H2 PORTS

First application of hydrogen technologies in port handling equipment in Europe

4 Newsletter

June 2023

Clean Hydrogen Partnership

Co-funded by the European Union

Hydrogen has been used in industrial applications for a very long time, and as a result, the technologies for its use for such applications are very well-known and there are experienced providers. However, new technologies and applications are currently being proposed to exploit all the potential of a hydrogen economy, which are currently under development. This is the case of mobility application such as its use as a zero emission options for port application, as a zero carbon maritime fuel, to decarbonize the road transport or to have a cleaner public transportation in European cities, to name some examples. New uses also imply new analysis needed and new challenges to be overcome for which collaboration among all actor involved will be necessary.

This Newsletter gather some contributions from several initiatives providing new insights and also result of collaborative efforts: in ports (new study released and the creation new cluster) about electrolyser technologies, and finally about the strategic approach of the Valencian Region.

INDEX

Study on hydrogen in ports and industrial coastal areas

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According to the REPowerEU Plan the "development of port infrastructure and their connection to both industrial and transport users in the vicinity will be of critical importance" for increasing the demand for renewable hydrogen in Europe to 20 million tonnes per year in 2030. REPowerEU includes the ambitious target of 10 million tonnes of renewable hydrogen production in the EU and 10 million tonnes of renewable hydrogen imports by 2030.

Using a scenario-based approach, Deloitte Belgium Energy and Climate practice carried out for the Clean Hydrogen Partnership an extensive study that provides detailed outlooks of the potential hydrogen demand and supply in European ports and coastal areas in 2030, 2040 and 2050, along with the required hydrogen value chain infrastructure and a no-regrets investment roadmap for the development of hydrogen activities and infrastructure in the vicinity of ports. The report also provides an overview of the various possible roles that a port could fulfil in Europe's future hydrogen economy.

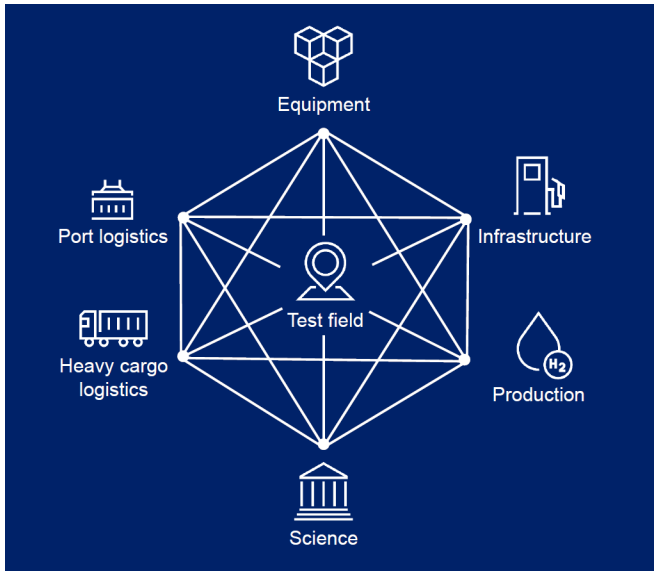
Overall, by 2050, in the most ambitious market-driven demand scenarios, annual hydrogen demand across the EU is expected to increase significantly, up to about 53 Mt (or 1,764 TWh), with 42% (22 Mt, or 730 TWh) of this demand being in port areas.

In the demand scenario aligned with the market development pathway envisioned by the REPowerEU plan, a considerable ramp-up (+174%) from the most ambitious market-driven scenario for 2030 (11.6 Mt) is envisaged. This extremely fast and large uptake of green and, to a lesser extent, blue hydrogen consumption in port areas as a substitution of fossil-based fuels has the potential to lead to significant CO_2-eq abatement in 2050 (up to 360 Mt of CO_2-eq, or 8% of total European GHG emissions in 2019) as well as additional environmental benefits (e.g., reduction of toxic atmospheric emissions, water pollutants, solid waste, and noise emissions).

On the supply side, ports are expected to play a key role as energy transit hubs in facilitating the import of hydrogen and subsequent transportation to multiple end-users in the wider port areas and/or into the hinterland. To match the future demand of hydrogen in 2030, 2040 and 2050, Deloitte's cost optimization model, which strived for economic optimum based on Levelized Cost of Hydrogen (LCOH), concludes that the share of hydrogen import in total hydrogen consumption in the EU could range between 25% and 70% in 2050, depending mostly on the ability of Member States to very rapidly increase the annual rate of deployment of local renewable energy production capacities (solar PV and onshore and offshore wind) over the next years and decades. In all scenarios, the largest hydrogen demand cluster (Belgium, Netherlands, Denmark, and North of Germany) is expected to heavily rely on hydrogen import (between 40% and 80% of total hydrogen consumption), mainly coming from North Africa , the Middle East and even further (e.g., such as Australia). Some intra-European hydrogen exports and imports can also be expected (e.g. from Spain to France).

Finally, achieving REPowerEU's ambitious target and continuing to expand the European hydrogen market through 2050 requires accelerated investment in dedicated infrastructure in port areas to deliver hydrogen to multiple end-users in the wider port areas and/or into the hinterland.

A unique feature of this study is that specific results for each of the 427 European seaports and inland ports in scope on future hydrogen demand, supply, related CO_2eq abatement and required infrastructures for each timeframe (2030, 2040 and 2050) and modelled scenarios can be freely accessed in an online dynamic dashboard accompanying this report. The dashboard provides clear insights to each port authorities and other port-related stakeholders on the potential for hydrogen demand in their port ecosystem and related CO_2 abatement, from where and at what cost this demand could be supplied, and which infrastructures and association investments could be required to unlock the full potential of the hydrogen economy in each individual ports. Stakeholders interested in accessing the dashboard can formulate a request by sending an email to Deloitte-sdebrabander@deloitte.be



Clean Ports and Logistics innovation cluster

Leif Carstens Project Manager, **Hydrogen Innovation Cluster**

Clean Port & Logistics (CPL) is an innovation cluster established by the Hamburger Hafen und Logistik AG (HHLA) with the aim of testing hydrogen-powered equipment in port logistics. The primary goal of the project is to investigate how hydrogen and further renewable energy carriers can be used reliably in port applications and logistics. The cluster consists of eight working groups that examine the different applications in heavy-duty logistics, their energy supply, and the influence on existing structures and processes. The core objective of the cluster is to create a solid decision-making basis for logistics companies that will have to decide on their path to climate neutrality for terminals and logistics hubs in the near future. Simultaneously, the market maturity of renewable technologies is to be accelerated by testing hydrogen-powered facilities directly in real operations and creating a lively marketplace where partners can exchange information about the challenges ahead and possible solutions.

The centrepiece of the CPL innovation cluster is a test centre at the HHLA Container Terminal Tollerort in Hamburg, where hydrogen-powered equipment for port handling and heavy-duty transport will be trialled in operation. A hydrogen refuelling station and initial applications for testing purposes are expected by the end of 2023. Further equipment will be added in the course of the project. The planned equipment classes for the test environment are straddle carriers, empty container stackers, forklifts, reach stackers, terminal tractors and trucks. In addition, the test field is open for testing other equipment classes and systems in terminal operations.

The innovation cluster intends to bring hydrogen-powered heavy-duty vehicles and terminal equipment to market maturity in a short time and to prepare the necessary measures for their deployment. The concepts developed for operation, safety, repair, maintenance, refuelling, and supply will be tested and validated in practical operation. By bringing together interested companies that are concerned with decarbonizing port handling and heavy-duty transport, the cluster aims to support these companies in decarbonizing their processes and making meaningful, climate-friendly investments by gathering necessary information and practical experience.

Currently, the cluster has international partners for instance from Germany, France, Spain, Italy, Estonia, and the USA. The members of the CPL innovation cluster include manufacturers and users of equipment (trucks, port handling equipment, filling stations, etc.), suppliers of hydrogen, responsible parties for the logistics infrastructure (e.g. port authorities), consulting, certification and other service companies, as well as scientific partners. Participation is generally open to all interested companies.

The project website and LinkedIn group are available for those who are interested in learning more about the project or getting in touch with the project team.

The cluster is supported by the National Innovation Programme for Hydrogen and Fuel Cell Technology through the German Federal Ministry of Digital and Transport. The funding guideline is coordinated by NOW GmbH and implemented by the project patron - Projektträger Jülich (PtJ).

The Role of Hydrogen Technologies and Electrolysers in Revolutionizing

África Castro Director of Strategy, Business Development and Communication at **H2B2**

The port industry is facing increasing pressure to reduce its environmental footprint and transition to cleaner energy sources. Ports play a crucial role in global trade and logistics, and the adoption of hydrogen technologies can offer numerous benefits, including reduced emissions, improved energy efficiency, and enhanced sustainability. Electrolysers offer a clean and sustainable method of producing hydrogen, resulting in significantly lower greenhouse gas emissions compared to conventional fossil fuels.

Hydrogen technologies enable the decarbonization of various port operations. For instance, hydrogen fuel cell-powered vehicles, including terminal trucks, forklifts, and cargo handling equipment, can replace diesel-powered counterparts. Furthermore, hydrogen-powered ships or tugboats have the potential to eliminate harmful emissions associated with traditional marine propulsion systems, paving the way for greener and more sustainable maritime transport.

Ports often experience fluctuations in energy demand due to varying ship arrivals and departures. Electrolyzers can act as energy storage systems by converting excess electricity into hydrogen, which can be stored and used during peak demand periods. This improves grid stability and can be used as a backup power source during power outages, ensuring continuity of port operations.

Powering Port Infrastructure

But hydrogen technologies can also play a crucial role in powering port infrastructure. Fuel cells, coupled with hydrogen storage systems, can provide clean and reliable energy for lighting, heating, cooling and other electrical needs within port facilities. By integrating hydrogen technologies into port infrastructure, operators can reduce dependence on external electricity sources and enhance energy self-sufficiency, ultimately leading to cost savings and improved resilience.

With the increasing adoption of hydrogen-powered vehicles, the demand for hydrogen refueling infrastructure is also growing. Ports can leverage their existing infrastructure and strategic locations to establish hydrogen refueling stations, facilitating the refueling of hydrogen-powered vehicles, including trucks, ships, and tugboats.

A project for energy self-sufficiency

One of the projects that is following this direction is the one developed by the Consorcio de la Zona Franca de Vigo together with H2B2 and ImesAPI, in which a hybrid photovoltaic-green hydrogen technology plant will be deployed in the facilities of the Port Area of Bouzas. Specifically, H2B2 will provide a 1 MW electrolyzer, which can produce up to 430 kilograms of hydrogen per day, in addition to the fuel compression, storage and dispensing system. The plant will serve to advance energy self-sufficiency and decarbonization of the Consortium's activity, which expects to reduce its CO_2 emissions by 1,215 tons per year.

Hydrogen technologies, particularly electrolyzers, offer a variety of opportunities for the port industry. From producing green energy to decarbonizing port operations and improving grid stability, hydrogen technologies are transforming ports into greener and more efficient facilities. The port sector can harness the potential of hydrogen technologies and lead the way to a more sustainable maritime industry.

Hydrogen drives the decarbonisation of the Valencian economy

Marta García Pellicer Director at **ITE** (Technological Institute of Energy).

One of the great challenges facing the European Union is to achieve climate neutrality by 2050. In order to achieve this, action by all economic sectors is necessary, and to this end, the different administrations have drawn up their own strategies and initiatives.

In the Valencian Community, the Green Hydrogen Strategy of the Valencian Community (EH2CV) has been designed in line with the European Green Pact, the European Hydrogen Strategy, the National Energy and Climate Plan (PNIEC) and the Strategic Plan for the Valencian Industry (PEIV). It is a public-private collaboration initiative, promoted and energised by the Valencian Regional Government and of which the Energy Technology Institute (ITE) holds the Technical Secretariat.

This industrial initiative is aligned with the promotion of the production and consumption of green hydrogen, its distribution for final use in applications, processes and different sectors of high energy consumption, addressing all the segments of the hydrogen value chain in a transversal and integrated way.

Aware of the importance of the energy transition and the need to decarbonise industrial processes, as well as the design of a new mobility model, the EH2CV provides a coherent framework for the deployment of the hydrogen economy in the Valencian Community, promoting the relevant innovations and investments, through the approach of multiple objectives that are addressed from 4 working groups:

- Promotion of generation and demand in which the needs and developments of the companies are studied, collected and analysed.
- Technological development in which the capacities and challenges of the different agents and the sector are identified, with the aim of tackling collaborative technological projects.
- Regulatory framework in which regional and European regulations are identified and analysed.
- Promotion of hydrogen opportunities, focused on collecting training needs, relating the capacities of the agents and mapping hydrogen producers and consumers in the region.

From ITE, as an Energy Technology Centre, technological partner of the companies and international reference with more than three decades dedicated to the energy sector in which we have focused on improving the competitiveness of the companies through the generation and transfer of knowledge and technology, we coordinate the EH2CV as a living and open roadmap, promoting innovation through collaboration and making all our know-how and infrastructures available to all its members, such as the Hydrogen Pilot Plant, which offers companies an innovative technological ecosystem for the development of R&D&I projects, as well as a testing and validation environment for commercial or experimental components and solutions.

Through ITE's H2 Pilot Plants, companies have access to the analysis of the performance of fuel cells and electrolysers in real applications and operating conditions, sensorisation, monitoring and data processing of operating parameters, in order to carry out usage/optimisation studies, modelling and advanced multiphysics simulation, the use of the equipment as an experimental laboratory for the adjustment and validation of models and algorithms, hybridisation studies of hydrogen technologies, the integration of fuel cells and electrolysers as an energy management platform, as well as the characterisation and synthesis of materials and the development of PEM and DMFC polymeric membranes, among others.

H2PORTS project News

The Port of Valencia now has its hydrogen plant

July 2022. The Port of Valencia begun the installation of the hydrogen generator with the assembly on the north quay, in the Bracet de la Xità area, of the tank and compressor of the station that will supply hydrogen to the machinery that forms part of the H2Ports project. A further step in this pioneering initiative which was completed with the arrival of the mobile unit with the dispenser to position the Port of Valencia as the first European site to use hydrogen technologies to reduce its environmental impact.

All set for the arrival of hydrogen at the Port of Valencia

January 2023. On Tuesday 17 January, the filling test of this clean fuel took place at the hydrogen plant located on the Xità quay. During the previous days, the technicians have been carrying out leak and pressure tests to determine whether the storage tank is leaking and to check that the operation is working properly. Specifically, these tests have been carried out using helium and nitrogen gas mixed with a small proportion of hydrogen, simulating the real conditions of the manoeuvre at high pressures.

The dockers of the Port of Valencia get first-hand knowledge of the H2PORTS hydrogen ReachStacker at the Hyster-Yale Group facilities in Weeze (Germany)

February 2023. On February 2023 a delegation composed of staff from Fundación Valenciaport, the MSCTV terminal and representatives of the Valencia dockers visited the Hyster-Yale Group facilities in Weeze (Germany) to test the operation of the hydrogen reach stacker that Hyster is developing in the framework of the European H2PORTS project.

The main objective of this visit was for both the group of stevedores and the terminal staff to spend as much time as possible with the machine to familiarise themselves with its operation and to be able to detect possible adjustments to be made before the machine is sent to the Port of Valencia to begin the testing period in real operations.

The Hydrogen Terminal Tractor of the H2PORTS project disembarks at the Port of Valencia

April 2023. The Port of Valencia received on April 2023 the H2PORTS hydrogen-powered Terminal Tractor. The terminal tractor disembarked at the VALTE terminal of the Grimaldi Group where it will be tested in real operations. The 4×4 RORO Tractor is the first hydrogen powered unit in the world and was developed by ATENA, a research and technology hub composed of Universities, Research Institutes, and Private Company mainly based in the Campania Region of Italy.

Shipping / Hydrogen International Events

2023-2024

London International Shipping Week - LISW

11-15 September 2023

London, United Kingdom

London International Shipping Week – The biggest maritime event in the UK

Global SmartPorts Summit 2023

17-18 October 2023

Hamburg, Germany

Global Smart Ports Summit 2023 | Hamburg, Germany | October 17-18, 2023 (wisdomevents.net)

GreenPort Cruise & Congress1

18-20 October 2023

Lisbon, Portugal

GreenPort Congress & Cruise (portstrategy.com)

IAPH World Ports Conference

31 October – 2 November 2023

Abu Dhabi, UAE

Home | World Ports Conference

European Hydrogen Week 2023

20-24 November 2023

Brussels, Belgium

Home - European Hydrogen Week (euhydrogenweek.eu)

TOC Europe 2024

11-13 June 2024

Rotterdam, the Netherlands

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