



 **Green** Inland Ports

Good Practices

Funded by
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01

Clean alternatives to energy generation



1.0 Clean alternatives to energy generation

1.1 Description

Solar power and wind energy are renewable, clean energy sources as they create no carbon emissions or GHG.

The measures outlined in this case study are not limited to generating renewable energy, but also include buying 100% green energy. It should be noted that from a life cycle perspective energy generation is not completely clean as raw materials like tin, cadmium, silicon and copper, needed for the production of solar cells, also need to be extracted from the environment and can be harmful to the ecosystem and human health (An, Y. J., 2020). Within this good practice, all alternatives to energy generation are included. The Dutch national Energy Agenda (a Dutch energy report that tries to show a clear and ambitious perspective on energy policy towards 2030 and 2050) provides an overview of the different alternatives for the different sectors, for example encouraging industrial estates to be made all-electric (Ministerie van EZ, 2016). An example of a green energy fuel that currently receives a lot of attention through pilots and trials within inland ports is hydrogen. In and around multiple ports, such as Port of Basel and Niedersachsen Ports (Cuxhaven), pilots with the generation of hydrogen are initiated.

1.2 Specific aim/goal of the measure

The long-term goal for ports is to become net zero. This can be achieved by using clean energy (solar energy, wind energy or potential clean(er) fuels like hydrogen and ammonia). Hydrogen and ammonia (especially hydrogen) are currently mainly in the pilot phase. Gerritsen, J. et al., (2024) stressed that implementing renewable forms of energy and becoming more sustainable are also important signals for other companies and other ports to put more effort into sustainability themselves. In practice, there are already multiple companies that invest in renewable energy, with relatively limited support from the port (van den Ende, J., 2023, Van Wijlick, P., 2023).

Ports that use clean energy

- Port of Vienna
- Port of Den Helder
- Port of Rotterdam

- Port of Amsterdam
- North Sea Port
- Port of Zwolle
- Port of Duisburg
- Port of Venlo
- Port of Antwerp–Bruges
- Port of Basel
- Niedersachsen Ports
- Virginia Inland Port
- Port of Karlsruhe
- Port of Brussels
- Compagnie Nationale du Rhône (Port of Lyon)
- DeltaPort (Wessel)
- Bayernhafen
- Port of Stuttgart
- Port of Aalborg
- Port of Mannheim
- HAROPA Port
- Port of Seville

Voluntary or mandatory measure?

Both voluntary and mandatory. Many ports must adhere to the goals of the municipality within they are located. This means that this measure is obligated in these ports. For other ports, for which this is not the case, sustainability can act as a license to operate within the field, and they are subject to their own climate targets.

1.3 Realised/potential impact

Several examples exist of different projects that are realized within ports that give an indication of the realized impact:

- The port of Barcelona recently installed more than 700 photovoltaic panels, which equals 7 megawatts of solar energy, which have the capacity to cover almost half of the building's energy consumption (PierNext, 2023).
- The port of Rotterdam recently opened the solar park on Patrizia buildings on the Maasvlakte in 2023. This solar park has an energy potential of 25 megawatts (120,000 m² rooftop), which has a capacity equivalent to the average annual energy consumption of around 80,000 households. The total installed solar capacity on the port building roofs reaches approximately 89 MWp (Port of Rotterdam, 2023).
- The North Sea Port puts a lot of effort into renewable energy. There are already 50 wind farms on the North Sea, which are partly built and maintained by companies in the North Sea Port. The port area also accommodates around 100 wind turbines, which jointly generate 280 megawatts each year (around 180,000 households yearly power supply). A solar park has been created at Zonneberg in Ghent, generating a total of 110 megawatts per year (annual consumption of 28,000 households) (North Sea Port, 2022).
- Seddiek, I. S., (2019) analysed the emission reductions of implementing fuel cells and offshore wind turbines as green power strategies in Damietta Port, Egypt. A reduction would be achieved of 32 tonnes of CO₂ and 8 tonnes of NO_x per year.
- Tawfik, M. et al., (2023) conducted a study which aims to optimise their energy management system. The result showed that the installed solar panels provided sufficient generated power to buildings in a Mediterranean port area.

1.4 Possible obstacles when implementing sustainable measures

- A common problem of hydrogen is that infrastructure needs to be built from scratch and many companies need to be connected to the hydrogen plant. To use an electrolyser is a time intensive task, as building permission needs to be granted and it needs time to become operational (Roethlingshoefer, F., 2023)
- Oftentimes with new fuels, such as hydrogen, the issue is that there is not enough fuel available and when there is, it is very expensive (Roethlingshoefer, F., 2023).
- Investment decisions are difficult to make, raising the question of whether a port will focus on hydrogen due to relevant infrastructure being present, or will infrastructure be built due to plans/pilots.
- To utilise the maximum potential of renewable energy on the long term, it is important that companies within the port area put effort into electrification in the short-term (Gerritsen, J. et al., 2024).
- The closer to the equator a location is, the more solar radiation it receives, and the more PV cells can produce. In areas with low levels of solar radiation, such as locations in

higher latitudes, solar panels may not produce as much energy, making them less cost-effective. Pollution, cloud cover, foliage, elevation and other factors may also play a role in the amount of solar energy hits the PV panels (PVcase, 2024).

- Solar panels require a large area for energy production. Utility-scale solar farms use at least 10 times as much land as coal and natural gas plants, including the land to extract and transport the fossil fuels, to produce a comparable amount of power (PVcase, 2024).
- As is the case for solar energy, wind energy is not always available and difficult to store. If wind speeds are low or there is no wind at all, other energy sources must be used.
- Wind turbines are commonly found in open areas, as they can be perceived as loud and be regarded as pollution of the landscape. The large rotor blades often present a hazard for birds (EWE, n.d.).
- Inland ports have different experiences with implementing this measure with regard to how difficult it is to implement, but many inland ports have already done so (source: Green Inland Ports survey, 2024).

1.5 Key learnings

- The goal of using clean renewable energy is not only to become more sustainable as a port authority, but it is also a sign to the world to put (more) effort into sustainability (Gerritsen, J. et al., 2024).

1.6 Sources

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