SEVERAL ROTTERDAM TERMINALS TO BE READY FOR HYDROGEN IMPORTS BY 2025

In the Port of Rotterdam, the first companies are busily preparing for the storage, processing and transit of hydrogen: a promising energy carrier that will allow companies to make the transition to climate neutrality. The Port of Rotterdam is in an excellent position to embark on the import, transit and transhipment of this new energy carrier:

- **By 2050, demand for this relatively clean energy carrier is expected to increase to 20 Mtonnes, around 18 Mtonnes of which will be imported.**
- **Rotterdam is already familiar with hydrogen in industry and the transhipment of hydrogen carriers such as ammonia. In addition, the port has experience in the transhipment of cold energy carriers such as LNG and chemicals such as methanol. This experience can be applied to the new forms of hydrogen that are anticipated: liquid hydrogen, ammonia and LOHCs. Rotterdam's extensive, existing tank storage and infrastructure for hydrogen and hydrogen carriers add to the port's appeal as an import location. Companies will be able to develop existing fossil energy assets for hydrogen and hydrogen carriers.**
- **All port areas - from Pernis to Maasvlakte 2 - have the potential to import hydrogen. Depending on the volumes, the import of hydrogen is possible in all of these port areas, both in terms of space and safety, and from an environmental and navigational point of view. Four companies working in refining, energy and tank storage are actively preparing to import hydrogen. It looks like they will have both the physical space and the licences to import, process and export hydrogen in various forms by 2025. In addition, several companies are preparing to free up physical and/or environmental space by restructuring their existing product portfolio.**
- **The unique navigational access means there are no restrictions to the safe shipment of hydrogen in Rotterdam.**

The above are the main findings of a study conducted by the Port Authority into the development of hydrogen import terminals in Rotterdam. The Port Authority held consultations with a large number of Rotterdam-based companies and asked several research agencies to carry out sub-studies into the necessary preconditions in the fields of navigation, safety, the environment and space.

The four terminals that could be operational by 2025 for the transhipment of hydrogen are spread throughout the port area. The hydrogen will be in various forms: liquid hydrogen or packaged in ammonia or methanol or specially developed hydrogen carriers, known as Liquid Organic Hydrogen Carriers (LOHC).

The import terminals will be connected to the central hydrogen pipeline HyTransPort.RTM, which will then transport hydrogen to the end users. Initially, these will mainly be industrial users in Rotterdam, but fairly soon it will also be possible to supply industry in Chemelot and North Rhine-Westphalia, as well as other parts of the Netherlands. For these inland

destinations, preparations for the laying of the Delta Corridor pipeline bundle and a link to the national hydrogen grid are underway.

Rotterdam is by far the largest energy port in Europe. Northwest Europe consumes more energy than it can sustainably produce. Consequently, it will need to import energy and, in particular, sustainable hydrogen. It will be beneficial to the economy, prosperity and the environment if the port industrial complex continues to fulfil this role in the future. For this reason, the Port of Rotterdam Authority, in collaboration with partners from the business community and government, is encouraging the development of the entire hydrogen chain from production to end use, including import, storage and transit, and in particular to Chemelot and North Rhine-Westphalia. Its existing industry, tank storage and infrastructure put the Port of Rotterdam in a strong position to become the hydrogen hub for Northwest Europe at the lowest social costs. The port itself is also well placed to make the transition to the use of hydrogen as an energy carrier and raw material.

FORECASTS

Hydrogen has a promising future, even though there are still doubts about how rapidly the market can develop due to, for example, uncertainty surrounding the form in which the gas will be transported.
The Dutch Top Sector Energy's Hydrogen Roadmap estimates that by 2050 Dutch demand will have reached 4.4 to 14 million tonnes, the variation mainly being put down to the availability of sustainable biomass. That is to say, the more biomass there is, the less hydrogen will be needed. The Hychain study (conducted by the Institute for Sustainable Process Technology) suggests the level of demand for hydrogen will range between 0.8 and 13.5 million tonnes by 2050. The Hy3 research (conducted by TNO, Forschungszentrum Jülich and DENA) puts Dutch demand at 7 million tonnes.

Germany anticipates a total demand of 28 million tonnes, 24 million of which will be imported. At the moment, around one third of German energy imports pass through Rotterdam. If we extrapolate this into the future, we can expect this to be 8 million tonnes of hydrogen. Added to the transit volume to other European countries of around 5 million tonnes and a Dutch demand of 7 million tonnes, this gives us a total of 20 million tonnes. Two million tonnes of this could be green hydrogen produced locally in Rotterdam with renewable energy from offshore wind or directly out at sea by 2050. This would bring the expected volume of hydrogen being imported through Rotterdam by 2050 to around 18 million tonnes.

ROTTERDAM 2025-2030

According to current expectations, the production of green hydrogen in Rotterdam will rise from 115 kilotonnes in 2025 to 195 kilotonnes by 2030.
On top of this, imports of 200 kilotonnes are expected by 2025 and 400 kilotonnes by 2030, with an upward potential of 1,300 kilotonnes, according to the National Hydrogen Programme's forecasts [1].
In terms of volume, imports will rapidly outstrip local production. Countries currently leading the way in developing hydrogen production for export include those in the Middle East, in addition to Morocco, Portugal, Spain, Chile, Iceland and Australia.

1 20210422-csww-inbreng-subgroep-import-export.pdf (nationaalwaterstofprogramma.nl)

These regions have more hours of sunshine and/or wind, which means the price of green electricity is significantly lower than in Northwest Europe and their green hydrogen plants (electrolysers) can run for longer. Besides imports, local production is crucial for pricing, market forces and limiting import dependency.

DIFFERENT HYDROGEN CARRIERS

There are various ways of transporting hydrogen. Unlike oil, which is liquid at fairly 'normal' temperatures, hydrogen must be cooled down considerably (to -253 degrees) for it to become liquid and therefore transportable. An alternative is to 'pack' (and 'unpack') hydrogen inside another molecule, such as ammonia (NH3), methanol or a Liquid Organic Hydrogen Carrier (LOHC).
The process of packing and unpacking requires a relatively large amount of energy and therefore costs. Many of the production countries are too far away for us to be able to transport hydrogen in gaseous form by pipeline. In addition, the cost of generating green electricity, the main cost item when making green hydrogen, is sometimes three times lower in countries with a lot of sunshine or wind and space than it is in Northwest Europe. This largely outweighs the costs of liquefaction or 'packing and unpacking' and makes transport by ship an attractive, flexible and cost-effective alternative.

ROTTERDAM

Based in part on the study into import terminals, the Port Authority is now committed to linking tank terminals in Rotterdam to producers of hydrogen in other parts of the world, as well as connecting them to end users in Northwest Europe. At the same time, we need to develop the connecting infrastructure to create robust hydrogen supply chains.

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