Onshore Power Supply: good examples and challenges

Sotiris Raptis, Senior Advisor for Environment
European Ports Forum, Brussels, 11 June 2018

European Sea Ports Organisation

Port authorities

Port associations

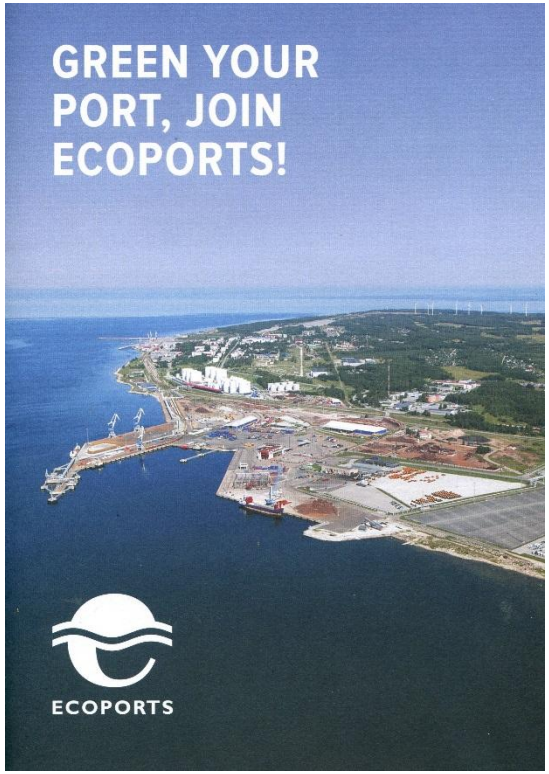
Port administrations

from EU and Norway

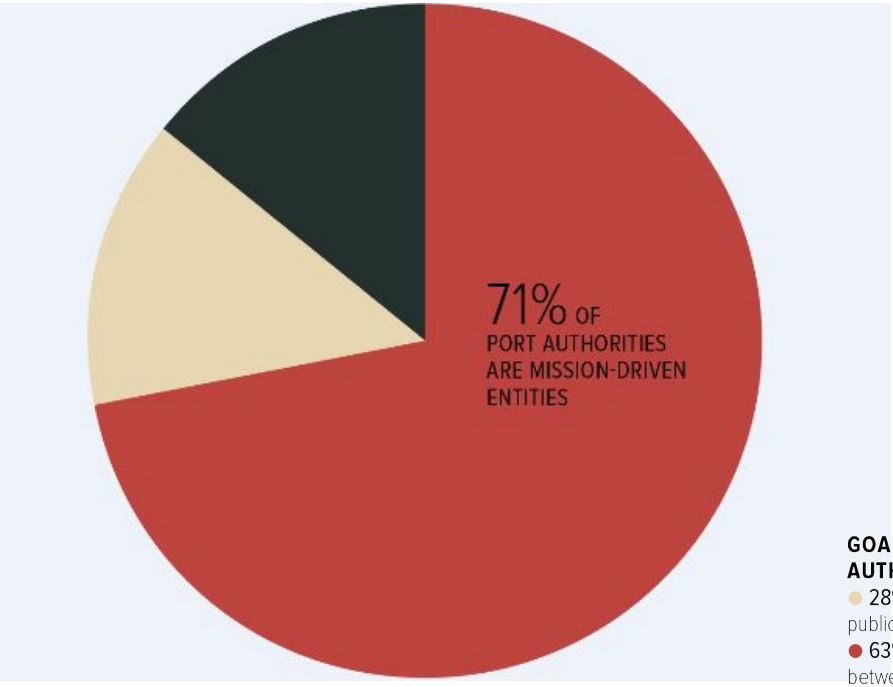
Observers: Iceland, Israel & Ukraine
Since 1993

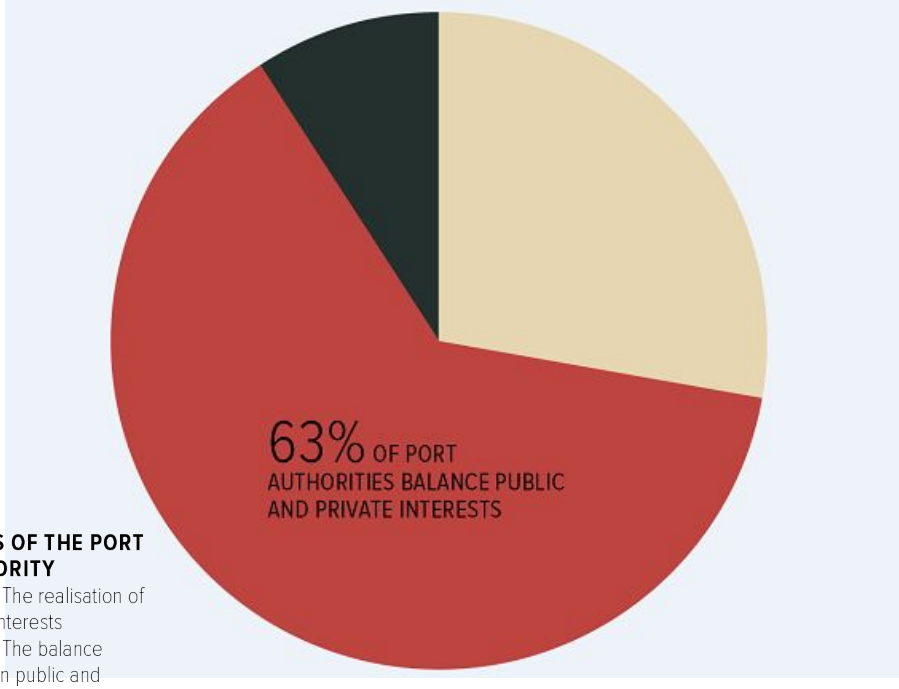
EcoPorts network

- ✓ 21 years
- ✓ Around 90 ports are currently in the network
- ✓ Defines the environmental profile of your port: answering 250 questions (SDM):“check up”
- ✓ Review: compare with the average “wake up call”
- ✓ 1/3 is PERS certified (Lloyd’s register)
- ✓ SDM and PERS: 2 years valid



Ports are mission-driven pursuing public interests





GOALS OF THE PORT AUTHORITY

- 28% The realisation of public interests
- 63% The balance between public and private interests
- 9% The realisation of private interests

Source Trends in port governance 2016

Emissions/Noise top priorities for ports

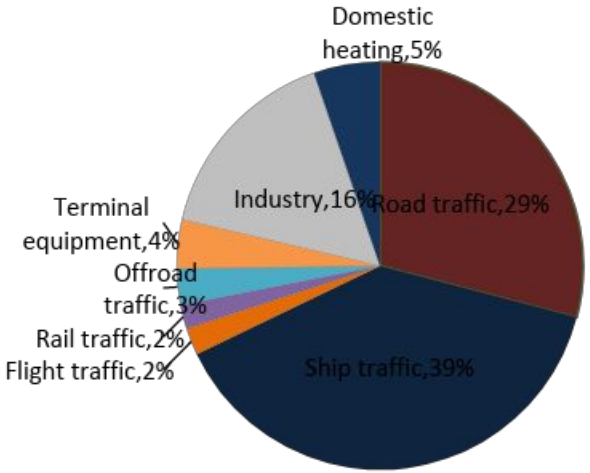
OPS for ships at berth

- Onshore power supply (OPS) replaces use of auxiliary engines of **ships at berth**
- It reduces environmental impact of ships: air/climate emissions and noise
- IMO initial GHG reduction strategy: within the scope of the proposed measures role can be identified for OPS as a GHG-reduction measure
- Electrification of specific segments of maritime transport may become commercially viable for specific vessel types and route

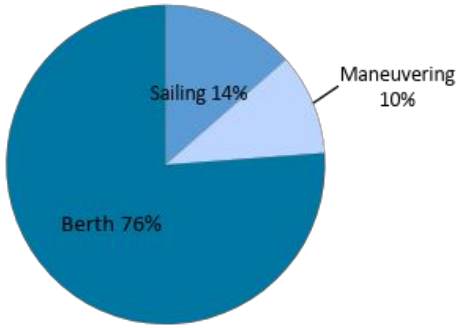
Port of Hamburg

Clean Air Action Plan 2017 - Inventory of air emissions

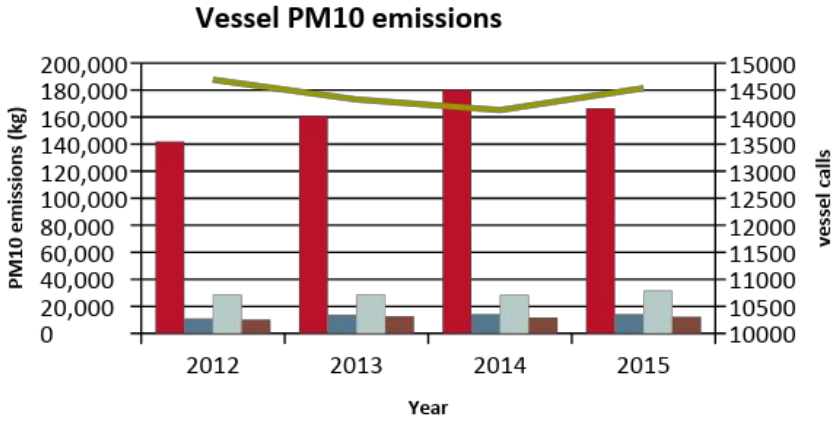
NOx emissions in city of Hamburg

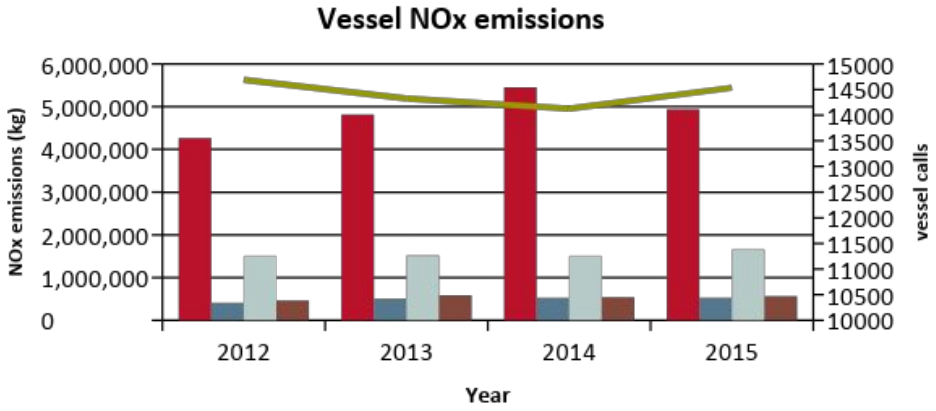


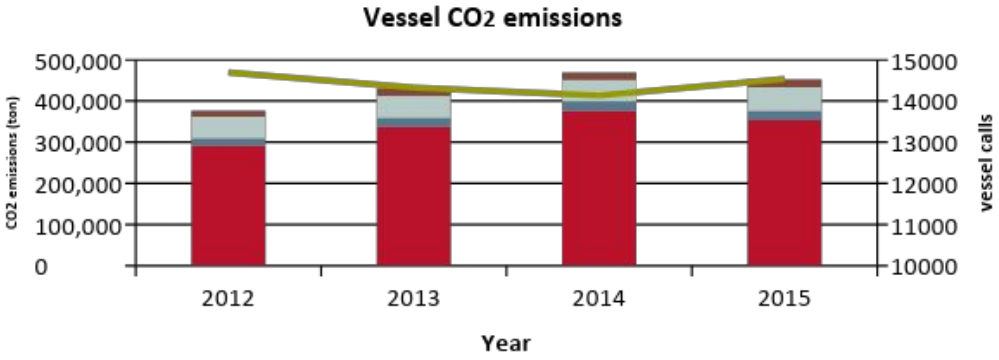
76% of NOx emissions from shipping at berth



Port of Antwerp







Port of Gothenburg

- 5550 tonnes of NOX emissions in Gothenburg
- Of these, 2200 tonnes of NOX from shipping within Gothenburg City boundaries, heading for the port
- Of these, 1000 tonnes NOX from vessels berthed

Directive 2014/94 on of alternative fuels infrastructure

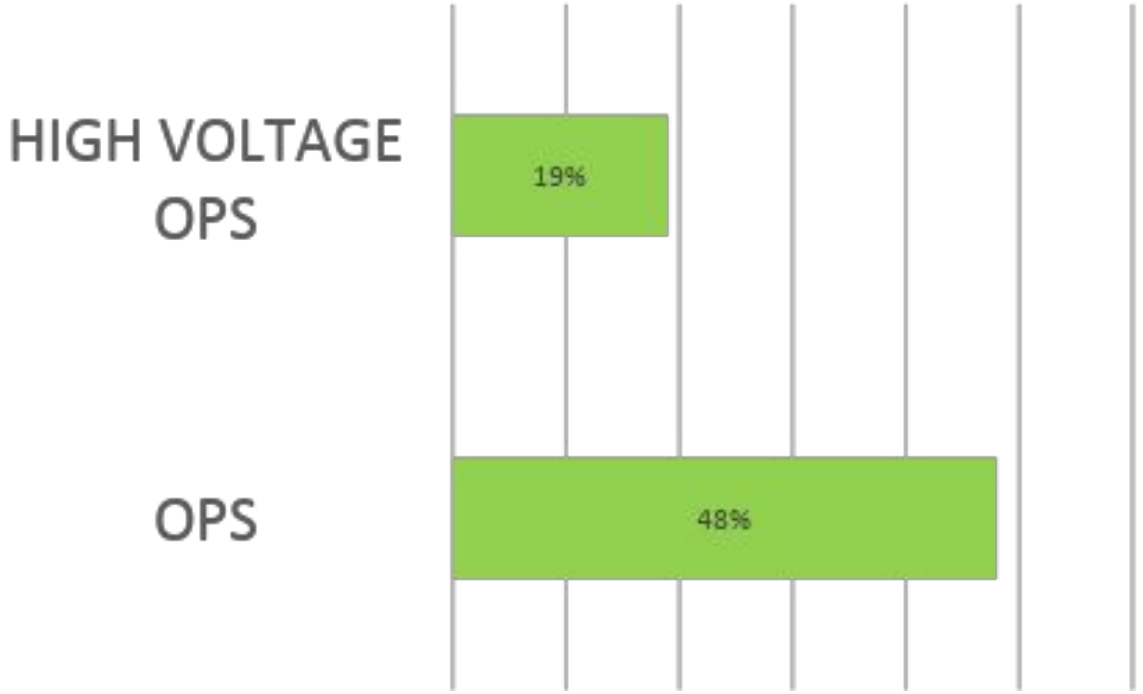
Article 4 par. 5

Member States shall ensure that the need for **shore-side electricity supply** for inland waterway vessels and seagoing ships in maritime and inland ports is assessed in their national policy frameworks.

Such **shore-side electricity supply** shall be installed as a priority in ports of the TEN-T Core Network, and in other ports, **by 31 December 2025**, **unless** there is no demand and the costs are disproportionate to the benefits, including environmental benefits.

Good examples in European ports

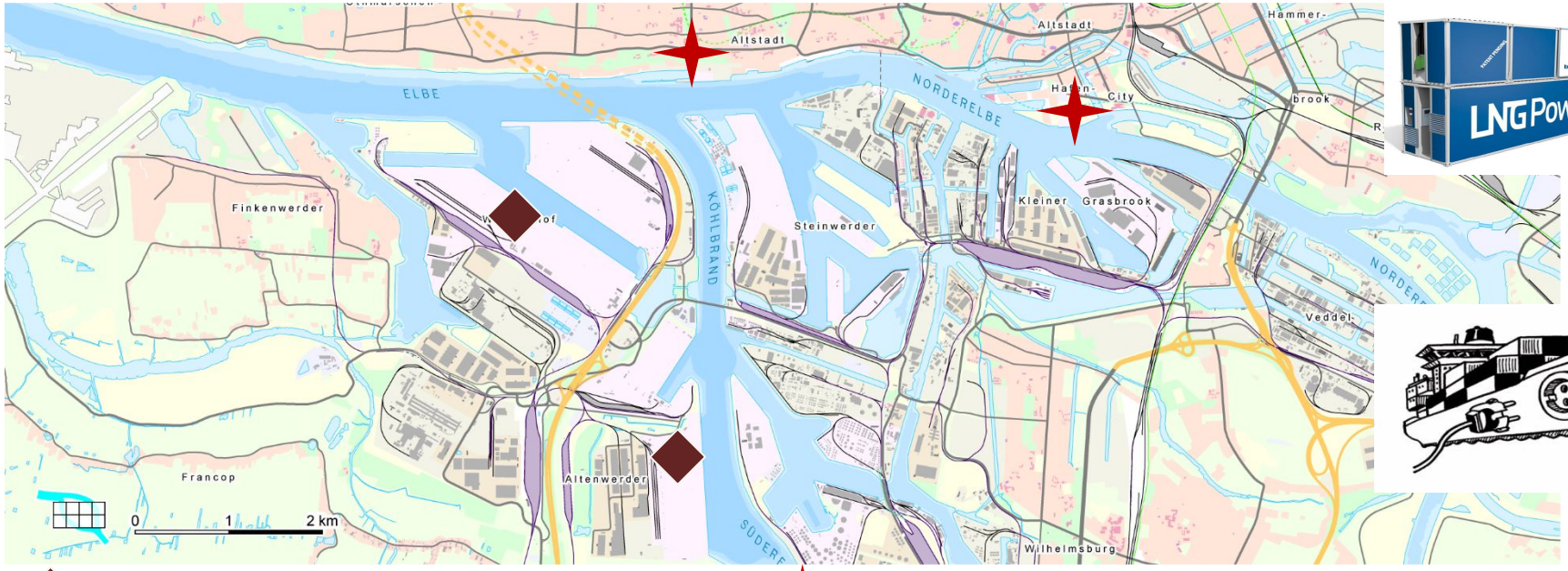
1/5 ports provide OPS for shipping at one or more of the berths



https://www.espo.be/publications/sustainability-report-2017

Port of Hamburg

Clean Air Action Plan 2017: four OPS stations



Stationary OPS container

Stationary OPS cruise

Source: HPA

Port of Antwerp

- 1 OPS-ready quay - 1 OPS installation
- All (re)new(ed) quays are being/will be made OPS-ready

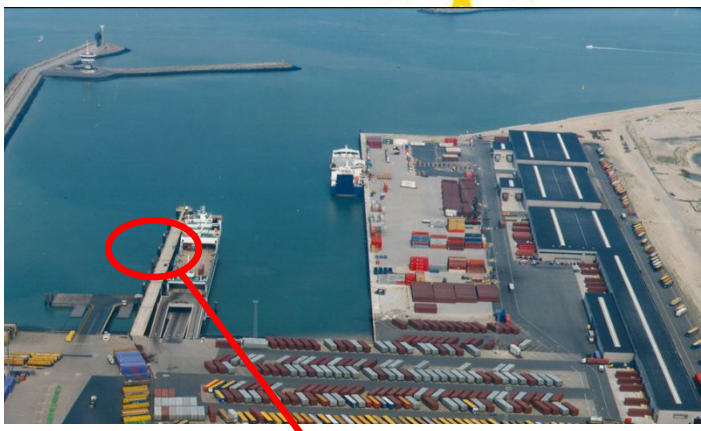
Port of Antwerp pushes ahead for OPS

signing two new agreements last March

- Agreement with Alfaport-VOKA, the representative of the private port community
- Agreement with 5 technical partners to make their expertise available to enable OPS for seagoing vessels in the short term (Techelec, Schneider Electric, ABB, Siemens and Actemium)

Port of Zeebrugge

- Wielingendok
- Operational since 1999
- Constructed for three Cobelfret ships for transporting goods for Stora Enso
- Voltage: 6600 V
- Frequency: 50 Hz
- Capacity: 1,25 MVA



Memorandum of Understanding Between 4 Ports on OPS

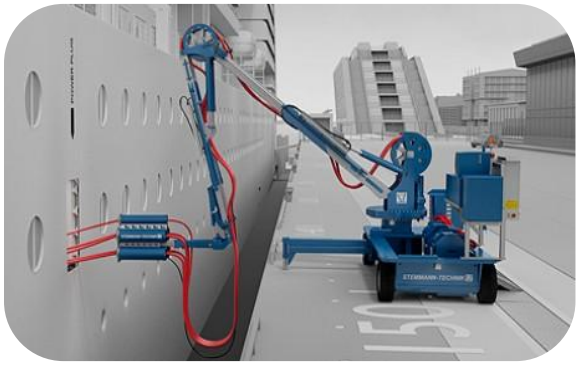
- Port of Helsinki, Ports of Stockholm, Port of Tallinn and Port of Turku
- 4 ports agree to set a common approach for the new on-shore power supply
- The Ports will provide new built connections with a voltage of 11 kV and a frequency of 50 Hz

Port of Tallin

- MoU: Ports Helsinki, Turku, Stockholm, Tallinn
- 11kV for Ro-Pax vessels
- For ferries berthing more than 6 h:
  Tallinn-Helsinki „mini-cruise“ ferry

  Tallinn-Stockholm ferry

- Potential users (shipping lines): Tallink, Eckerö Line, Viking Line
- OPS ready 2020
- Investment 2 million EUR



Port of Gothenburg

- Initiated in 2000
- Initially a project/test phase
- Eventually included also in permits
- Funding from national, regional level
- 35% of all port calls can connect to OPS
- All new quays are prepared
- Tax-free electricity

Finnish Ports

OPS infrastructure available:

- Port of Oulu and Port of Kemi, both facilitating forest industry and other cargo traffic.
- Port of Helsinki OPS for passenger vessels

Port of Barcelona

- Study of electric connection from the electric distribution grid
- Study of electric connection from cogeneration engines of natural gas or renewable energy (in this case, with batteries to accumulate energy). Power would be generated “in situ” without going through an electric distribution grid.
- Study of direct connection from the generation plant (Combined Cycle Power Plant)

Port of Rotterdam

At 2 berths since 2012 - Use of OPS by seagoing vessels in MWh/yr:

2012: 3.506

2013: 7.667

2014: 7.158

2015: 6.739

2016: 5.664

Port of Kristiansand

- Shore power for cruise ships
- Shore power will be established and tested within the cruise season of 2018
- Frequency converter that will provide the ships with 50/60 Hz
- Total investment of approximately 4 million euro co-financed by Horizon 2020

Challenges

- **Leveling the playing field** between the price of OPS and the price of electricity generated by burning marine fuel
- Energy availability costs for connections from the electric distribution grid that increase the price of electricity
- **Connection fees** to the grid are paid regardless of whether there is consumption or not

Challenges

- **Additional fees/levies on the price of electricity** not applying to marine fuel
- **Investment costs** to connect to the electric grid
- Low diesel price, which makes electricity from generation with the auxiliary engines of the ship very cheap

OPS: Is it a business case?

Table 1-1. Business case analysis for establishing OPS with a shore to grid solution and a LNG-power-barge solution with a sales electricity price of EUR 115 per MWh

	Bergen		Hamburg		Rostock		Tallinn		Helsinki	
2017 prices, MEUR	**Grid**	**LGN-barge**	**Grid**	**LGN-barge**	**Grid**	**LGN-barge**	**Grid**	**LGN-barge**	**Grid**	**LGN-barge**
Annual utilization of OPS infrastructure	1,730 hrs		570 hrs		1,040 hrs		1,530 hrs		510 hrs	
Interest and loan repayments	-11.2	-16.2	-11.0	-16.2	-25.6	-16.2	-16.8	-16.2	-13.0	-16.2
Operation & maintenance	-1.6	-1.6	-0.5	-0.5	-1.0	-1.0	-2.2	-2.2	-0.7	-0.7
Purchase of electricity/LNG	-14.9	-14.6	-15.1	-4.7	-19.5	-8.5	-19.7	-12.6	-9.3	-4.2
Sale of electricity	21.8	21.8	7.2	7.2	13.1	13.1	19.4	19.4	6.5	6.5
Total	**-5.9**	**-10.6**	**-19.4**	**-14.3**	**-33.1**	**-12.7**	**-19.2**	**-11.6**	**-16.5**	**-14.7**
Min. investment support	**5.9**	**10.6**	**19.4**	**14.3**	**33.1**	**12.7**	**19.2**	**11.6**	**16.5**	**14.7**

1) Port of Bergen has today a capacity fee reduction of 90 percent. The business case assumes a capacity fee reduction of 50 percent throughout the calculation period.

Source DNV GL

Energy Taxation Directive

Member States provided with a tax exemption for OPS

Country	In force	Tax rate
Sweden	2011-25.06.2020	50 SEK/MWh (without reduction185-293 SEK/MWh)
Germany	2011-16.07.2020	0,50 euroa/MWh (without reduction 20,50 EUR/MWh)
Denmark	07/2015-06/2021	4 DKK/MWh (without reduction 878 DKK/MWh)

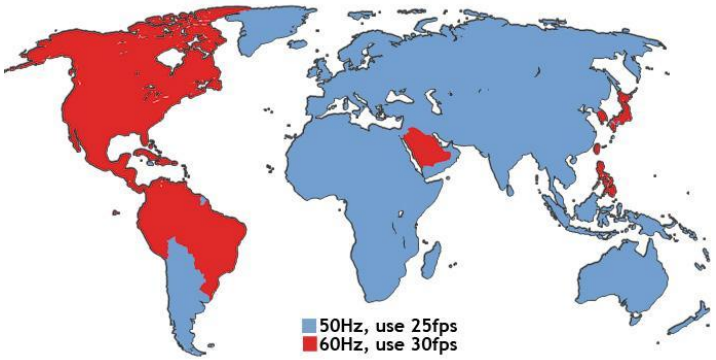
Marine fuel Vs OPS

	Diesel aux. engine generation	OPS
Sales price/Stock exchange price	ca. 10.1 ct/kWh	3.39 ct/kWh
Renewable energy fee	-	6.88 ct/kWh
Fee for use/expansion (KWKG)	-	0.445 ct/kWh
Electricity Tax	-	0.05 ct/kWh (exemption until 2020)
Electricity grid fees	-	0.588 ct/kWh
Total	**ca. 10.1 ct/kWh**	**11.353 ct/kWh**

Source: HPA

Technical challenges

Europe – Frequency challenge



1,000 vessels in the world fleet

→ Mainly low-power demanding off-shore & container vessels after regulation introduced in California

→ Mostly new builds

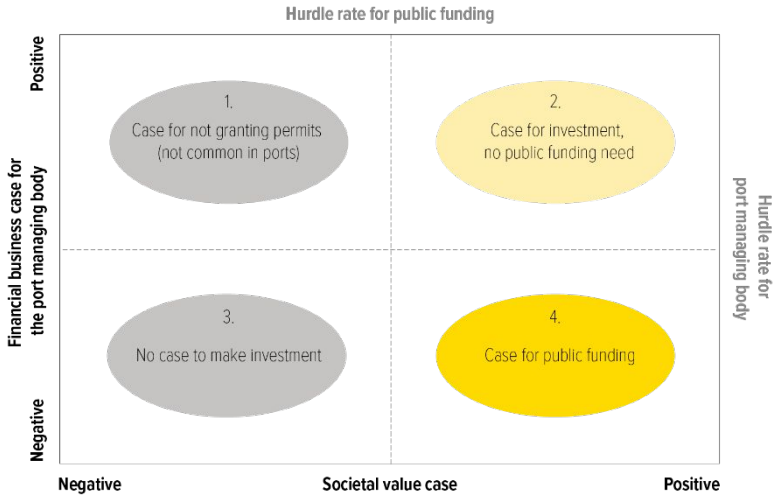
Value creation & funding challenge

ESPO study: “The infrastructure investment needs and financing challenge of European ports”

- Ports have substantial investment needs of €48bn until 2027 to fulfil their role as sustainable, efficient and well-connected nodes
- BUT ports have been able to obtain only 4% of the total CEF budget

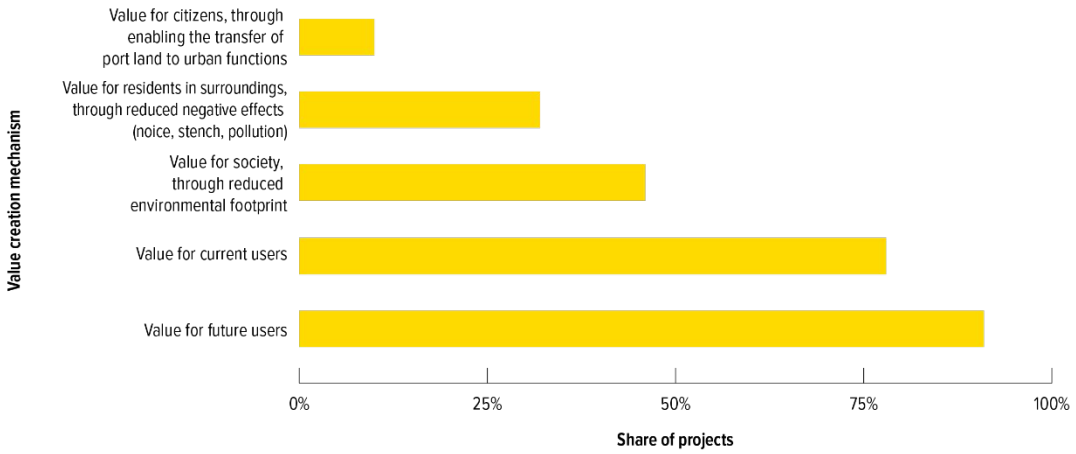
- OPS projects create societal value, which cannot be fully monetised by the port and thus creates a funding gap
- Projects which have a negative business case, but create added value, should be eligible for public co-financing

Value creation & funding challenge

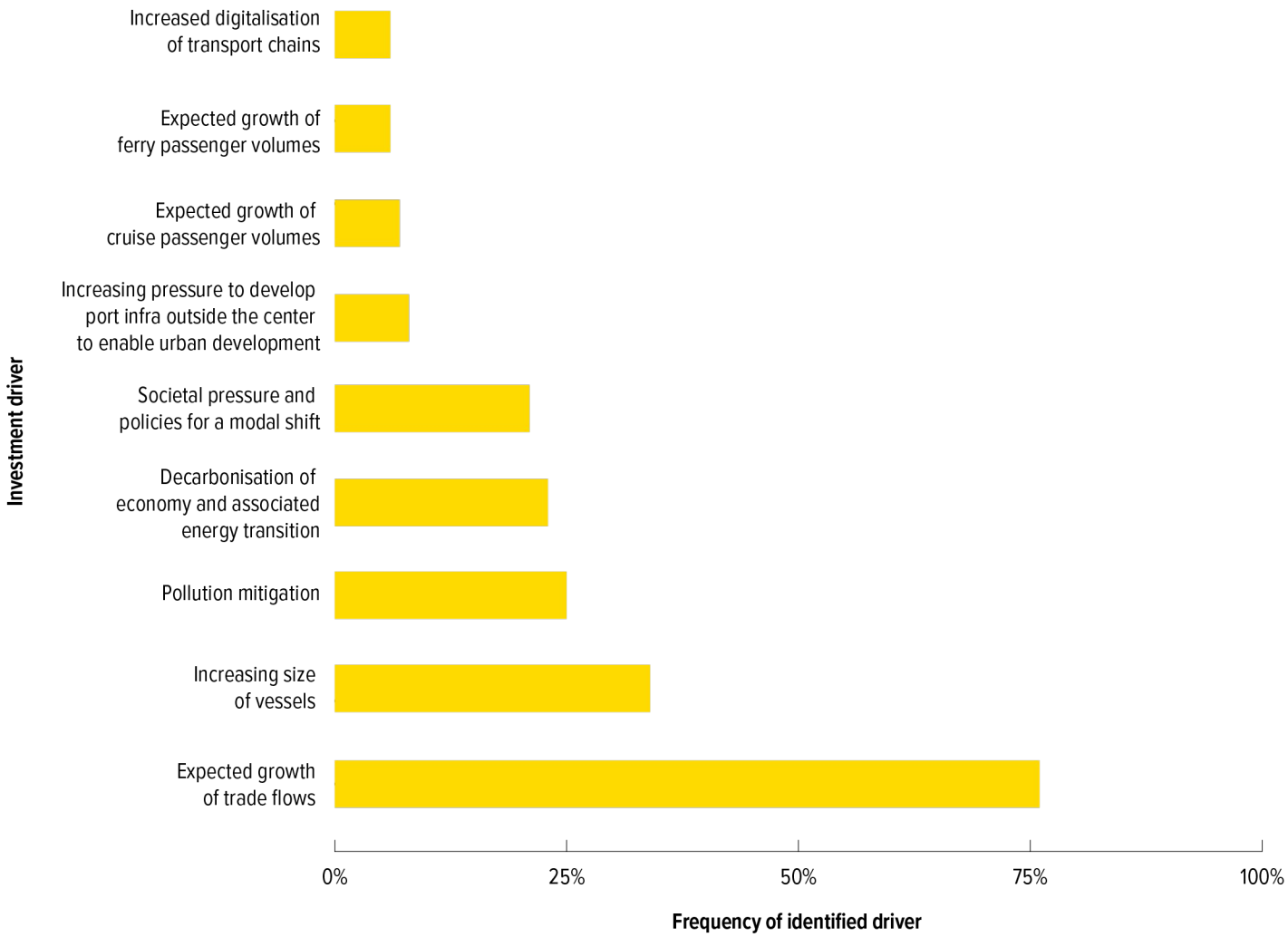


Type 4 projects make the case for public co-funding

Value creation for society through reduced environmental footprint is the most important value creation mechanism of ports



Investment drivers



Thank you for your attention!

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