DNV·GL

MARITIME

# Pathways to port decarbonization

## Technologies and state-of-the art

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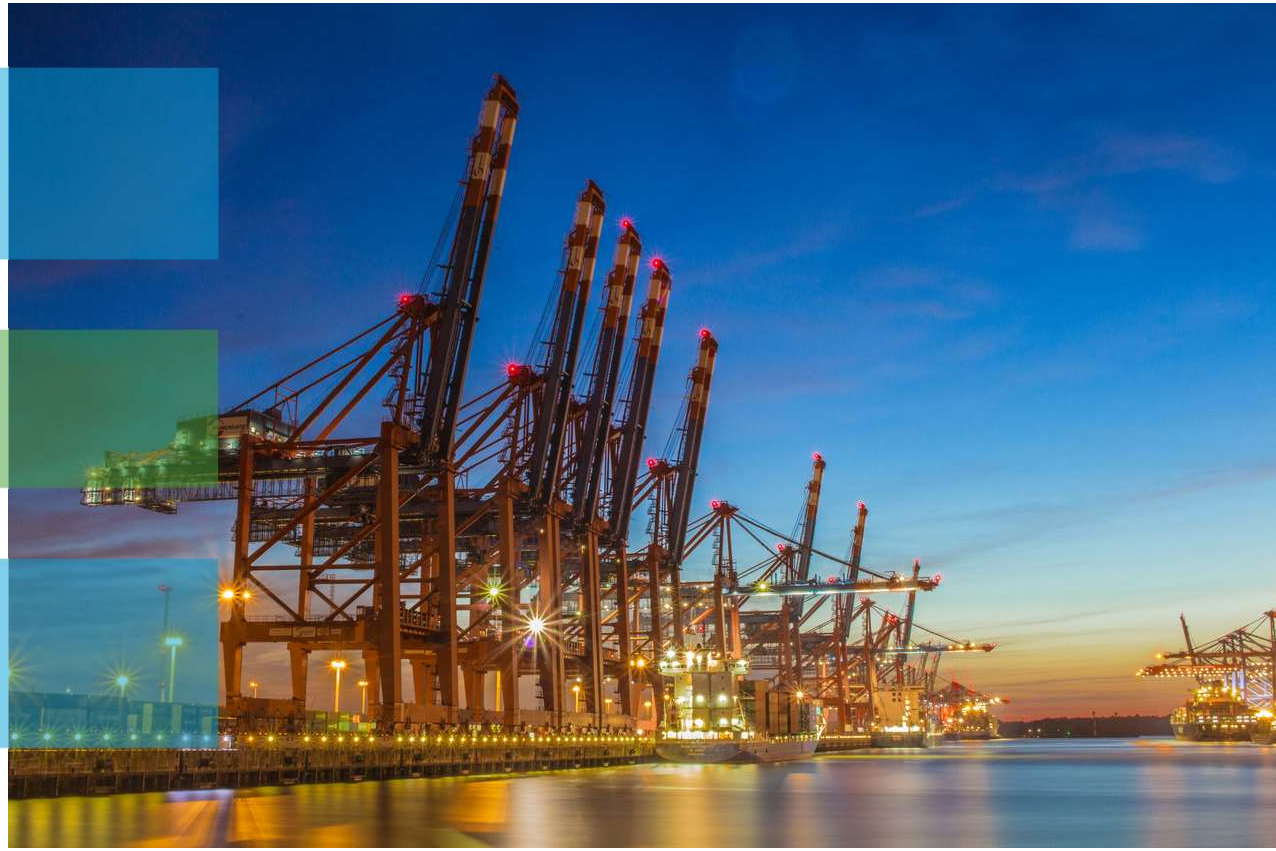
# Can ports become hubs for decarbonization?

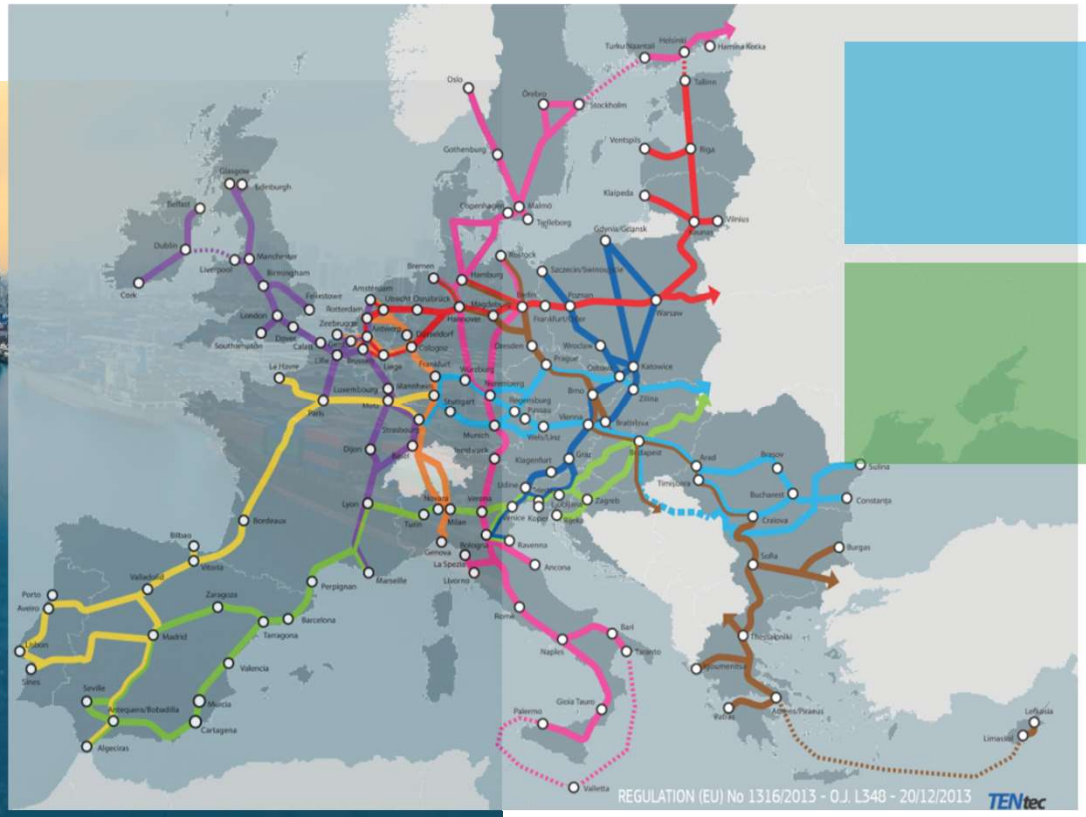
Clean energy future

Technology to curb emissions

Sectoral integration



# Ports can be the front runners!




Host of multiple sectors

Ground for green transitions

Source: https://ec.europa.eu/transport/themes/infrastructure/ten-t_en

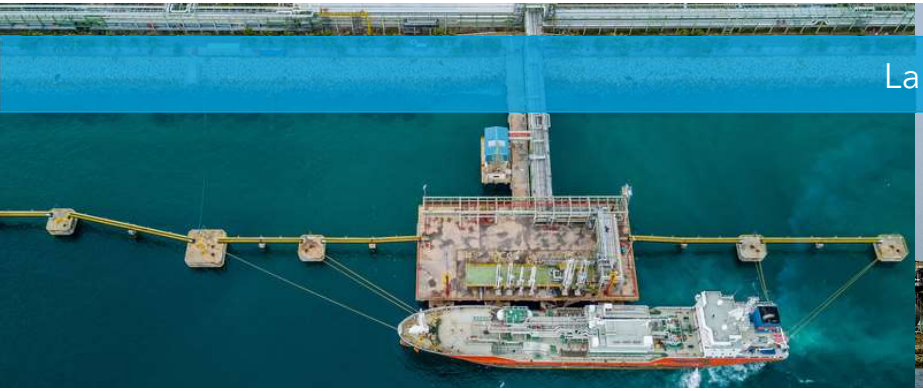
# Pathway to decarbonization

## Green transitions

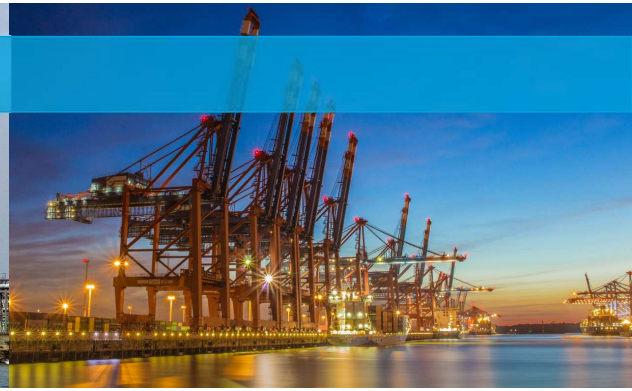
Ports: Green Gateways to Europe
by DNV GL with input
from Eurelectric

www.dnvgl.com

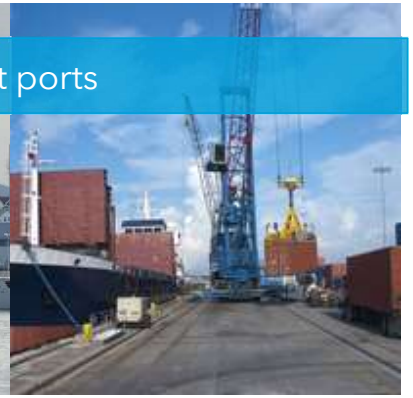
# Ports of the future



Large industrial ports



Smaller transport ports

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# Decarbonizing large industrial ports

# Decarbonizing smaller transport ports

Hybrid systems

Fuel cells

Alternative fuels

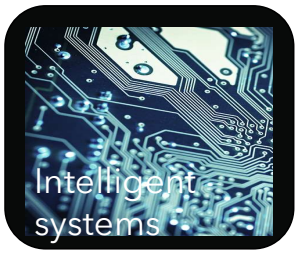
AI

Case-dependent

# Technology enablers will be intermodal solutions





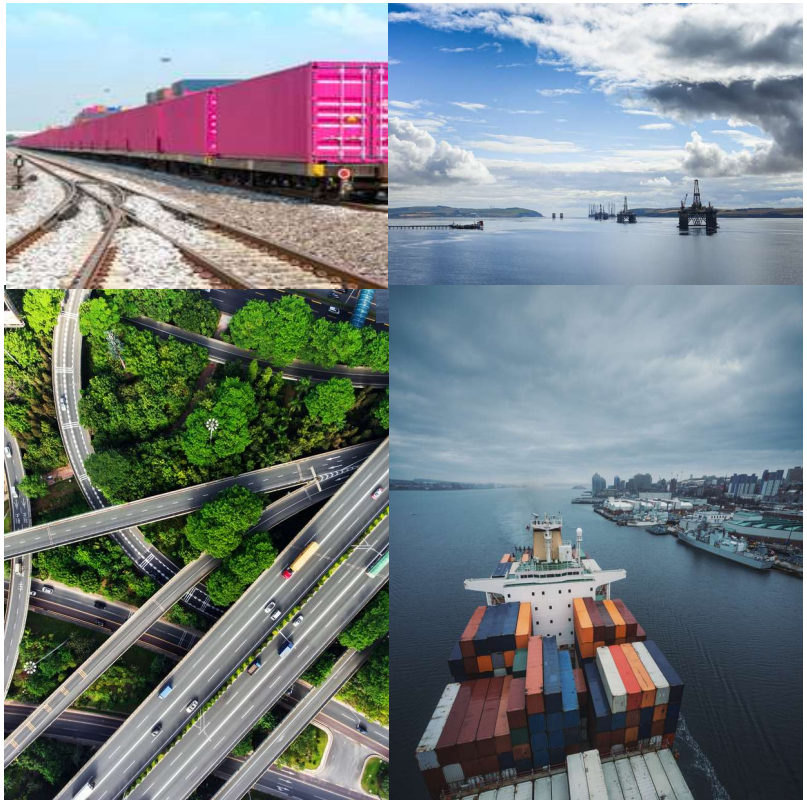




Autonomous systems

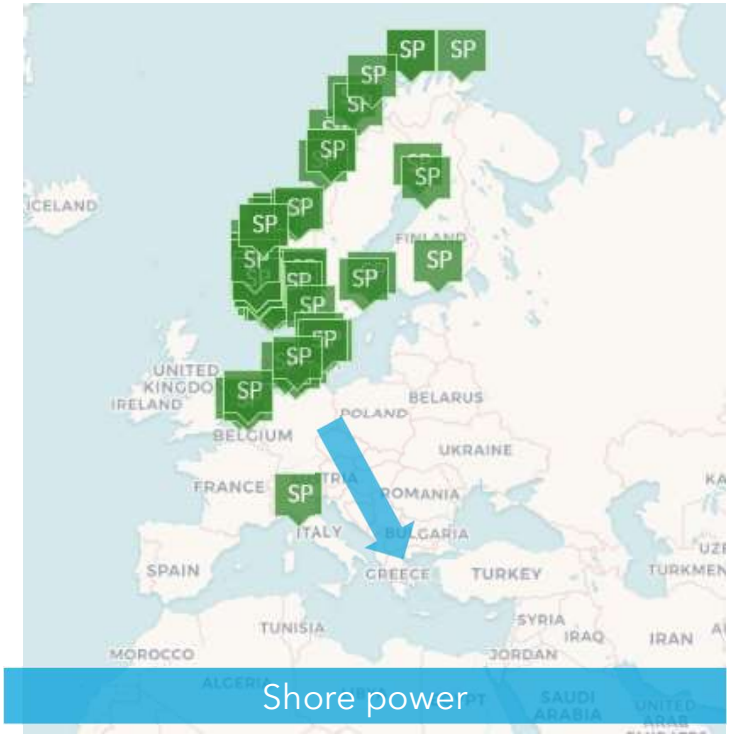
Digital integration

…



# Electrification, digitalization and automation

Alternative Fuel Insight → Access through DNV GL Veracity




Shore power


Battery use

www. moses-h2020.eu

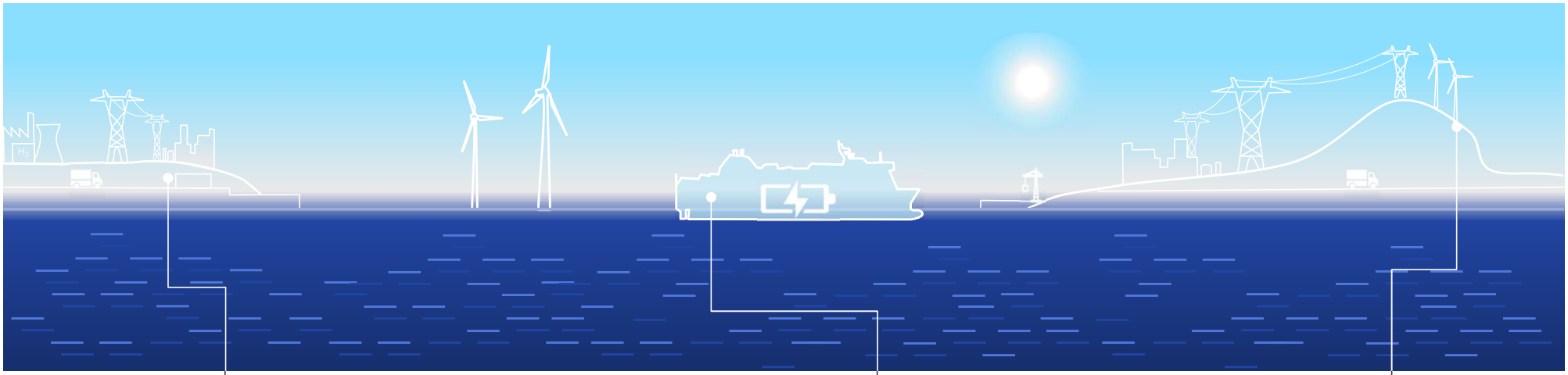
MOSES

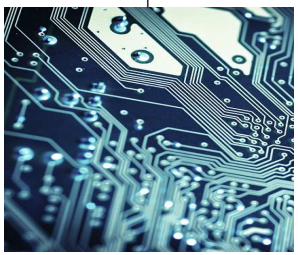
MOSES Project Overview

AutoMated Vessels and Supply Chain Optimisation for Sustainable Short SEa Shipping

This project has received funding from the European Union's horizon 2020 research and innovation programme under grant agreement No. 861678.

# Integrating RoPax segments with renewable electricity sources





# Status of hydrogen

Fuel cells

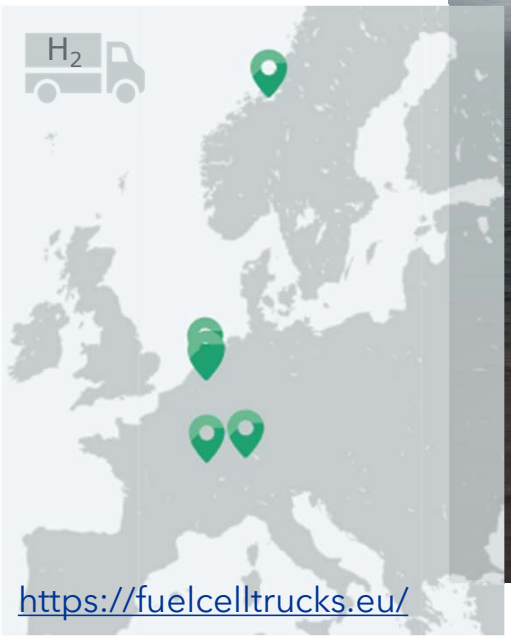
High efficiency integrated systems

Hydrogen carriers and alternative fuels

Fueling infrastructure

Safety codes

Regulation




https://fuelcelltrucks.eu/

# Status of cleaner fuels

LNG, LPG

Hydrogen carriers

Biofuels

Bunkering infrastructure development


# Status of multimodality sector coupling

Development of multimodal corridors

Technologies for multiple modes

Digitalization and intelligent systems

Coupling of transport modes and energy infrastructures

Concept not old…

SuperGreen Supporting European Union's Freight Transport Logistics Action Plan on Green Corridors Issues

# Status of carbon capture and storage

Mature technologies

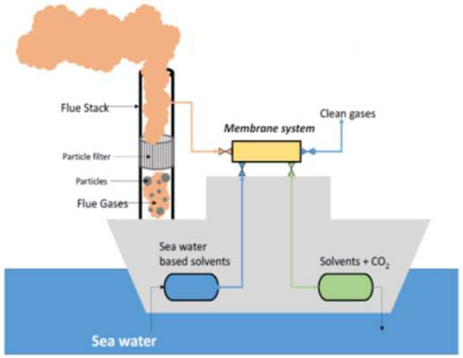
Research and development for transport modes

Intramodality

Supply chains

**MemCCSea**

Innovative membrane systems for $CO_2$ capture and storage at sea




memccsea.certh.gr

The MemCCSea project No 299690 has received funding from GSRT (GR), FZJ/PtJ (DE), RCN (NO), DoE (USA) and is co-funded by the European Commission under the Horizon 2020 Programme, ACT Grant Agreement No XXXX.

# Making ports green gateways

Policies and regulations

Market incentives

Research and development

Sectoral integration

## More info:

*Energy transition outlook 2020*
*Ports: Green Gateways to Europe, DNV GL with input from Eurelectric*
*Ammonia as a marine fuel, DNV GL*
*memccsea.certh.gr*
*moses-h2020.eu*

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