DELIVERABLE D.T3.3.4
LEADER-FOLLOWER IMPLEMENTATION

Leader Follower Report

Version 1

06 2022

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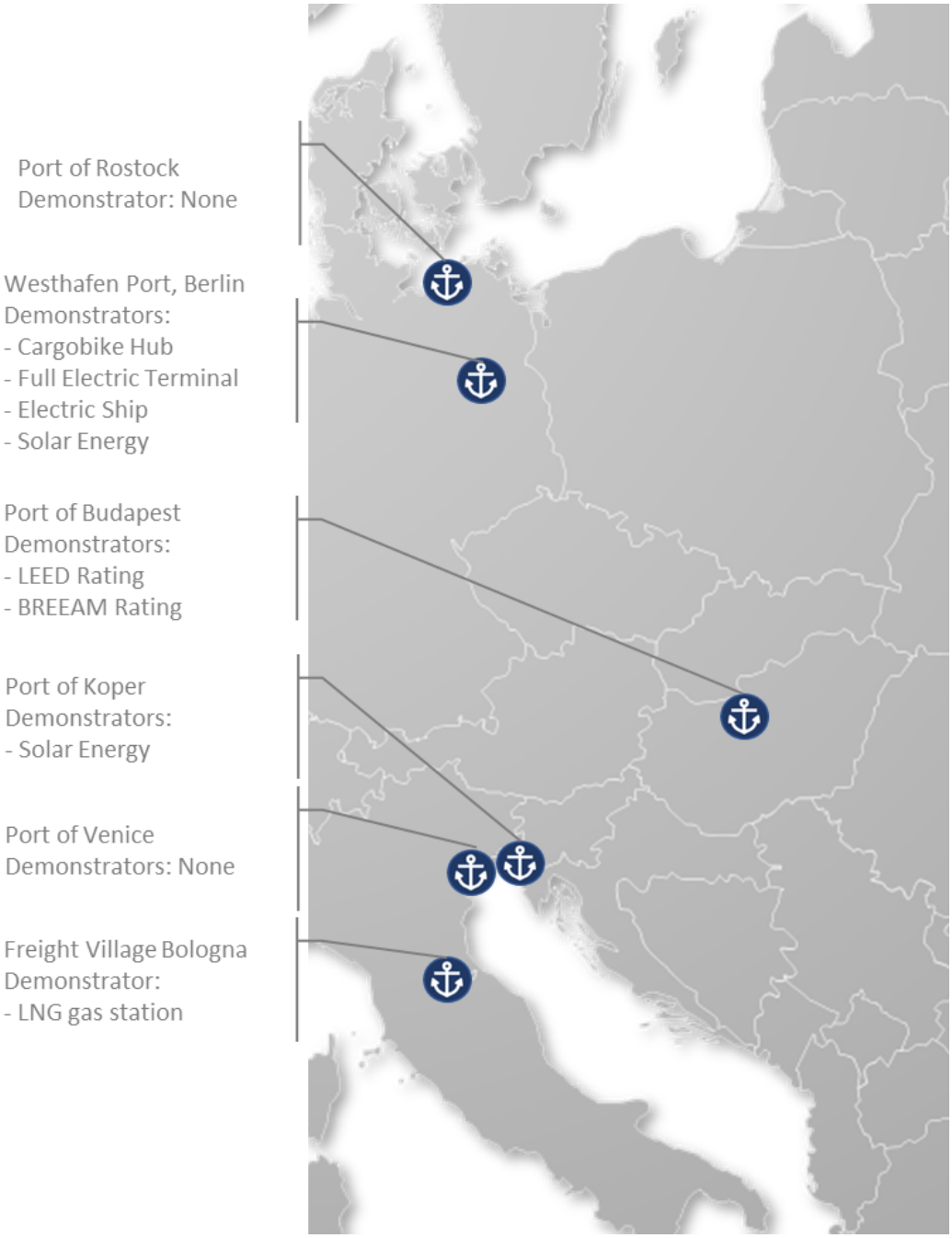
1. Introduction

As part of the InterGreen-Nodes project, the ports involved in the project, followed a leader-follower model. Where some of the ports introduced demonstrators, in order to test and showcase certain solutions, meant to reduce CO2 emissions and other negative environmental impacts.

All ports evaluated each of the demonstrators, in order to make a decision on introducing the underlying solutions themselves.

2. Ports involved



3. Demonstrators

The following seven demonstrators were tested in the Intergreen-Nodes project. All were evaluated by all partner-ports in the project.

Cargobike Hub

Where: Berlin (Westhafen port)

What: Developing and operating an innercity-cargobike hub on the port premise.

Potential Impact: Shifting freight from truck to cargobike on the last mile, with the potential to use rail for the main run (using the ports rail-road transhipment facilities).

Full-Electric Terminal

Where: Berlin (Westhafen port)

What: Changing port operation processes from conventional (diesel) fuel driven processes to electric drives (e.g. trucks, internal terminal freight transport, general purpose cars, utility vans, rail shunting vehicles).

Potential Impact: CO2 reduction

Electric Ship

Where: Berlin (Westhafen port)

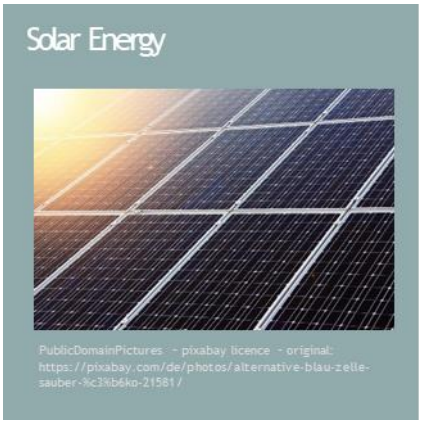
What: Using an electric ship (with battery electric and hydrogen energy storages) instead of diesel driven ships for transport on inland waterways.

Potential Impact: Significant CO2 reduction (exact numbers still pending).

Where: Port of Budapest

What: Using BREEAM and LEED ratings to make the effects of environmental friendly building measurable.

Potential Impact: Environmental friendly building in the areas in energy, land use, materials, pollution, transport, waste and water.



Where: Berlin (Westhafen port) and Port of Koper

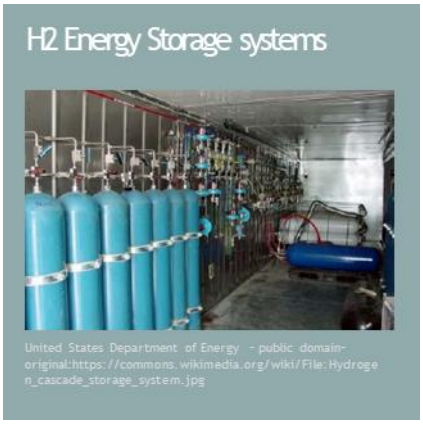
What: Using solar energy to complement the energy mix used by a port.

Potential Impact: CO2 reduction

Where: Freight Village Bologna

What: Developing and operating an LNG gas station for trucks, to be used by customers of the freight village.

Potential Impact: CO2 reduction



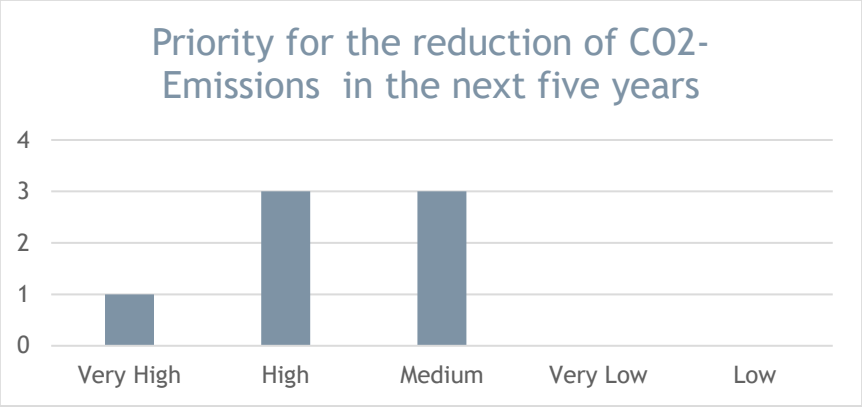
Where: various

What: Using hydrogen fuel cells to store electric energy during high availability times and use them when high energy demand arises.

Potential Impact: Flattening usage peaks and storing energy from clean energy production, making clean energy use economically more viable.

4. Overview of the Leader-Follower strategies

The vast majority of the ports in the project, rate the priority for the reduction of CO2-Emissions in the overall strategy of their organization, during the next 5 years high to medium. Only NASPA (port of Venice) rates it as “very high”. The port of Koper rates the importance as medium to high, leading to them being counted in both categories (medium and high), and also leading to a total count of seven, in the graphic below:



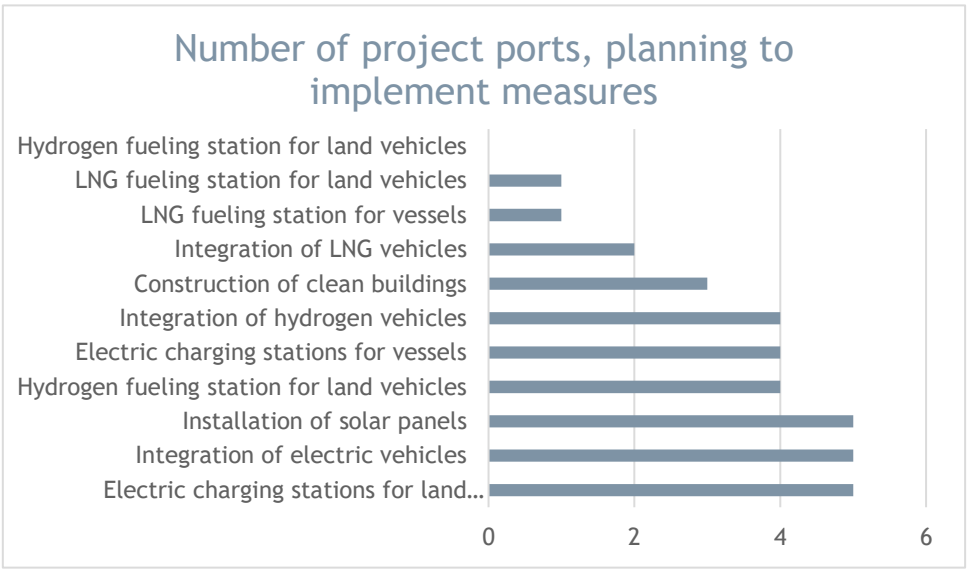
None of the ports rates the importance of CO2 reductions as low or very low, implicating a higher willingness to implement CO2-neutral solutions.

The vast majority of ports plan to integrate infrastructure for electric vehicles and/or electric vehicles. The use of solar energy has a similar importance as the use of electric vehicles.

This approach is closely followed by using hydrogen for transport and transhipment (including the introduction of hydrogen infrastructure).

Half of the ports also plan to implement clean building measures.

The use of LNG is mainly considered by the two Italian partners, an observation that is in line with prior experiences, that LNG is a solution, more often considered in Italy, than in other countries. Though it needs to be noted the Westhafen port in Berlin also already introduced LNG solutions and plans to expand on this solution.



5. Leader-Follower implementations and plans

5.1. Port of Venice (NASPA)

Measures already implemented:

The port of Venice already implemented the following measures. These measures were not part of the Intergreen project:

- Installation of solar panels
- Integration of electric vehicles
- Electric charging stations for land vehicles

Measures planned:

During the next five years, the port of Venice plans to implement the following measures, that were demonstrated and described in the InterGreen-Nodes project:

- Installation of solar panels
- Integration of electric vehicles
- Integration of hydrogen vehicles
- Construction of clean buildings
- LNG fuelling station for land vehicles
- Electric charging stations for land vehicles

Additionally the port of Venices also plans to implement the following measures, that were not demonstrated in InterGreen-Nodes:

- Integration of LNG vehicles
- LNG fuelling station for vessels
- Electric charging stations for vessels
- Hydrogen fuelling station for land vehicles

The port plans to introduce a solar panel plants, one with a planned output of 200 kWp, and another one with a planned output of 1087 kWp. The procurement of two hydrogen-powered for railway loco/tractor-shunting vehicles for wagon handling/shunting is planned.

In order to produce hydrogen a green hydrogen production plant shall be constructed. It is envisioned to produce hydrogen autonomously, through electrolysis, by using fully renewable energy sources (photovoltaics) and also includes storage facilities and the installation of a hydrogen refuelling station near the railways tracks at the port. A Hydrogen-powered vessel (10

m) equipped with a hydrogen fuel cell capable of delivering up to 100kW of power is planned to be purchased.

To further foster the use of electricity in land transport, 8 recharging stations for EV are planned.

Use of the InterGreen-Nodes project, in implementing new measures:

The following information elaborated within the InterGreen-Nodes pilot actions will be used:

- Handbook on the adoption of clean fuels at terminals - Energy Systems
- Handbook on the adoption of clean fuels at terminals - Vehicles.

Moreover, the strategies developed on greening the nodes and spatial planning tools will be used to further implement the action plans.

5.2. Westhafen port Berlin (BEHALA)

Measures already implemented:

BEHALA as the operator of the Berlin ports, already implemented and/or demonstrated the following measures during the InterGreen-Nodes project:

- Installation of solar panels
- Integration of electric vehicles
- Electric charging stations for land vehicles
- Integration of hydrogen vehicles (electric-ship with fuel cells)

Additionally BEHALA implemented the following measures during the project lifetime (but outside the project scope):

- Integration of LNG vehicles
- LNG fuelling station for land vehicles

Measures planned:

During the next five years, BEHALA plans to further expand clean measures at their Berlin Südhafen port locations - including transhipment facilities for loading ships and handling machines as well as the construction of additional buildings with photovoltaic systems for the clean production of electricity.

Use of the InterGreen-Nodes project, in implementing new measures:

BEHALA stated, that they are going to use the reports and handbooks developed during the projects, in order to further their planned CO2-reduction measures.

5.3. Freight Village Bologna (Interporto Bologna)

Measures already implemented:

Interporto Bologna constructed and demonstrated an LNG fuelling station as one of the demonstrators of the InterGreen-Nodes project.

Additionally the also implemented the following measures:

- Installation of solar panels
- Construction of clean buildings
- Installation of electric charging stations for land vehicles

Measures planned:

During the next five years, Interporto Bologna plans to construct hydrogen fuelling stations for land vehicles. The company is already participating in a focus group dedicated to hydrogen, which aims to supplement the existing plant, which already includes an LNG one, with one dedicated precisely to hydrogen, to be evaluated according to market needs.

Use of the InterGreen-Nodes project, in implementing new measures:

Interporto Bologna plans to implement the output of the Deliverable D.T3.3.2 “Full electric terminal pilot” in regard to the development of their own rail facilities. They are also planning on using “Handbook Part 1 – Buildings” with the BREEAM- and LEED ratings demonstrator for the development and the construction of new buildings inside the Bologna freight village.

5.4. Port of Rostock (Rostock Port GmbH)

Measures already implemented:

The port of Rostock took the following measures:

- Installation of solar panels
- Integration of electric vehicles
- Electric charging stations for land vehicles
- Electric charging stations for vessels

Measures planned:

The port of Rostock plans to take up the following measures during the next five years:

- Installation of solar panels
- Integration of electric vehicles
- Integration of hydrogen vehicles
- Construction of clean buildings
- Electric charging stations for land vehicles
- Electric charging stations for vessels
- Hydrogen fuelling station for land vehicles

Rostock Port is obliged to reduce its CO2-emissions by 10% per annum (basis year is 2019). That means a 50% reduction in the next 5 years. A huge leverage effect is expected by switching the energy supply to green electricity. Energy saving measures will be implemented like the complete remaining conversion (20%) to LED lighting of the port. New buildings will be energy efficient, e.g. with solar panels.

Use of the InterGreen-Nodes project, in implementing new measures:

The port of Rostock states that:

“Gathered experiences with the realized demonstrators in InterGreen-Nodes (A.T3.2) will be useful, e.g. the full electric intermodal terminal pilot in Berlin, the solar energy demonstrators in Berlin and Koper or the gained knowledge about energy storage systems in ports.”

5.5. Port of Budapest (Budapesti Szabadkiköt ő Logisztikai)

Measures already implemented:

The Port of Budapest constructed clean buildings and demonstrated the LEED and BREEAM rating process for clean building within the project.

Additionally the port also implemented electric charging stations for land vehicles

Measures planned:

During the next five years the port plans to take up the following measures:

- Installation of solar panels
- Integration of electric vehicles
- Construction of clean buildings
- Additional Electric charging stations for land vehicles

The port of Budapest also plans to implement an internal electric shuttle service, 10 electric charging station for electric vehicles and the installation of solar panels with an output of 50KW.

Use of the InterGreen-Nodes project, in implementing new measures:

The port of Budapest states that:

“Project best practices will be used in the implementation and planning of various measures mentioned above, also technical and financial solutions to fund the various greening effort.”

5.6. Port of Koper (Luka Koper)

Measures already implemented:

The Port of Koper installed a small solar power plant within the project.

Additionally the port also Integrated electric vehicles and electric charging stations for land vehicles

Measures planned:

During the next five years, the port plans to take up the following measures:

- Installation of solar panels, bringing the solar electric output up to 5MW
- Integration of electric vehicles
- Integration of hydrogen vehicles
- Electric charging stations for land vehicles
- Electric charging stations for vessels
- Hydrogen fuelling station for land vehicles

Use of the InterGreen-Nodes project, in implementing new measures:

The knowledge and experiences gained through the project, were used for planning of new larger solar power plant of 3MW to be installed in 2024; funded by ILN grants.