Green Inland Ports

Good Practices

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01

Ports as “energy hubs”

1.0 Ports as “energy hubs’

1.1 Description

Inland ports can play an important regional or even a national role as energy hubs. An energy hub is defined as a place where production, conversion, storage and consumption of different forms of energy (hydrogen and ammonia are often mentioned within ports) takes place. Inland ports can provide low- and zero-carbon energy to end-users within the port network and beyond.

The Eemshaven (part of Groningen Seaports) can be considered an energy hub. Around a third of all the energy that is produced in the Netherlands comes from Eemshaven, as there is an installed capacity of 8,000 MW. Eemshaven is geographically well-situated for offshore wind activities in the North Sea (Groningen Seaports, 2018). Three operational power plants are situated within the port area. Electricity is also being transported to Eemshaven from a Norwegian hydroelectric power station via a submarine high-voltage cable. Offshore wind energy, which will be expanded in the North Sea near Eemshaven, can be transported via cables to other countries, such as Denmark (Groningen Seaports, n.d.). More information can be found on Energyport Eemshaven.

The port of Switzerland aims to become an energy hub. In February 2024, the Port of Switzerland, together with Industrielle Werke Basel, the petrol station operator Fritz Meyer AG/AVIA, GETEC, the energy company VARO and the Basel Chamber of Commerce founded the H2-HUB Switzerland association in Basel. The aim of the association is to develop the Rhine ports as a centre for production, import and distribution of hydrogen in Switzerland. (Roethlingshoefer, F., 2023).

Furthermore, the port of Antwerp-Bruges is aiming to become an energy hub for hydrogen. As sustainable energy will become more and more important, demand for hydrogen fromport users and industry are expected to increase. Due to limited production capacity and available space for production, the port of Antwerp-Bruges wants to provide space for production and transshipment. Effort is being put into creating a hydrogen plant with a 25 mWh electrolyser. Although this will not be sufficient for the expected demand for hydrogen, it gives a signal that the port is trying to become more sustainable (Gerritsen, J. et al., 2024).

1.2 Specific aim of the measure

To stay relevant and resilient, ports need to switch to using sustainable fuel alternatives. When clean alternatives for fuels are being produced in the vicinity of port areas and the port areas

are used to store, export, import and transshipment of clean fuels, the dependence on a limited number of suppliers decreases and the chances of a shortage of clean fuels become minimal. With the aim to decarbonise transport, including inland shipping, inland ports are very well located to play a role in this transition. According to Buonomano, A. et al., (2023), to realise this goal and to contribute to green port areas, attention must be paid to the sustainability of the ship-port combination. Electricity from the energy hub can be used to supply onshore power to docked ships. Also, biomass and waste (water) can be converted to energy, promoting a circular economy.

Ports (planning on) becoming an energy hub

- Eemshaven
- Port of Zwolle
- Port of Antwerp-Bruges
- Port of Amsterdam
- Port of Switzerland
- Niedersachsen ports
- Port of Rotterdam
- Port of Mulhouse Rhine
- Compagnie Nationale Du Rhône (Port of Lyon)
- DeltaPort (Wessel)
- Bayernhafen
- Port of Hamm
- Port of Stuttgart
- Port of Mannheim
- HAROPA Port
- Port of Sevilla

Stakeholders

- Port authority: The port authority is responsible for the sustainable development, management and operation of the port (Port of Rotterdam, n.d.). They would be directly responsible for the port to become an energy hub.

- Companies within the port area: The port functions as a driver of more sustainable port activities. This means that the companies located within the port area need to adopt cleaner forms of energy (Basterra, M. L., 2022).
- Shipping companies: Ports can also promote the improvement of technical energy efficiency on ships, operational efficiency and facilitate the supply of cleaner marine fuels (Basterra, M. L., 2022).

Voluntary or mandatory

Partly voluntary, partly mandatory. Inland ports play a key role in achieving the objectives of the European Green Deal to reduce transport emissions with 90% by 2050 (Ecorys, 2023). To achieve this goal, it is important to implement more energy efficient ways of working in inland ports.

1.3 Realised/potential impact

Due to the early stages of adopting clean forms of energy (hydrogen and ammonia for example), it is difficult to quantify the effect. It will take time to get the supply chains in order and to put infrastructure in place to handle more sustainable forms of energy (Gerritsen, J. et al., 2024, Roethlingshoefer, F., 2023). For example, the port of Switzerland (i.e. Basel) has a hydrogen strategy. As part of this strategy the aim is to develop an electrolyser to produce hydrogen. To give an indication of the time it takes before it is operational: a granted building permission would take around half a year. After this, it would take another 2 years before it would be operational.

1.4 Possible obstacles when implementing sustainable measures

- Ports differ drastically from one another, depending on factors such as size, handled cargo, geography, legal nature of port authorities, connections by air/sea/land, their industrial/transhipment nature etc. This means that the scale in which this can be realised (production/transshipment of clean fuels, and to which extent) varies for each port (Basterra, M. L., 2022).
- It is still uncertain which clean fuel has the largest chance of a strong market penetration because almost all clean fuel alternatives have important drawbacks, such as high prices, safety issues and insufficient infrastructure.
- Although a lot of progress is being made in cleaner marine fuels (LNG), port networks need to be developed to facilitate the penetration of these alternative fuels in ships. On

land, a growing penetration of cleaner energies is also visible, but 85% of port equipment still runs on diesel or gasoline (Basterra, M. L., 2022).

- As port infrastructure can exist for a long time, can be relatively expensive and ports often face spatial challenges, it is important to prioritise certain investments and avoid underutilised projects (Basterra, M. L., 2022).
- Alternative fuels have different energy density. Therefore, more storage space is required which creates challenges to store sufficient volumes and/or makes alternative fuels more expensive and less interesting in comparison to fossil fuels (Foslie, S. S. et al., 2021).
- Currently, there is not enough hydrogen to fuel potential demand and there are not many users due to very high prices (Roethlingshoefer, F., 2023). This leads to a chicken-and-egg situation: as long as hydrogen is not available at a port, hydrogen ships will not go there (van Santen, A., 2023).
- Depending on where the demand of hydrogen is and where the generation of hydrogen occurs, it is possible that ammonia or hydrogen must be transported through the city. There is also a question of safety. Currently, a study on this topic is being carried out in Basel (Roethlingshoefer, F., 2023).
- Results from the Green Inland Ports survey (2024) show that ports in general find this relatively difficult to implement (score of 6.6 on a scale from 1 (being very easy) to 10 (being very difficult)). However, respondents who haven't started developing an energy hub believe an energy hub is of added value to their port.

As long as hydrogen is still being produced with fossil fuels, the CO2 benefits of hydrogen are limited. This is a big obstacle compared to the large investments that it takes (Wuczkowski, M., 2023).

- It is still relatively difficult to get permission to build (large) electrolyser plants (Wuczkowski, M., 2023). Like shown in the realised/potential impact paragraph, it is also relatively time consuming (Roethlingshoefer, F., 2023).
- Ports which do not have large production facilities and wish to become energy hubs face the challenge of transporting energy carriers from countries across the world. (Gerritsen, J. et al., 2024).

1.5 Sources

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