BLUE MISSION BANOS

Funded by the European Union

Supporting the Mission Ocean Lighthouse in the North and Baltic Sea

Ports as energy innovation hubs

Ports as energy innovation hubs

Exploring practical avenues on how to further innovate ports as energy hubs responding to societal needs utilizing the symbiosis of collaboration and enabling technologies. The aim is to seek large engagement from the audience in an informal setting as a catalyst for ideating novel collaboration opportunities.

09:00 – 09:05	Gathering and welcome, Martin Sjöberg, IVL and Mikael Lind, RISE
09:05 – 09:20	Ports as energy hubs for sustainable ports, Mikael Lind, RISE
09:20 – 09:30	Blue Supply Chains – ports as intermediary hubs in green corridors enabling a sustainable transport ecosystem, Linda Styhre, IVL
09:30 – 09:40	Ports and terminals in transition and focal point for distribution of sustainable energy, Karl Jivén, IVL
09:40 – 09:45	Workshop introduction – setup and areas to discuss
09:45 – 10:10	Round table discussions addressing the following questions: • The role of the ports in tomorrow's new energy landscape? • How can ports in the Baltic Sea act to respond to the needs of the transport sector? What new innovations, collaborative models or other changes are needed?
10:10 – 10:25	Presentations from each table and joint reflections
10:25 – 10:30	Closing remarks – positioning ports in the larger end to end flow

Ports as energy hubs for Sustainable Ports

- a part and enabler of sustainable transport ecosystems

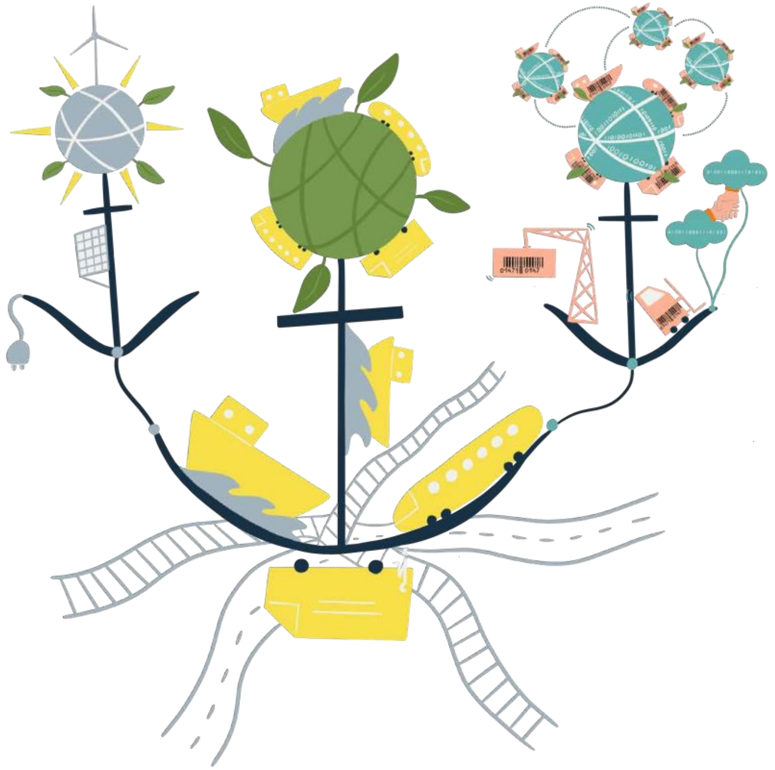
Mikael Lind

Research Institutes of Sweden

Chalmers University of Technology

Vision: The Sustainable Port

The sustainable port is a **transport and logistics node** that by enhancing and leveraging its human and financial capabilities and using its role as an **energy and digital/information node** generates value for its customers, owners, employees and the wider society while prioritizing environmental, social, and economic sustainability in its operations. The port is run on commercial foundations and as a transport node the port contributes to sustainable use of the transport system by being an integrated part of global, regional and local transport systems where **different modes of transports are included and interact**.



The Sustainable Port

with capabilities as a transport node, an energy node and a digital node

- Window to all modes of transport
- Services for the port's stakeholders
- Consumer and supplier of sustainable energy for the sustainable transport system
- Consumer and producer of information
- Enabler for the transition towards a sustainable transport system

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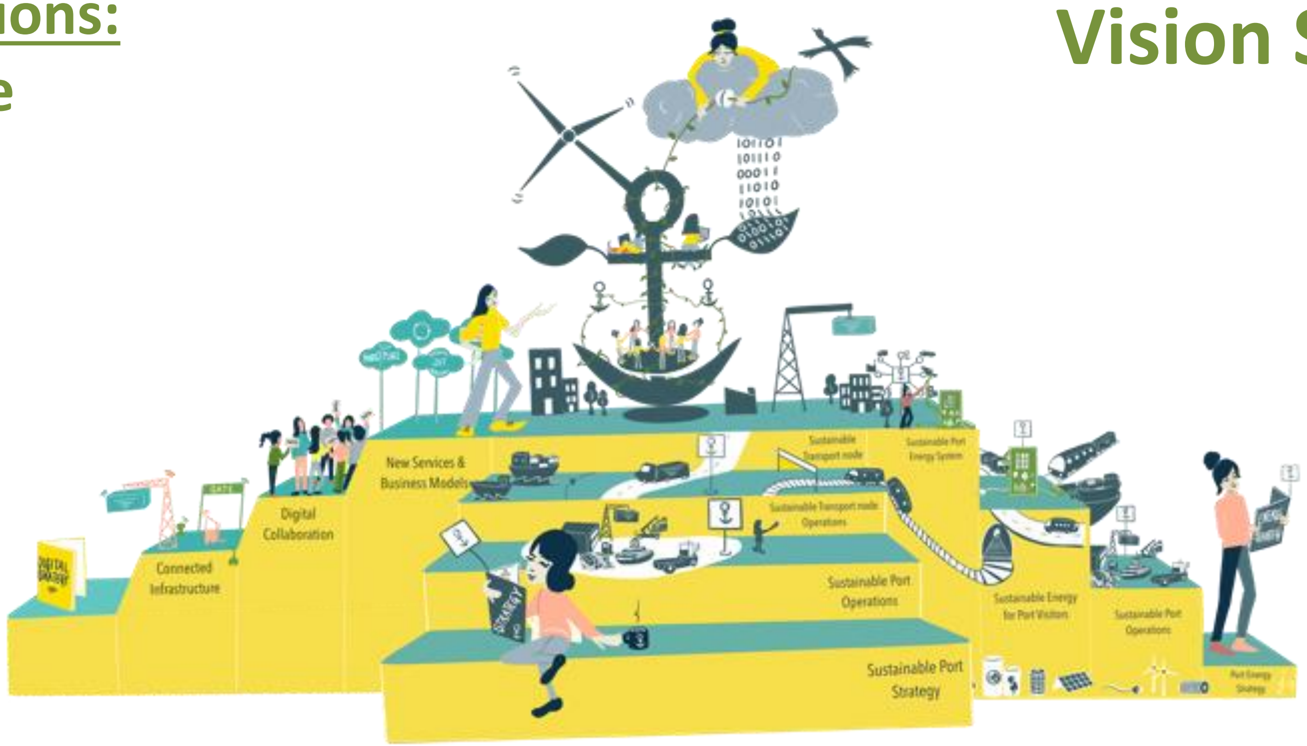
Ports' Nodal Functions:

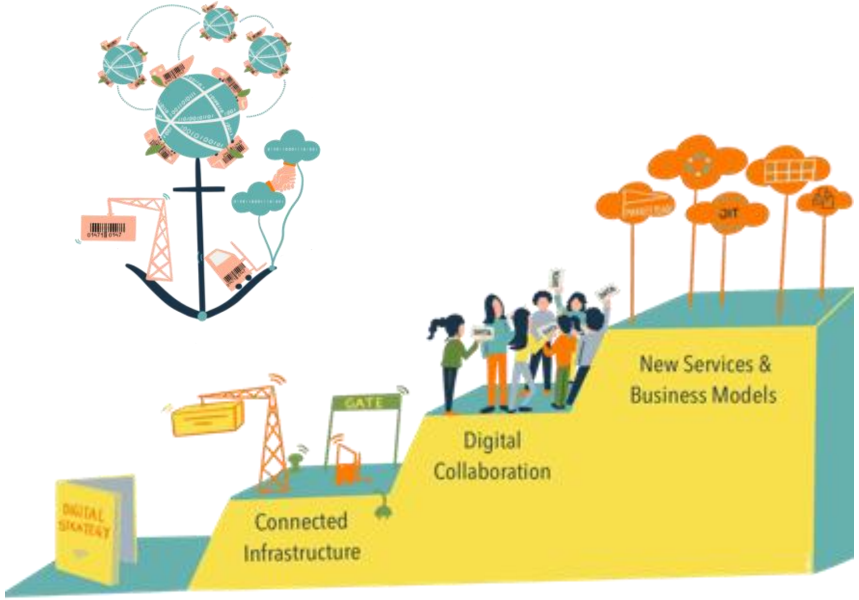
Transport node
Energy node
Digital node

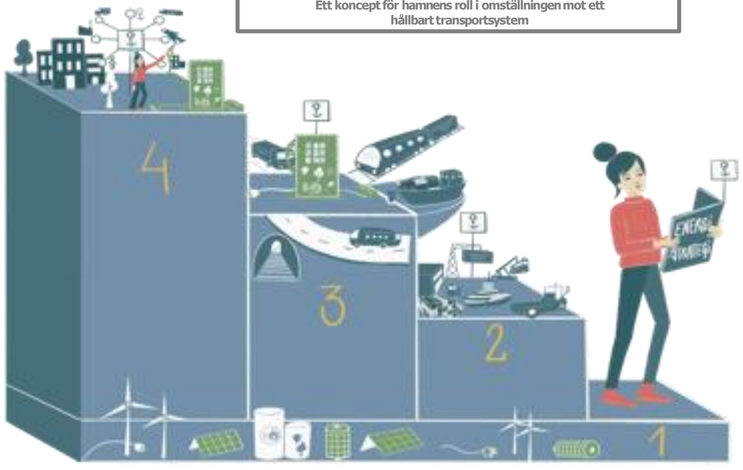
Vision Sustainable Port



TRAFIKVERKET

RAPPORT
2021-09-30
Hamnen som digital nod
En förstudie ledd av RISE på uppdrag av Trafikverket





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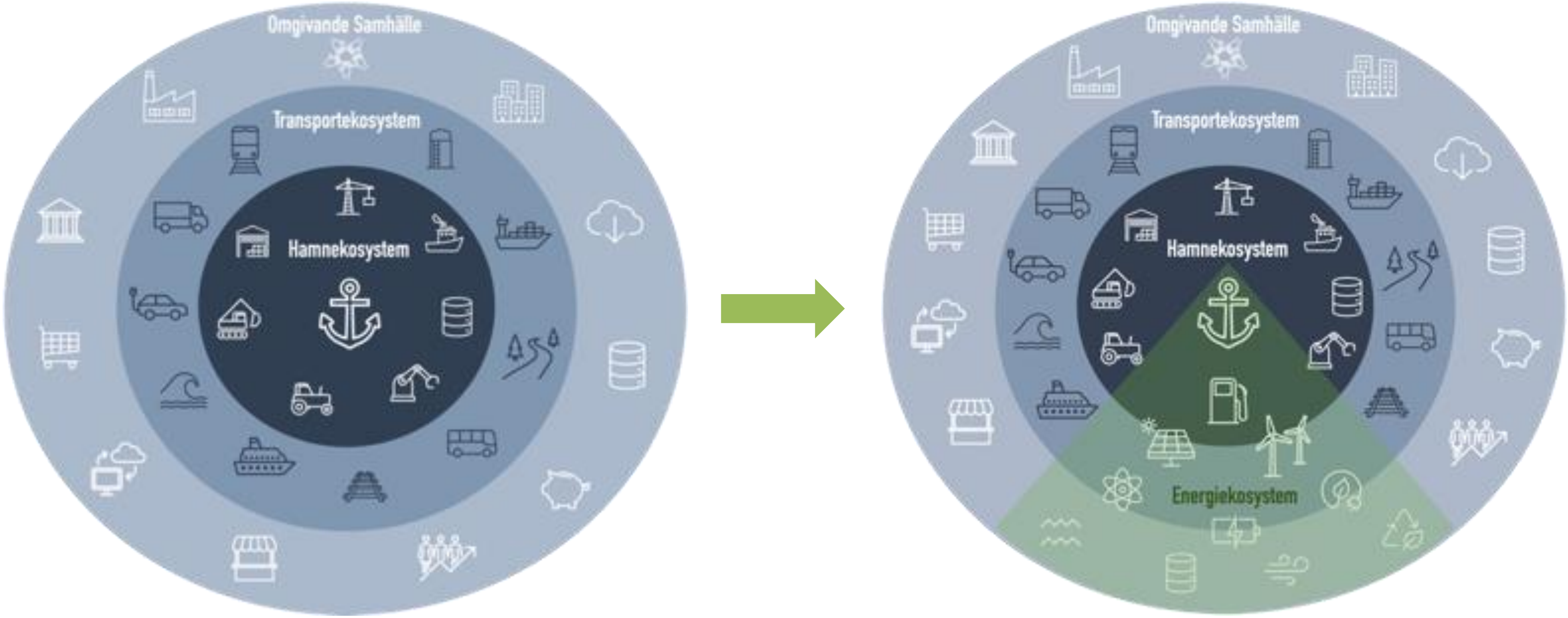
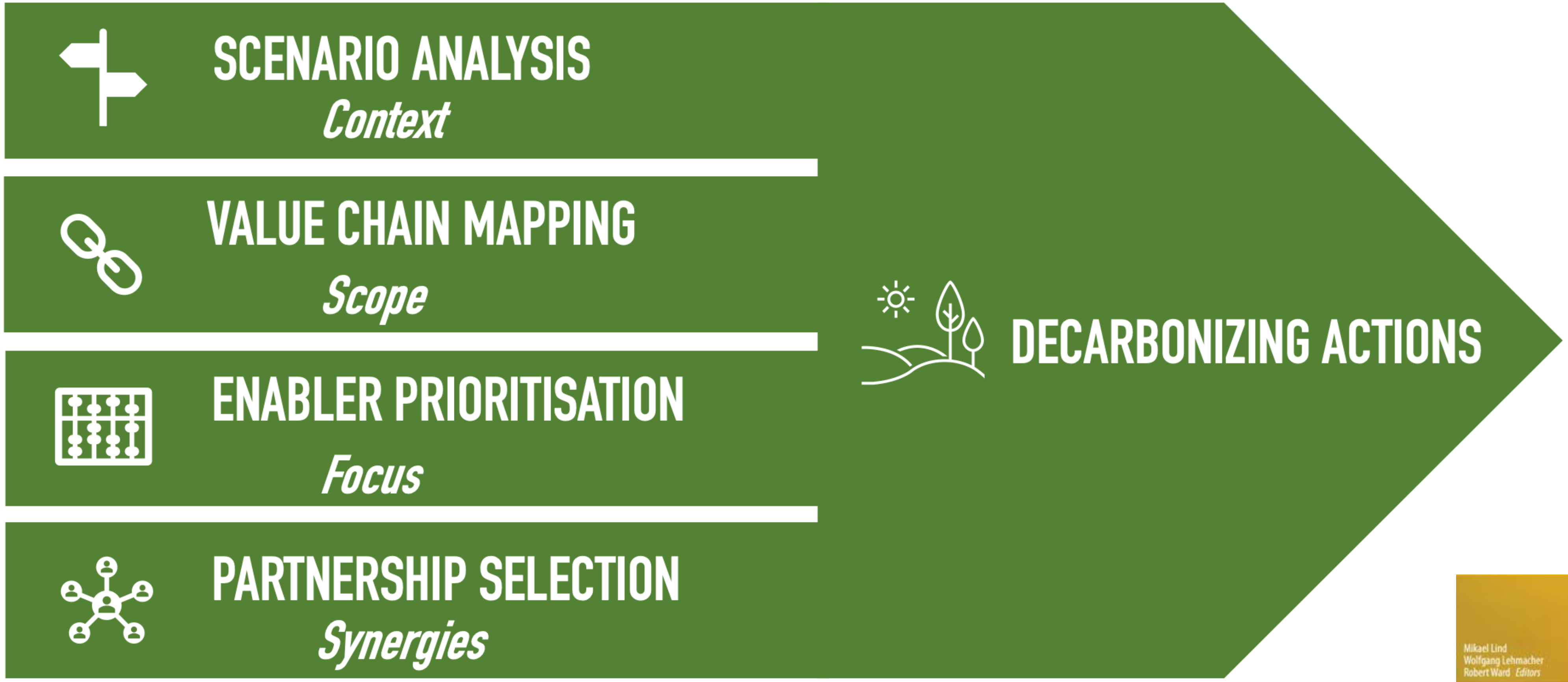
Towards Sustainable Port ecosystem

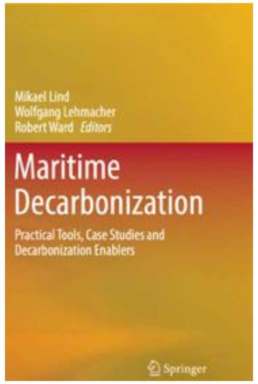
The traditional port in the ecosystem

... with energy node capabilities



Enabling Maritime Decarbonization






The Maritime Executive

Four Steps Towards Maritime Decarbonizing Actions: Playbook Part 5

PUBLISHED DEC 11, 2022 9:53 PM BY MIKAEL LIND ET AL.

(By Mikael Lind, Wolfgang Lemacher, Jeremy Bentham, Sanjay Kuttan, Kirsi Tikka and Richard T. Watson)

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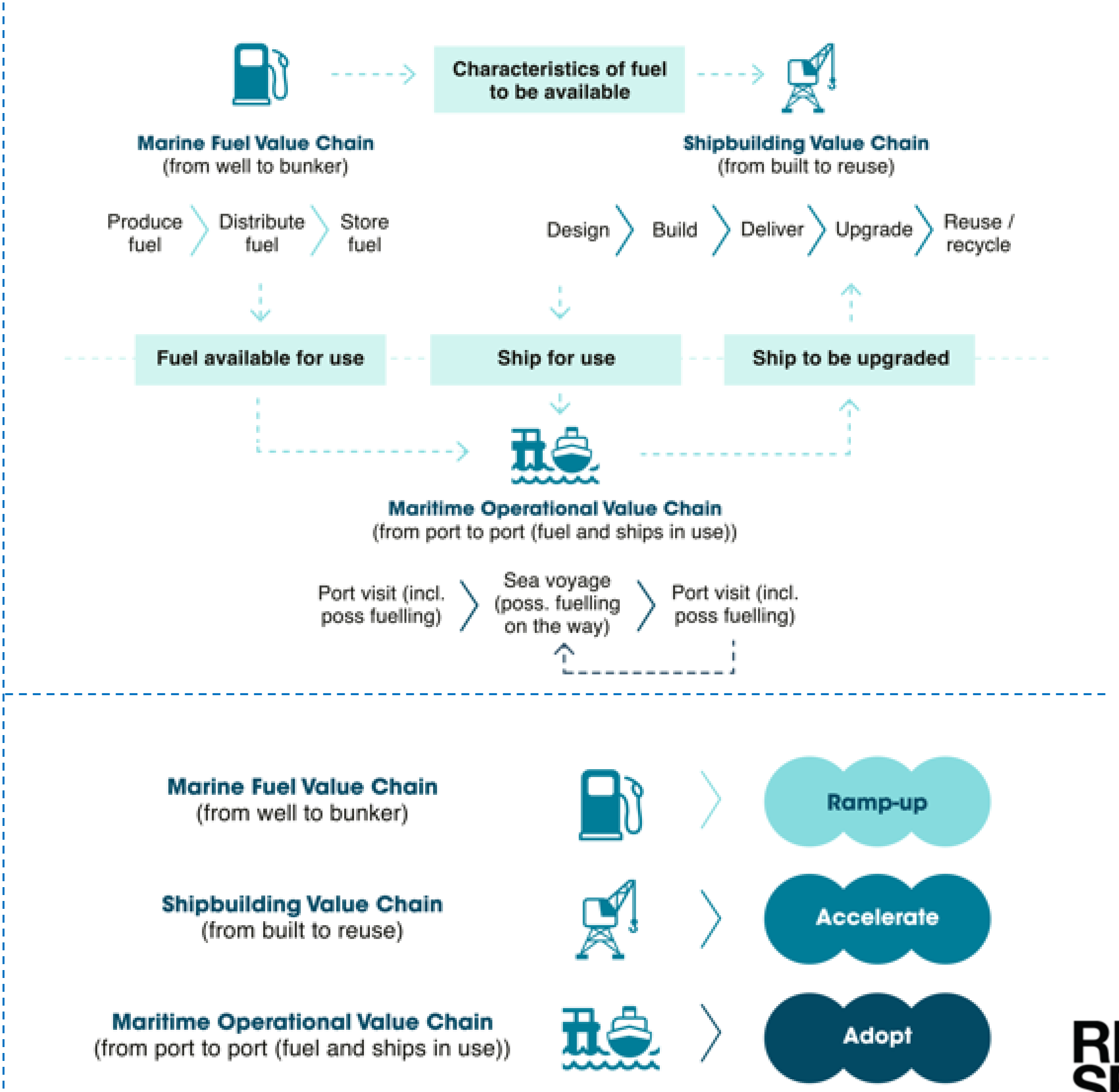
Foundational viewpoint: Interdependent value chains



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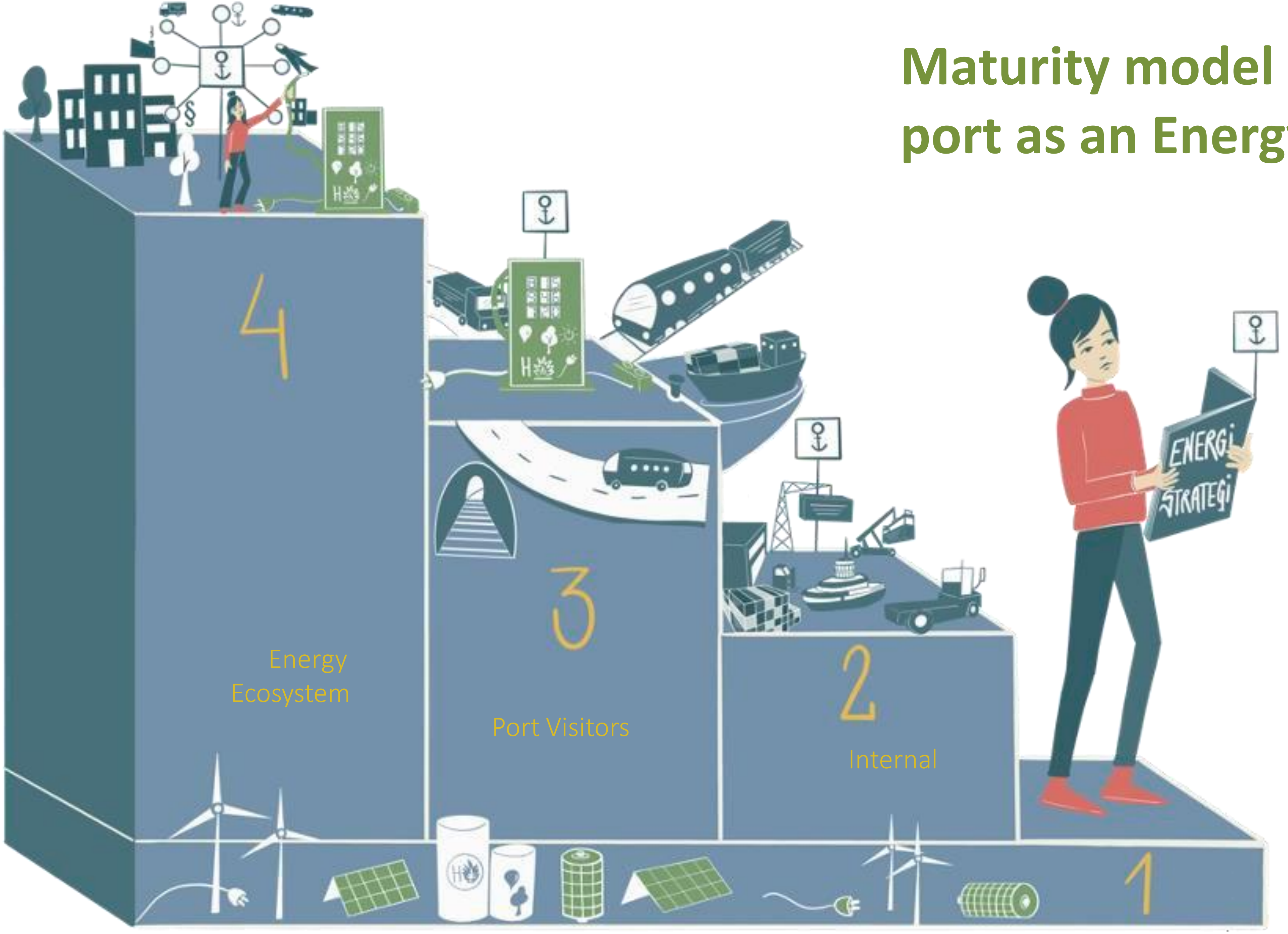
Maturity model for port as an Energy node



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For different modes of transports …

Trucking industry

Very large emitter of GHG

Dependent on affordable clean technologies and trucks

Train industry

Often seen as green

Many countries use diesel trains

Shipping industry

Often seen as a more sustainable mode

Dirty fuel in use

Clean sustainable fuel (incl. electricity needs and sources), powering infrastructure, green corridors, enhanced capabilities of transport nodes, multi-fuel engines

The need

Enhanced transparency, objectivization, and clear transformation maps

Governmental directions and support

Managing the competition of the supply of energy

Supply chain visibility solutions for enhanced performance and tools for ecosystem collaboration

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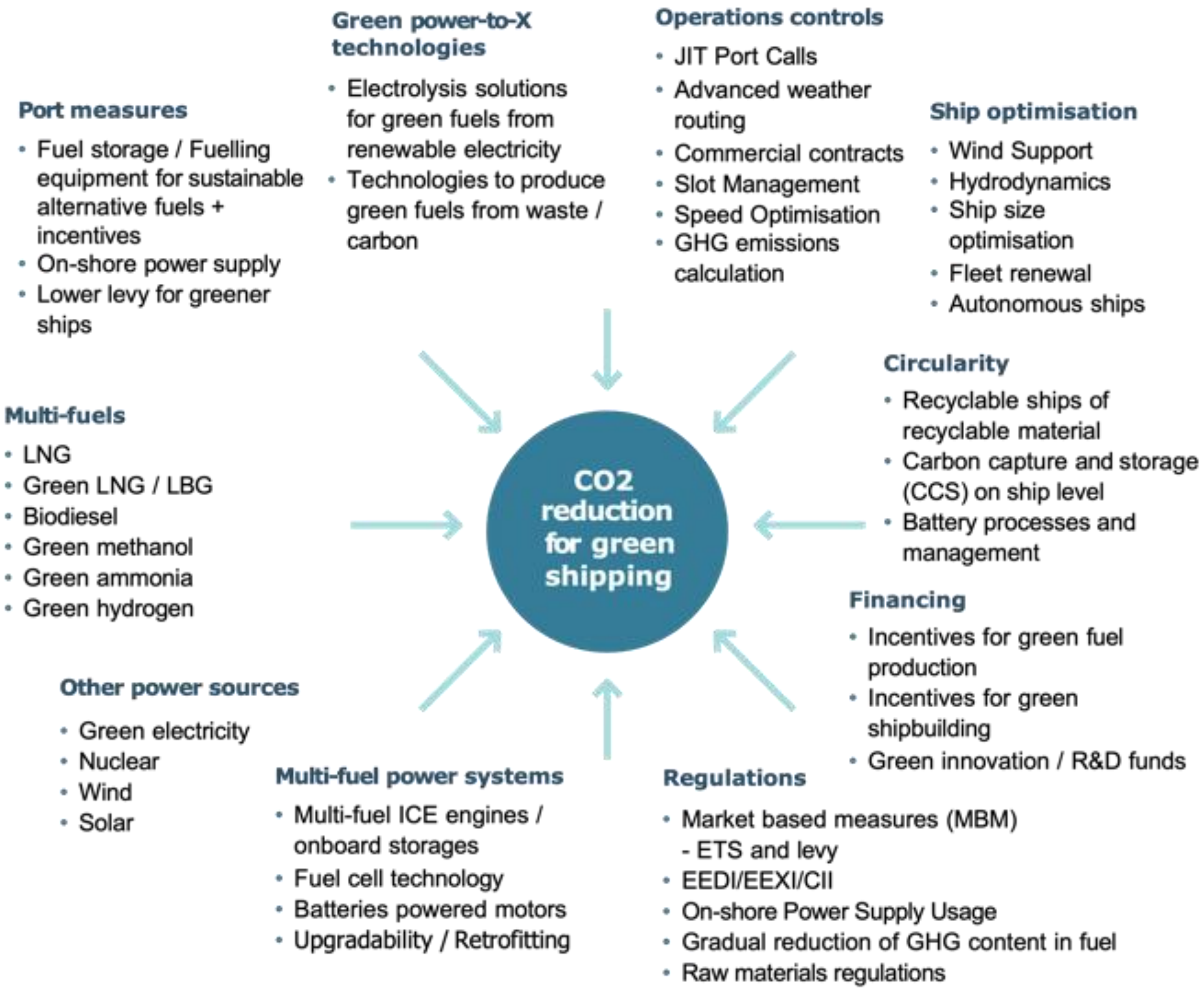
Decarbonization enablers across interdependent value chains



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Framework for Roadmap: Sustainable Ports

Dimensions:
- Legal requirements
- Owner requirements
- Customer requirements
- Societal expectations
- New business models
- …

	Internal port operations	The visitors of the port	The port as a node
The port as digital node			
The port as energy node			
The port as transport node			

YEAR → VISION

Goal Sustainable Port

	Internal port operations	The visitors of the port	The port as a node
ENERGINOD	FOSSILFRIA ARBETSMASKINER & INFRASTRUKTUR (HAMN)	FOSSILFRIA TRANSPORTER (HAMN & BESÖKARE)	HÅLLBART EKOSYSTEM (HAMN/ BESÖKARE/ SAMHÄLLE)
DIGITAL NOD	UPPKOPPLAD INFRSTRUKTUR (HAMN)	DIGITAL SAMVERKAN (HAMN & BESÖKARE)	AFFÄRER & DIGITALA TJÄNSTER (HAMN/ BESÖKARE/ SAMHÄLLE)
TRANSPORTNOD	TRANSPORTEFFEKTIVA OPERATIONER (HAMN)	SÖMLÖS OMLASTNINGSPUNKT (HAMN & BESÖKARE)	HÅLLBAR TRANSPORTiNFRASTRUKTUR (HAMN/ BESÖKARE/ SAMHÄLLE)
ORGANISATION			

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Ports as energy innovation hubs

Blue Supply Chains – ports as intermediary hubs in green corridors enabling a sustainable transport ecosystem

Linda Styhre

Researcher, IVL Swedish Environmental Research Institute

Ports and terminals in transition and focal point for distribution of sustainable energy

Karl Jivén

Researcher, IVL Swedish Environmental Research Institute

ivl Swedish Environmental Research Institute

Ports as energy innovation hubs

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ivl Swedish Environmental Research Institute

Green Ports fostering zero-emissions in

BLUE SUPPLY CHAINS

#BlueSupplyChains

Dr Linda Styhre

IVL Swedish Environmental Research Institute

linda.styhre@ivl.se

Interreg Baltic Sea Region

Co-funded by the European Union

BLUE ECONOMY Blue Supply Chains

Key Facts – Blue Supply Chains Project (BSC)

Interreg Baltic Sea Region | Co-funded by the European Union

BLUE ECONOMY Blue Supply Chains

- Duration: 01/2023 – 12/2025
- Budget: 4.6 Mio. EUR
- Lead Partner: Port of Hamburg Marketing

- Co-Funded by: Interreg Baltic Sea Region Programme
- Programme Priority: 2. Water-smart societies
- Programme objective: 2.2 Blue economy

- 20 Project Partners from eight BSR countries
- 16 Associated Organisations supporting projects' implementation

#BlueSupplyChains

ivl Swedish Environmental Research Institute

Project Partners & Associated Organisations

Interreg Baltic Sea Region

Co-funded by the European Union

BLUE ECONOMY
Blue Supply Chains

SWEDEN

CLOSER

ivl Swedish Environmental Research Institute

UMEÅ ENERGI

UMEÅ KOMMUN

Umeå Hamn

Trelleborgs Hamn AB -Port of Trelleborg-

DENMARK

PORT OF SKAGEN

LATVIA

VHTP VENTSPILS HIGH TECHNOLOGY PARK

NORWAY

Shipping Offshore NETWORK

POLAND

HUTCHISON PORTS GDYNIA

UNIVERSITY OF GDANSK

motus foundation

ESTONIA

BPO BALTIC PORTS ORGANIZATION

LITHUANIA

VĮ VIDAUS VANDENS KELIŲ DIREKCIJA

KLAIPĖDA SCIENCE AND TECHNOLOGY PARK

GERMANY

Stena Line

ROSTOCK PORT

SGKV

modility

Port of Hamburg

Associated Organization (selection)

Hamburg | Behörde für Wirtschaft und Innovation

GDYNIA moje miasto

TRAFIKVERKET SWEDISH TRANSPORT ADMINISTRATION

DANSKE HAVNE

Bundesministerium für Verkehr und digitale Infrastruktur

TRAFICOM Finnish Transport and Communications Agency

VASAB VISION & STRATEGIES AROUND THE BALTIC SEA

LAND BRANDENBURG be Berlin Gemeinsame Landesplanungsabteilung

EUSBSR EU STRATEGY FOR THE BALTIC SEA REGION POLICY AREA 'TRANSPORT'

EUSBSR EU STRATEGY FOR THE BALTIC SEA REGION POLICY AREA 'SHIP'

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The Swedish Case: Introducing green energy supply roadmaps

Fostering Port Authorities' role in green energy supply for transport chains

Green bunkering and charging strategy for ports

- Present and future situation for bunkering of maritime vessels in Sweden and what is lacking related to charging/bunkering of fossil free fuels and local production
- Future demand and supply of alternative fuels and charging facilities
- Identification of appropriate fuels for the different market segments
- Analysis of policy instruments within the next 5 years that are expected to increase the uptake of renewable and low-carbon fuels

Feasibility study (Umeå Region) - local green hydrogen in port areas

- Investigation of possibilities to introduce hydrogen as a maritime fuel in the Umeå Region
- Feasibility study of a green hydrogen market
- Green hydrogen production (technological aspects, synergies with existing infrastructure, approaches of power grid connections
- Cost/Benefit Analysis

Altogether create possible scenario for green charging and bunkering

- → How will the **demand side** for alternative fuels look like in different part of Sweden and develop over time?
- → How will the **supply side**, incl. production system and charging facilities, look like and what is needed?

Investigation of demand and supply of green bunker and charging in ports

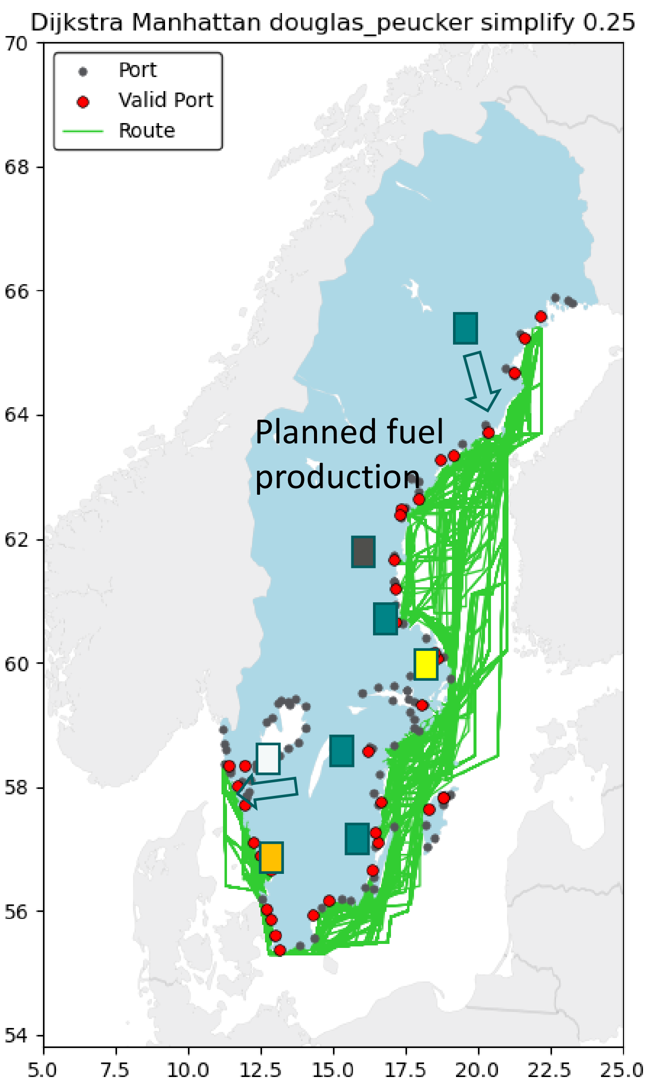
Interreg Baltic Sea Region

Co-funded by the European Union

BLUE ECONOMY Blue Supply Chains

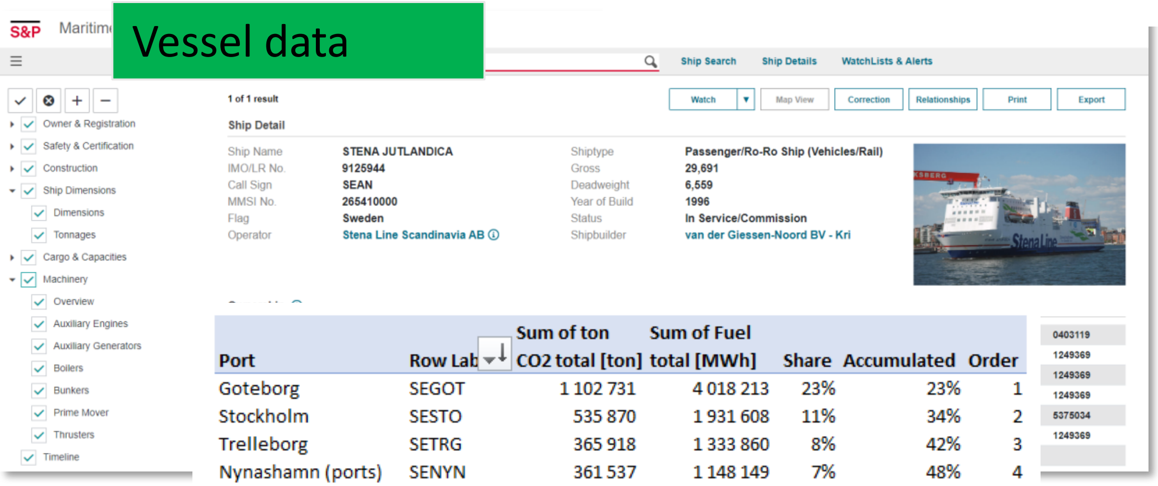
Planned fuel production

Available and planned electricity connections in ports



Port data

Vessel data



Port	Row Lab	Sum of ton CO2 total [ton]	Sum of Fuel total [MWh]	Share	Accumulated	Order
Goteborg	SEGOT	1 102 731	4 018 213	23%	23%	1
Stockholm	SESTO	535 870	1 931 608	11%	34%	2
Trelleborg	SETRG	365 918	1 333 860	8%	42%	3
Nynashamn (ports)	SENYN	361 537	1 148 149	7%	48%	4
Brofjorden	SEBRO	259 407	936 653	5%	54%	5
Malmo	SEMMA	257 022	933 607	5%	59%	6
Karlskrona	SEKAA	173 133	632 817	4%	63%	7
Karlshamn	SEKAN	123 327	447 320	3%	65%	8
Helsingborg	SEHEL	122 556	449 371	3%	68%	9
Kappelskar	SEKPS	115 695	420 901	2%	70%	10
Ystad	SEYST	113 339	415 347	2%	72%	11
Norrkoping	SENRK	110 443	404 010	2%	75%	12
Lulea	SELLA	104 288	379 858	2%	77%	13
Gavle	SEGVX	103 528	377 898	2%	79%	14
Visby	SEVBY	95 421	349 347	2%	81%	15
Stenungsund (Ports)	SESTE	91 377	328 038	2%	83%	16
Sundsvall	SESDL	79 500	288 720	2%	85%	17
Uddeva[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18
Husum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	19
Haraho[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20
Wallhamn	SEWAL	55 311	201 117	1%	90%	21
Sodertalje	SESOE	53 823	196 537	1%	91%	22
Stromstad	SESMD	50 031	186 401	1%	92%	23

Energy and emission calculations

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CLOSER ivl Swedish Environmental Research Institute UMEÅ ENERGI Umeå Hamn UMEÅ KOMMUN Kvarken Ports

Altogether create possible scenario for green charging and bunkering

- → How will the **demand side** for alternative fuels look like in different part of Sweden and develop over time?
- → How will the **supply side**, incl. production system and charging facilities, look like and what is needed?
- → How can a **methodology for green bunkering and charging strategy** be develop and describe?
- → How can actors in Umeå work together to develop a **regional green energy supply concept for the port of Umeå**?

Ports as energy innovation hubs

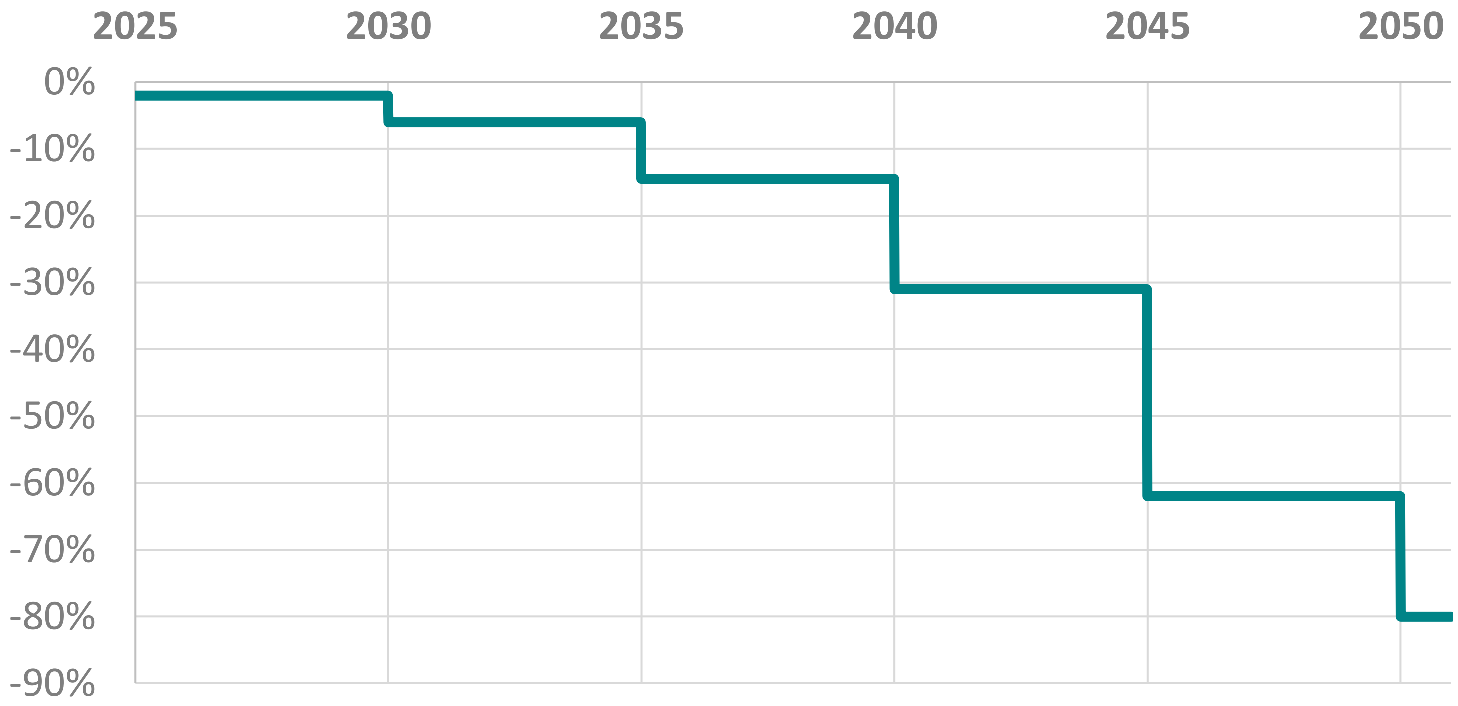
Ports and terminals in transition and focal point for distribution of sustainable energy

Karl Jivén

Researcher, IVL Swedish Environmental Research Institute

Swedish Environmental Research Institute

Development of the greenhouse gas intensity in the fuel relative to 2020 in accordance with EUFuel Maritime



Renewable fuels and propulsion for ships

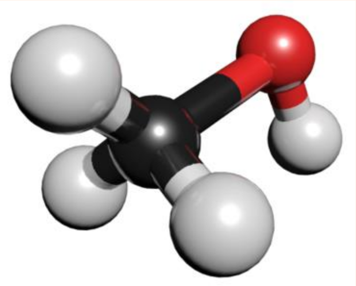
Hydrogen | **Electricity/Batteries** | **Wind** | **Efficiency**

HVO

- Requires no specific adaptation
- Does not improve emissions of NOX and PM
- Dependence on imports

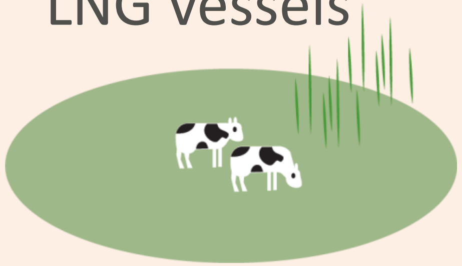
Methanol

- Tested in marine applications
- Planned production in Sweden



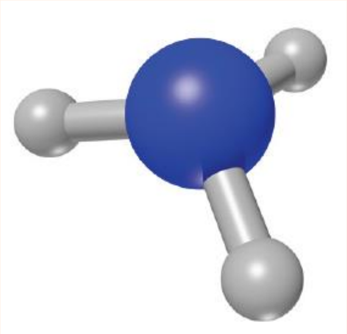
Biogas/LBM

- Good climate performance
- Does not require specific adaptation in LNG vessels



Ammonia

- Does not contain carbon
- Strongly toxic



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PUBLICATION FDOS 28:2022

Final report

CAN LNG BE REPLACED WITH LIQUID BIO-METHANE (LBM) IN SHIPPING?

January 2022

Karl Jivén[1], Anders Hjort[1], Elin Malmgren[2], Emelie Persson[1], Selma Brynolf[2], Tomas Lönnqvist[1], Mirjam Särnbratt[1] and Anna Mellin[1]

[1] IVL Swedish Environmental Research Institute

[2] Chalmers University of Technology

A project within

RENEWABLE TRANSPORTATION FUELS AND SYSTEMS 2018-2021

A collaborative research program between the Swedish Energy Agency and f3 The Swedish Knowledge Centre for Renewable Transportation Fuels

Swedish Energy Agency

www.energimyndigheten.se

THE SWEDISH KNOWLEDGE CENTRE FOR RENEWABLE TRANSPORTATION FUELS

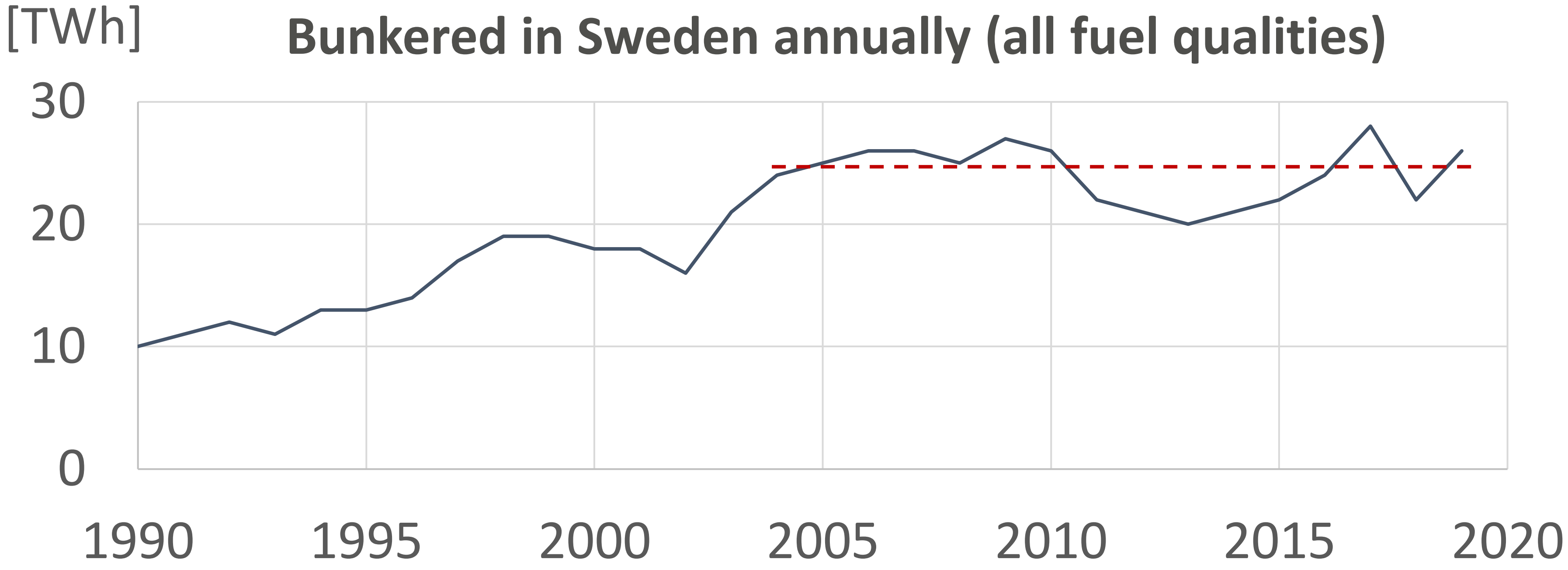
www.f3centre.se

Can LNG be replaced with Liquid bio methane (LBM) in shipping?

ivl SVENSKA MILJÖINSTITUTET

	Bio-methane production potential 2030 (TWh/year)	Bio-methane production potential 2045 Bio-metan (TWh/year)	*Restrictions regarding technical, economical and sustainability regard*
Biogas (anaerobic digestion)	14	19	*Only substrates originating from manure, organic residues, straw and biomass from ecological focus areas and fallow land are included.*
Methanation of CO_2 from anaerobic digestion plants	4.7	6.4	*CO_2 rom biogas plants is used to produce electromethane*
Methanation of syngas from gasification plants	3.5	3.5	*Only syngas from gasification from residues of lignocellulosic material (e.g., demolitions and package material including pallets) is included.*
TOTAL	**22.2**	**28.9**	

Swedish potential for sustainable biogas production



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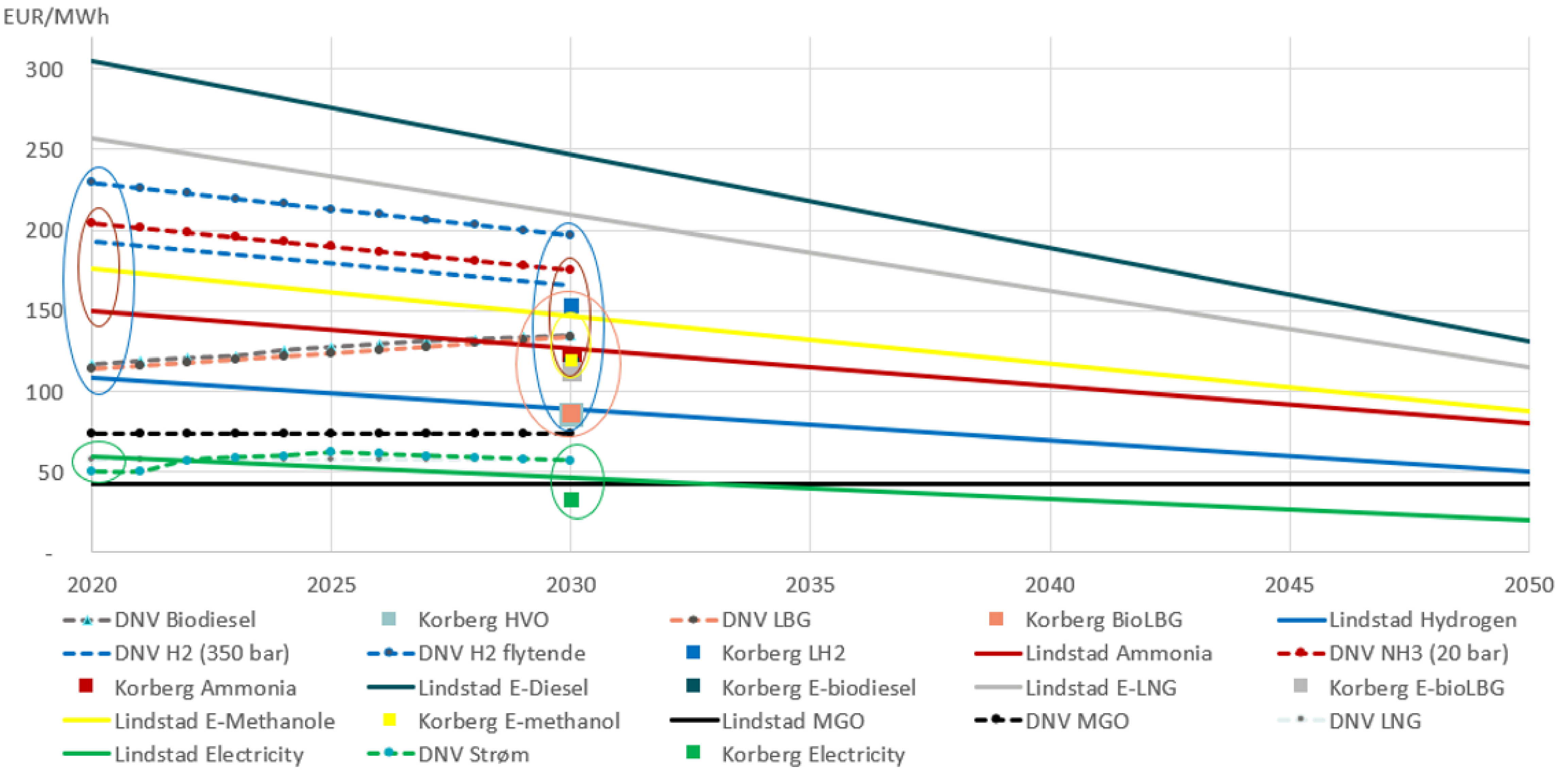
… expected cost development for marine fuels



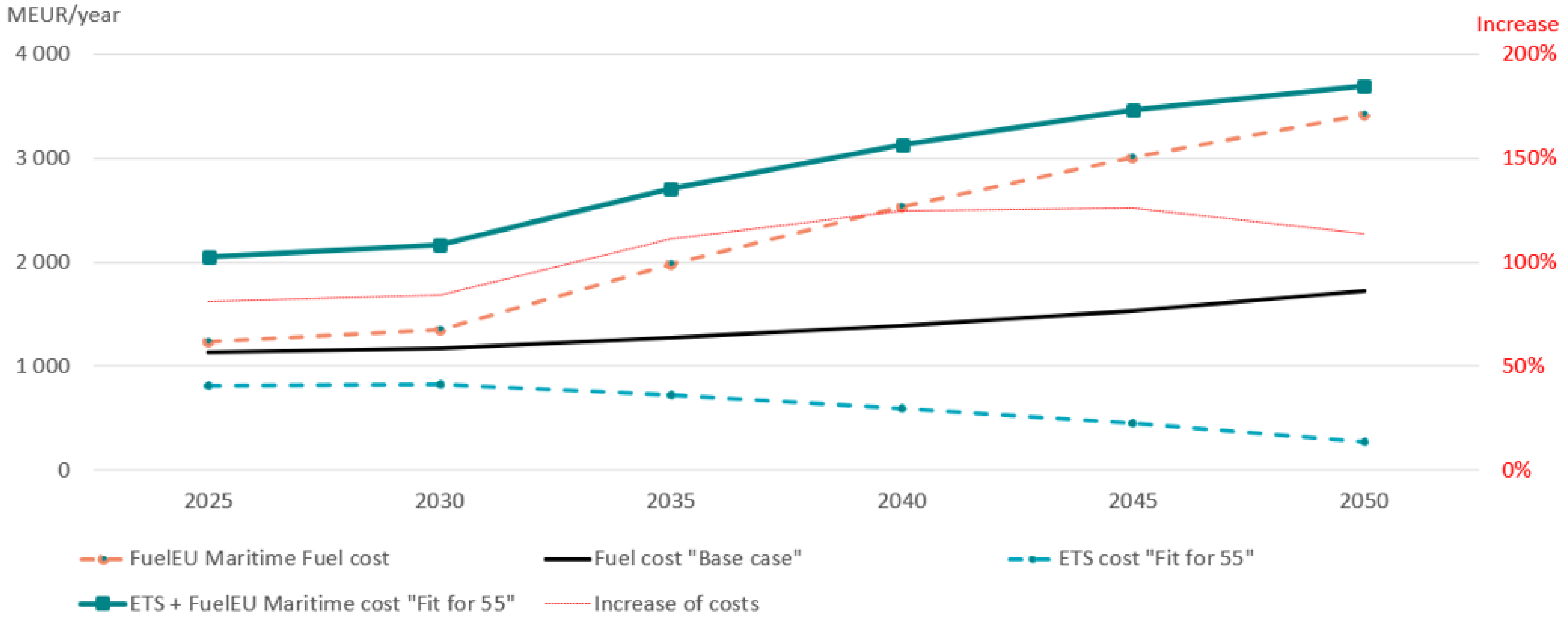


Figure 21. Scenario based on the implementation of FuelEU Maritime and the ETS which will require an increased share of alternative bunker fuels within the European shipping over time as one of the proposed measures within the Fit for 55 packages. With the assumptions that total energy consumption stays the same as the base case. Fuel cost for Base case relates to conventional fossil fuels being used without any taxes, emission allowances etc.

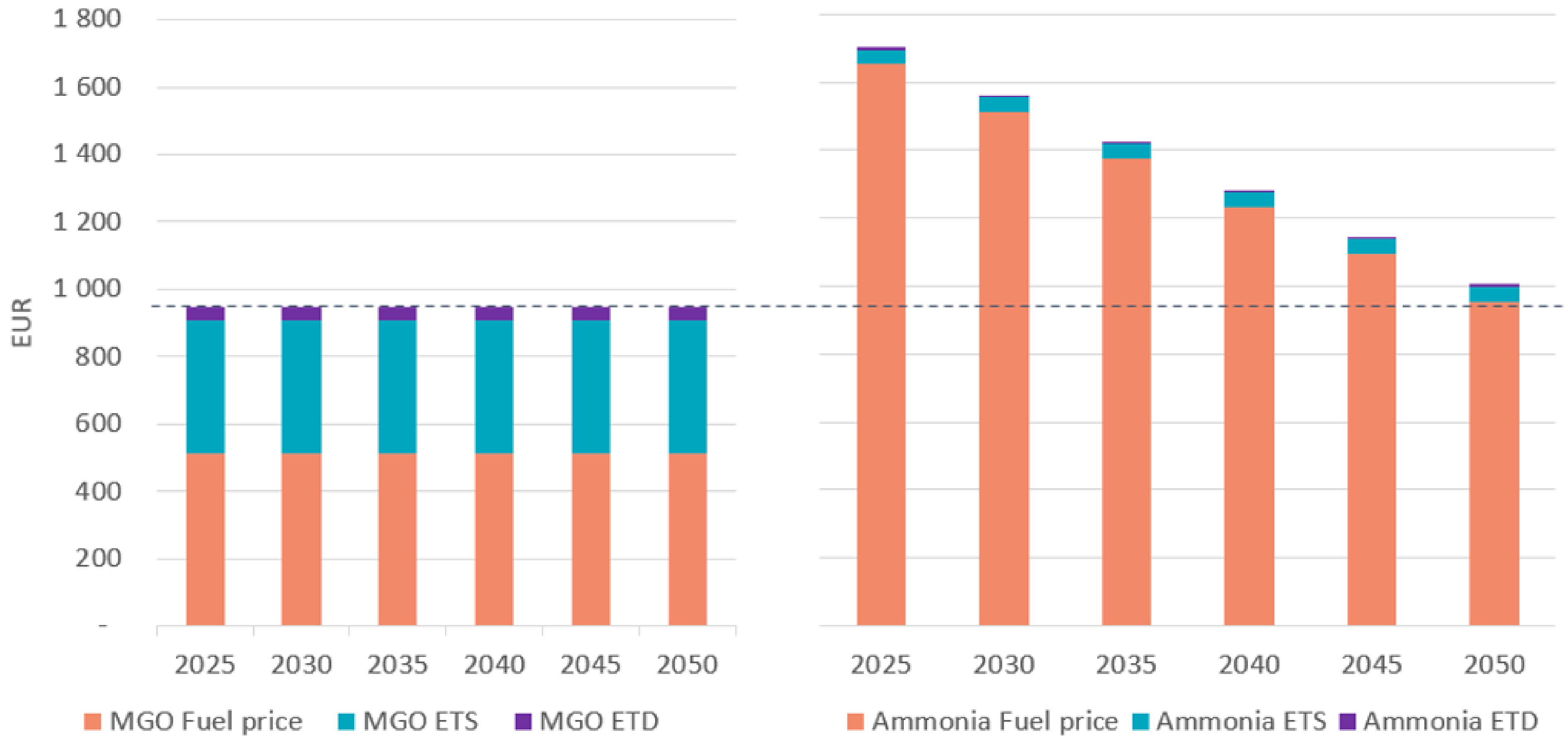


Figure 25. Example of cost structure development for fossil MGO and Ammonia. Calculated for 1-ton MGO ~ 12 MWh and for similar amount of energy content of renewable ammonia. Fuel price, Emission allowances (ETS) and Energy taxation (ETD) in EUR.

THANK YOU!

Any questions, please get in touch!

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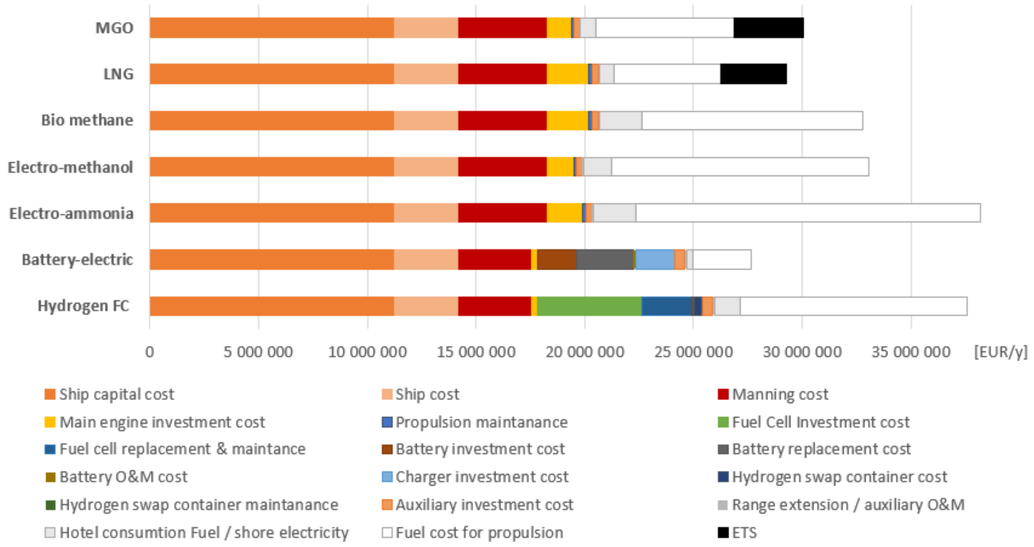
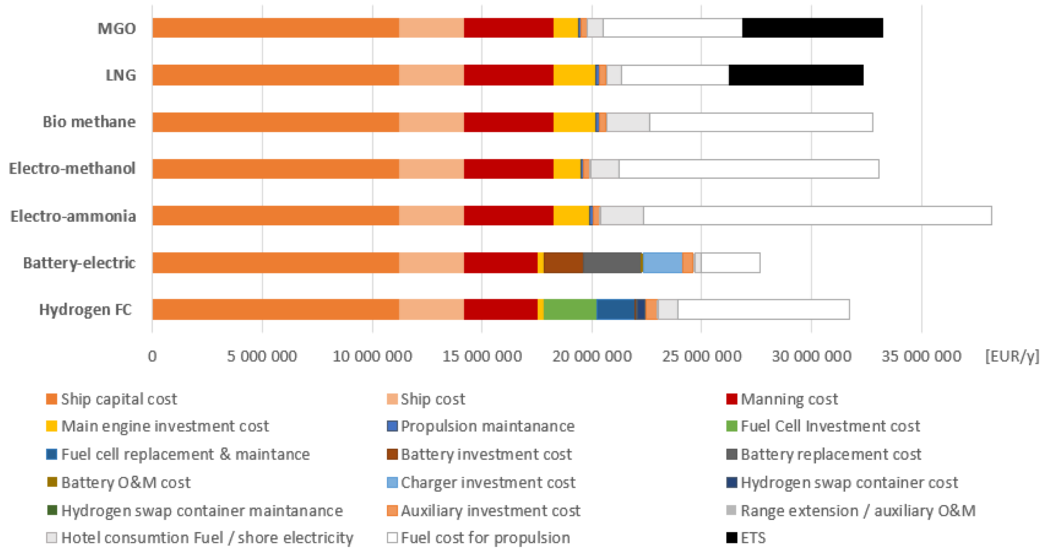
Total annual cost of ownership for operating the six concept ships:

Base case:





Sensitivity analysis assuming:

- *25% lower hydrogen cost than in the base case,*
- *halved fuel cell costs,*
- *25% lower cost for maintenance of the fuel cells (including replacement),*
- *200% higher costs for carbon emission allowances in the EU ETS*

Swedish Environmental Research Institute

Färdplan Hållbara Hamnen
2025-2050
HÅLLBARA HAMNBESÖK
HÅLLBARA HAMNOPERATIONER
HÅLLBART SAMHÄLLE
2025
2050
Hållbar transportinfrastruktur
Sömlös omlastningspunkt
Hållbart ekosystem
Affärer & digitala tjänster
Transporteffektiva operationer
Fossilfria transporter
Fossilfria arbetsmaskiner & infrastruktur
Digital samverkan
Uppkopplad infrastruktur
TRANSPORT NOD
ENERGI NOD
DIGITAL NOD
SUSTAINABLE PORT 10 KM
TIDSLINJE
METODIK/ LAGKRAV
Samskapat av Sveriges Små & Medelstora Hamnar

Roundtable discussion

- Each table elaborate on what has been presented related to the
  1. Which is the role of the ports in tomorrow's new energy landscape?
  2. How can ports in the Baltic Sea act to respond to the needs of the transport sector? What new innovations, collaborative models or other changes are needed?
- Each table have a moderator
- The moderator takes notes and prepares the presentation
- @10:10, the presentation from each group starts and we reflect jointly

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Questions to discuss

Which is the role of the ports in tomorrow's new energy landscape?

How can ports in the Baltic Sea act to respond to the needs of the transport sector? What new innovations, collaborative models or other changes are needed?

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Closing remarks

Ports must be empowered for their role in end-to-end chains

... enabling seamless and integrated performance for sustainable transports

BLUE MISSION BANOS

What are the actions needed?

in your perspectives

What action can you contribute to?

BLUE MISSION BANOS

Who else is needed in the actions?

New partnerships

2an Mission Arena sessions