Package 3 activities support LIHYP pilots, contribute to WP1 platform, and shape WP4 Roadmaps.

Key Activities
Thoroughly mapping frameworks and regulations, we align them with the platform, roadmaps, and pilots, informing a publication on cross-border green hydrogen value chains. We analyze LIHYP pilots for regulatory gaps, considering certification, standardization, safety, and Fit-for-55 target policies.
Researching conditions for aligning certifications and standards, we ensure the guaranteed origin of green hydrogen. Roundtable discussions contribute to a comprehensive report. Organizing roundtables mid-project and at the end, we engage stakeholders to provide solutions and recommendations for national and EU policy levels.
Consolidating pilot and platform findings, we identify governments' roles in supporting hydrogen implementation, resulting in coherent recommendations for industries, infrastructure, and NSR hydrogen supply. Supporting pilot actions and regions from legal perspectives, we disseminate lessons learned. Ensuring coherence with regulatory frameworks, we transform learnings into a strategic plan, actively contributing to LIHYP objectives.

WORK PACKAGE 4

REALIZING INTERREGIONAL H2 DYNAMIC ROADMAPS

Objective
In Work Package 4, we craft a Hydrogen roadmap for the North Sea Region (NSR) until 2030. Drawing insights from bottom-up platform data and LIHYP pilot regions, this roadmap serves to elevate awareness of Fit4-55 targets, offering decision support for stakeholders.

Communication Objectives and Target Audience
Our aim is to inform policymakers and SMEs, guiding them on optimizing hydrogen tools and policy instruments to align with Fit-for-55 hydrogen goals. This outreach targets regional and national stakeholders involved in NSR hydrogen development.

Key Activities
We conduct comprehensive studies, interviews, and questionnaires to collect regional and national hydrogen goals, ambitions, and strategies. Collaborating with WP partners, we consolidate this information into a top-down roadmap report for the NSR, including regional chapters.

Platform data on H2 supply and demand is sorted and enriched from WP1, transforming it into a detailed bottom-up roadmap for the NSR. This enables in-depth analysis and monitoring of hydrogen development.

Insights from pilot actions (WP2) and regulatory assessments (WP3) are compiled into yearly reports, offering valuable input into regional roadmaps. A dynamic LIHYP interregional roadmap is developed, updated three times during the project.

Interviews assess policy effectiveness, and stakeholder input is integrated through advisory group sessions twice a year. Engaging in discussion and feedback sessions, we organize a roadshow with five sessions and actively participate in at least 10 regional, national, and EU Hydrogen events.

Disseminating roadmaps and recommendations is a collaborative effort across all WPs during the final conference. Work Package 4 actively shapes the hydrogen landscape in the NSR, ensuring informed progress toward Fit-for-55 targets.

HYDROGEN DRIVEN FREIGHT TRAIN IN THE CROSS-BORDER REGION DE/NL

The transportation of goods always connects to the emission of greenhouse gases. Different approaches exist to reduce these emissions, for example the combination of different transport solutions (train, truck, barge&ships, aircraft) or the usage of "green" driving technologies like battery electric vehicles.

Though transporting goods via train has generally a low CO2 footprint, freight trains often use diesel engine, since not every track and especially freight railway stations are not fully electrified – and cross border transport even on fully electrified tracks is not always possible. Therefore, alternative driving solutions are necessary for transporting goods without the emission of greenhouse gases on railways – especially in international context.
But what is necessary to run a cross-border freight train on hydrogen? What are the technological challenges, what is the most feasible way for hydrogen supply and what synergies can be generated in the region?
Within the pilot, these questions will be answered and the foundation of deploying hydrogen driven freight trains in the cross-border region Northwest Germany – Northers Netherlands will be laid by performing an in-depth analysis of economic and ecologic feasibility. Beyond the project itself, the results will help other pilots to be implemented more easily and the first steps to CO2-neutral freight trains can be made.

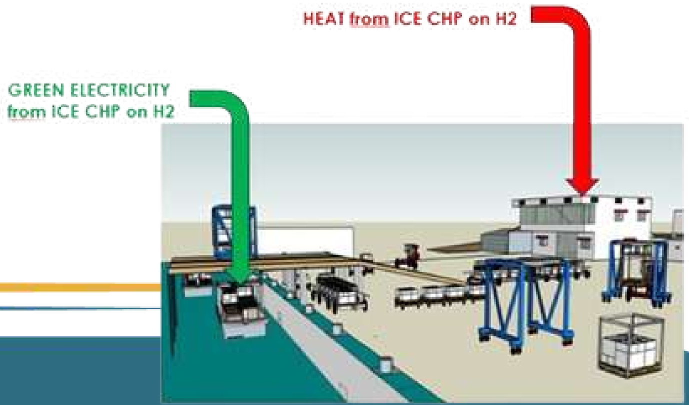
LIHYP – PILOT – GENT (BE)

Usecase Living Lab Belgium:
Onsite surplus power will be stored in an urban barge for movable energy supply + test CHP unit for power and heat production.

Concept:
The principle of cogeneration or combined heat and power (CHP)is easy : residual heat radiated by an electric power generator is collected and then put to gooduse. CHP is the most energy efficient transformer of stored renewable energy into useful heat and electrical power. The electrical power generator will power e-vehicles/vessels/e-cargobikes and use the residual heat for heating the building on site. Electricity from PV (Photo Voltaic Panels) is used for small-scale local (on site) production of H2 and be used as a Smart Grid solution.

LIVING LAB BELGIUM

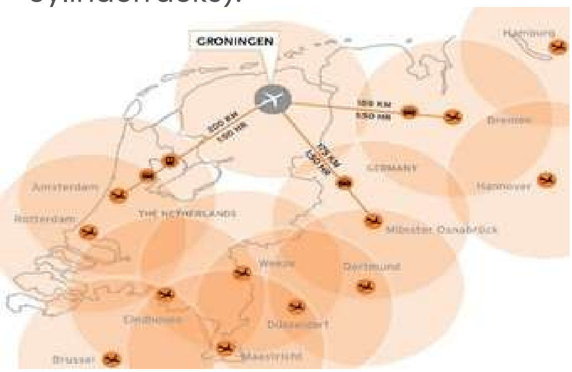
The locally stored H2 is converted energy-efficiently into electricity and heat when there is a demand for electricity (when the vessel is at the quay, e.g. during the night).
The electricity is used to charge the "floating battery" installed the vessel. The heat is used for building/warehouse heating or other heat consumers on site. The "floating battery" can be used as a mobile emergency power supply. The "floating battery" can be used additionally (if it is not sailing) together with the CHP (Combined Heat & Power) on H2 for grid support. The latter can be very important in critical situations (black out threat in crisis situations for example).
If not enough hydrogen can be produced locally (due to weather conditions), the hydrogen can still be supplied from larger production sites in Gent area along the available waterways. Alternatively, a strategic stock could be kept on site since H2 can be stored for long periods without loss of energy and is therefore extremely interesting as a strategic storage of energy.



LIHYP – PILOT – GRONINGEN (NL)

HYDROGEN VALLEY AIRPORT GONINGEN AIRPORT EELDE

The Hydrogen Valley Airport project will focus on the feasibility of utilizing the on sitegenerated green solar power as feedstock for a direct coupling with an (airside) 1MW electrolyser system there by ensuring full green hydrogen production.
Optimization and simulation studies will outline the optimal operational characteristics and the sizing of the electrolyser.
The switch towards greenhydrogen will ensure the demonstration of the full decarbonization of the described airport operations (landside, airside). The green hydrogen production will be connected to a trailer fill installation to enablefilling of mobile storage equipment (hydrogen trailers or cylinderracks).



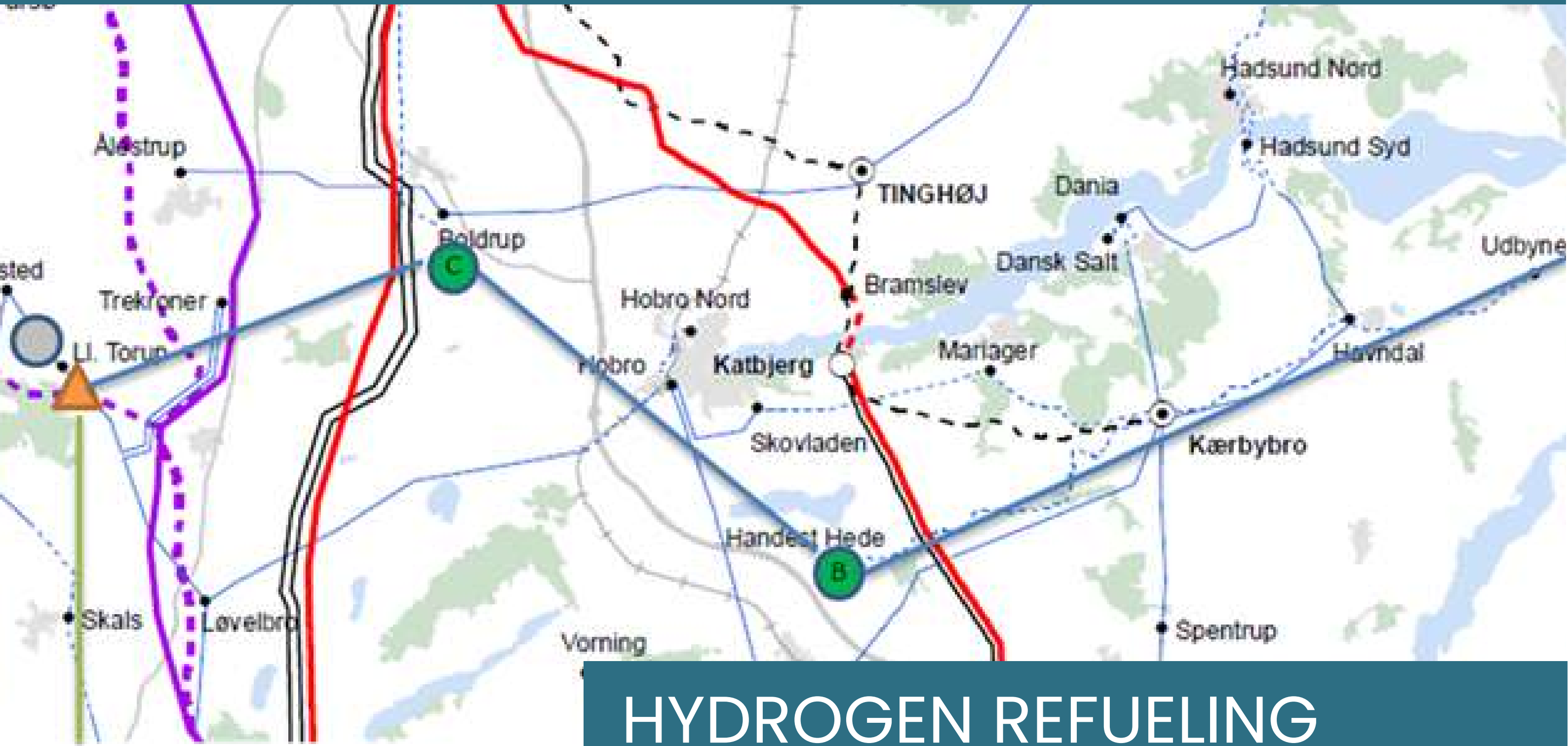
This will enable the effective distribution of the green hydrogen to locations on and off site including a hydrogen refuelling station(HRS), that serves both land and airside vehicles, to be realized on or in the vicinity of the airport. Here the fuel cell electric vehicles (FCEV) can be fuelled with green hydrogen.
Moreover, connections will be made to the regional hydrogen distribution system as already in place in the region developed under various EU supported projects thereby making effective use of the zero-emission infrastructure. Optimal control strategies will be developed to ensure that the energy delivery targets are reached.
Feasibility studies will be executed, and optimization and simulation models will be developed to extend the value chain by a closed loop covered walkway test/trial-installation on landside, combined with direct individual charging stations for vehicles and powering public lighting.
End goal of the project is to implement the system at a fully covered parking area. A connection will be made to the SkyNRGDSL-01 project which will produce 100.000 tons of Sustainable Aviation Fuel (SAF) at the Chemical complex in Delfzijl (province Groningen) as of 2022. This connection will ensure that the aircrafts at GRQ Hydrogen Valley Airport will have access to regionally produced SAF with clean kerosene. The bulk of this clean kerosene will be shipped and trucked via Pernis (Shell Aviation) to Schiphol Airport (not included in this project).

LIHYP – PILOT – OLDENBURG (DE)

DEVELOPMENT OF A LOCAL ENERGY HUB FOR CITY CARGO

Internal logistics with many start and stop cycles and limited accessibility through desired emission reduction measures need an energy supply that meets the operating and usage expectations of the users.
The supply of the application with green hydrogen allows the reduction of emissions and long operating times of the cargo bike. The rapid restoring readiness will then also allow for reliable delivery in cold periods of the year with increased goods traffic.

Operation in several shifts and optimised conditions for trained staff through changing or refuelling times and heat supply for the driver of the vehicle also offer advantages here.
How can and must green hydrogen reach the customer?
How should the application be supplied with hydrogen in the best way for the user? Which requirements on the personnel and on the filling functionality have to be considered? All these questions are to be investigated in practice in the LIHYP project and provide answers to the required infrastructure and the provision of the fuel.
Fuel cell cargo bikes for inner-city logistics allow longer operating times and advantages for the operator. This proof will be investigated in the project as a technical demonstration. Both the supply of green hydrogen and the provisioning will be investigated. In addition, influences of the fuel quality and there filling of the tanks for use in the vehicle will be conceptually and prototypically implemented. In the process, both official regulations and labour law requirements for handling hydrogen must be implemented accordingly.
In addition to the reduction of emissions and the new logistical advantages, the pilot should also be able to be recommended toother regions for as a blueprint. To this end, appropriate communication and presentation of the concept to interested parties will be promoted within the framework of the project.



HYDROGEN REFUELING STATION CONNECTED DIRECTLY WIND/PV SITE

Eurowind is the owner of a largescale onshore wind/PV site, located at Handest Hede, Northern Denmark. Eurowind is currently developing a Hydrogen Refueling Station (HRS) connected directly to the Wind/PV site. The permitting application for electrolysis on site is being developed at this moment.
The technical solutions for HRS are well known, but the direct connection to renewable energy sources creates the necessity for a revised design, based on the needs of the customers, which is the goal of this pilot.

The activities will include the following:

Activity 1: Techno-economic specifications
Specifications of hydrogen pressure, buffer tank size, locations/piping, connection to existing infrastructure, usage of excess heat in district heating.

Activity 2: Stakeholder study
Eurowind and Hydrogen Valley have received multiple requests from local distribution companies, as these are beginning to test hydrogen trucks in their fleet. The need of these stakeholders are key to creating the optimal system design for the HRS.

Activity 3: System integration
Optimal System Design, based on activity 1 and 2 (Wind to Truck),different scenarios can be utilized, as Eurowind is an integral partner of Green Hydrogen Hub Denmark, it will be analyzed whether to connect to the GHH infrastructure or use a closed-loop, "behind the meter" setup – or a combination, based on the delivery of documented green hydrogen following the ISO standard.