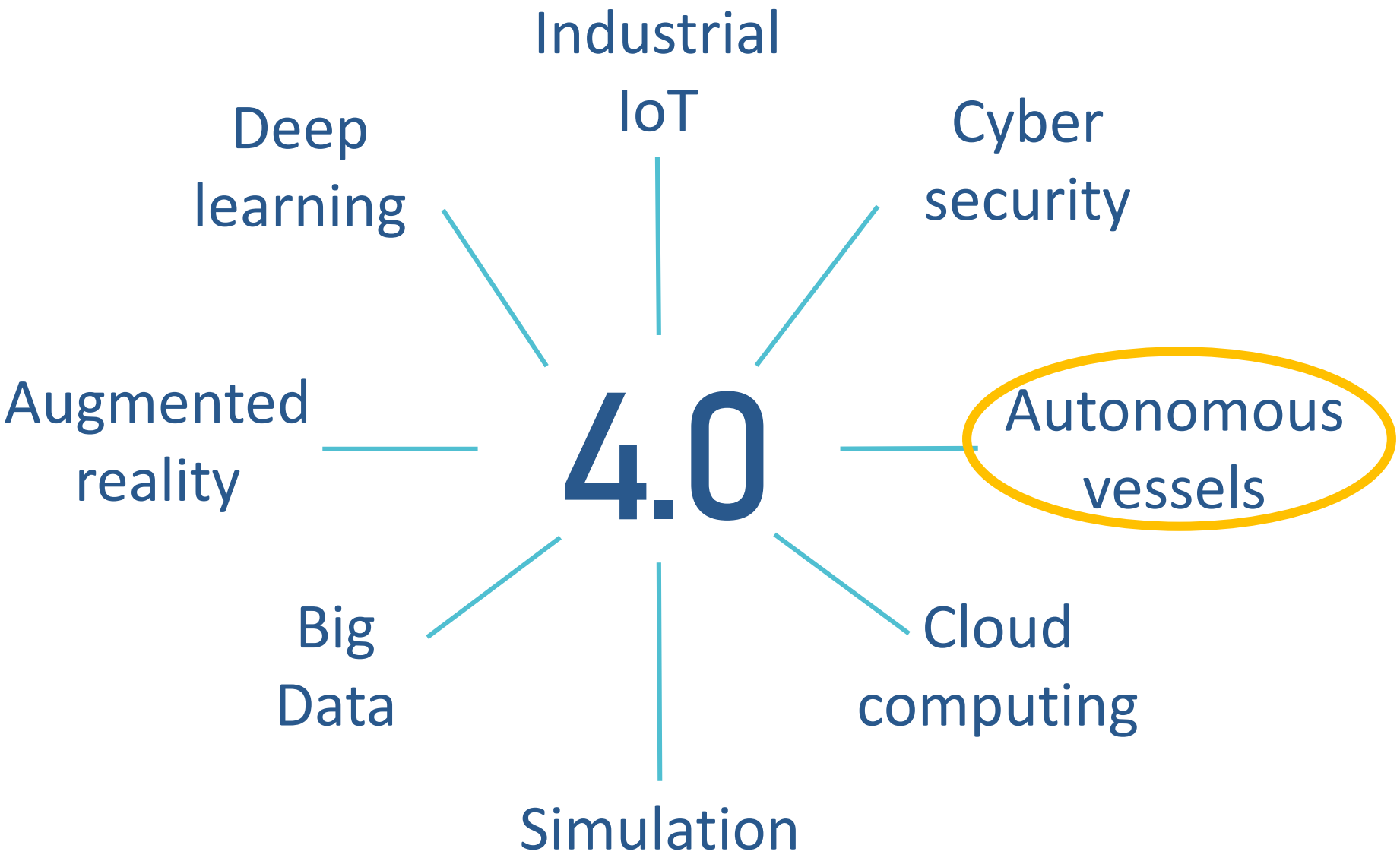
massterly
a Kongsberg Wilhelmsen joint venture

Enabling sustainable logistics

- through efficient autonomous shipping


Industrial
IoT
Deep
learning
Cyber
security
Augmented
reality
4.0
Autonomous
vessels
Big
Data
Cloud
computing
Simulation

Massterly is Kongsberg and Wilhelmsen's joint effort to develop the autonomous maritime market

TECHNOLOGY

- Leading in development of autonomy
- Frontrunner in digital development
- In front on cyber security

OPERATION

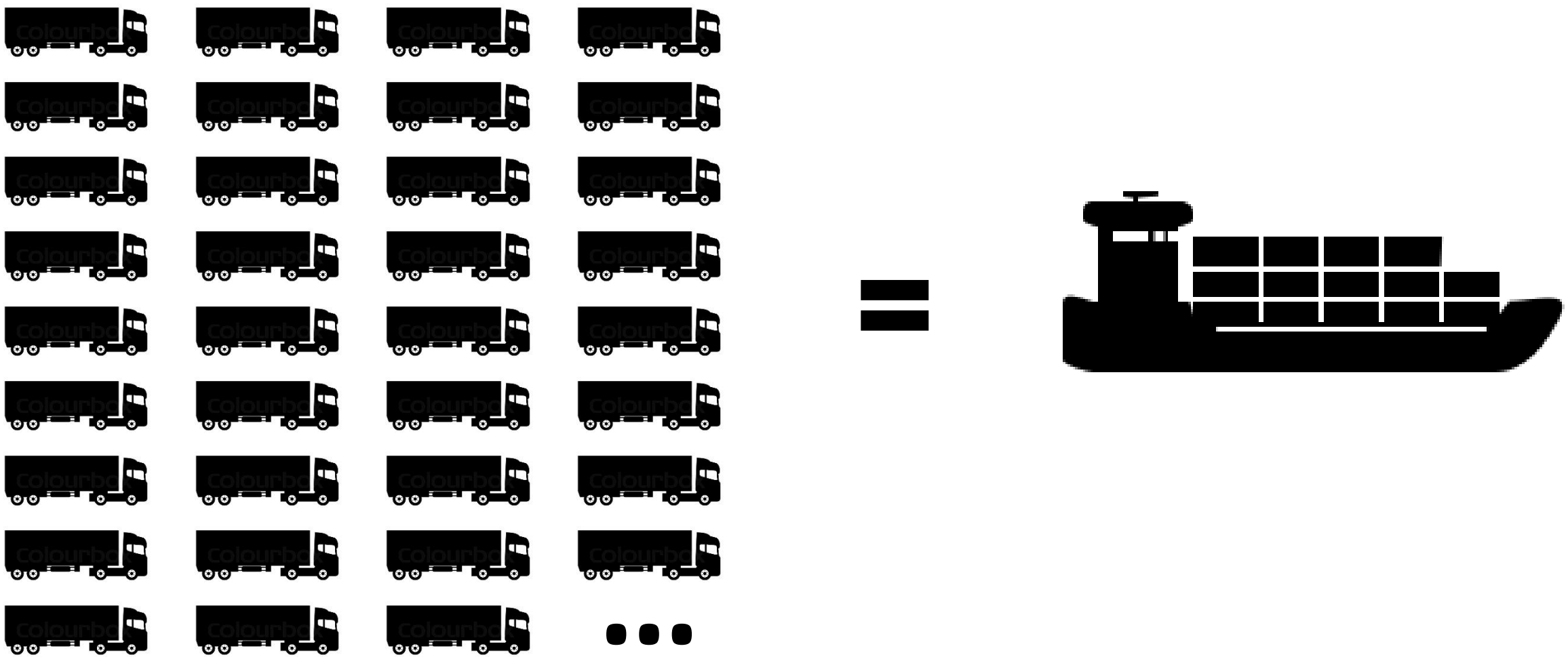
- In front on vessel operation
- Major logistics operator at sea and on land
- One of the largest maritime network globally

What shall Massterly deliver?

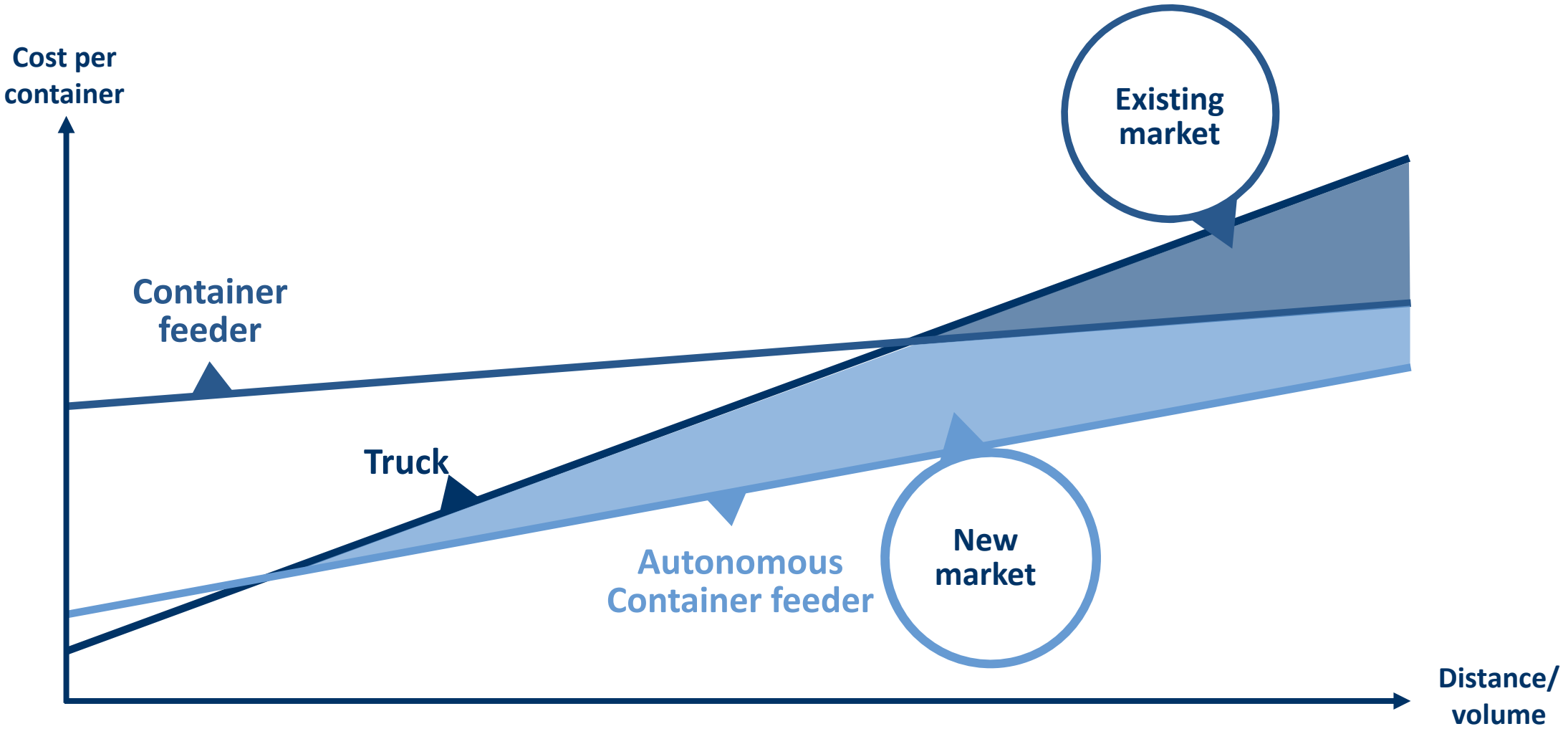
Environmentally friendly logistics
enabling the shift from road to sea

30% of all cargo that is transported by truck over 300 km to be transported by waterways & rail within 2030 and 50% by 2050

European Commission, 2011



Creating a new market for ocean transportation



Our offering: The entire value chain

Logistics

Planning and full operation from factory to dealer

Terminals

Design, specification, project management and operation

Autonomy

All hardware and software for the vessel and the shore control center

Vessel

Turn key; design, specification, site management and approvals

Operation

Vessel operation from control center, ship management, all approvals etc.

Manning

Access to all maritime and technical competence as required

Insurance

Broking and facilitation

Financing

Facilitation and possible participation

Autonomous does not mean unmanned, and we work with customers requesting varying degree of autonomy

Degree of unmanned

Unmanned vessel

Reduced crew

Full crew

Cost-effective logistics,
moving goods by sea rather than truck

"Next Generation Shipping"
OPEX reduction
(fuel, crew, maintenance)

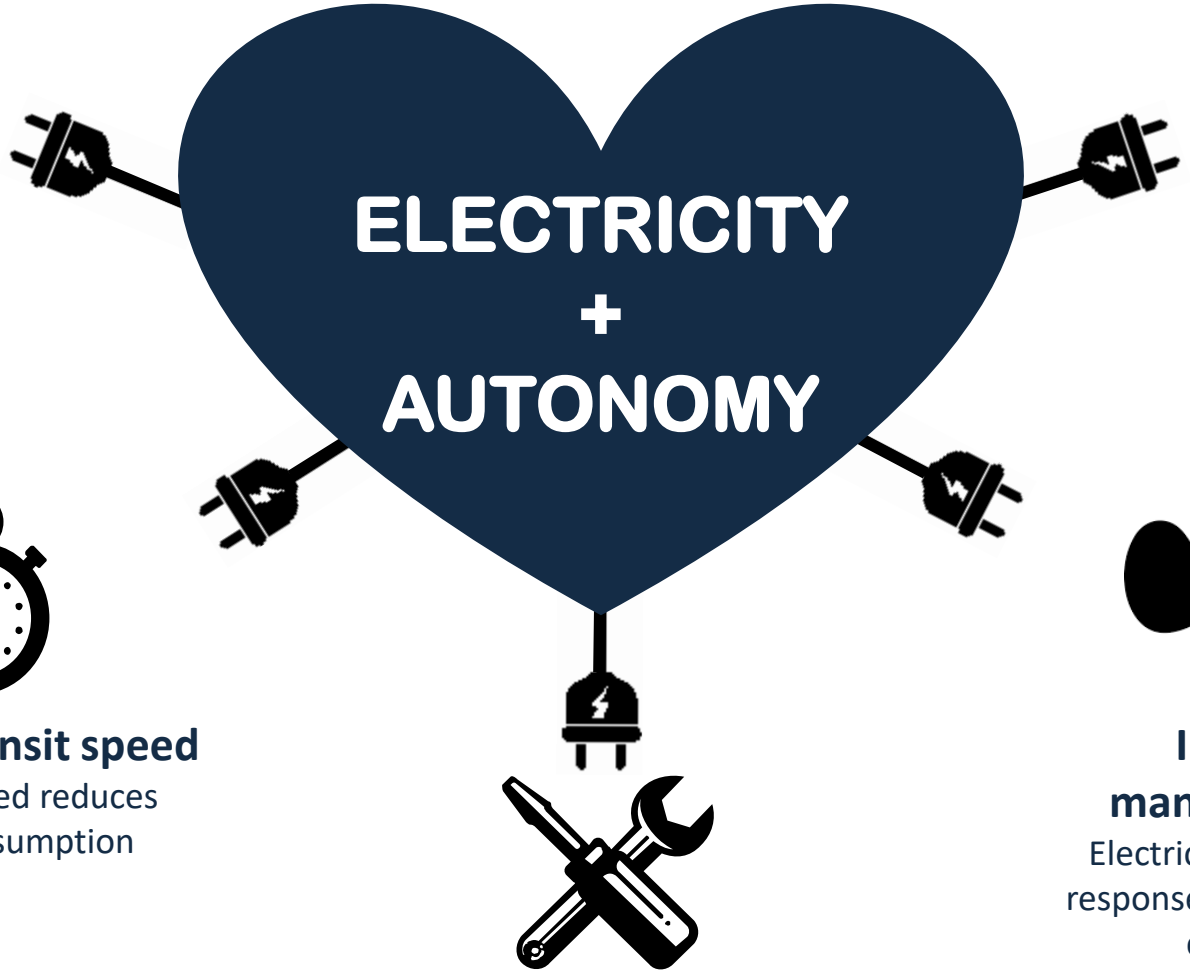
Conventional vessel

Autonomous functionality / remote control

Fully autonomous

Degree of autonomy

The first generation autonomous vessels are battery driven



Reduced CO2 emissions
Zero emission solution

Reduced fuel cost
Electricity is cheaper than diesel

Reduced transit speed
Reduced speed reduces energy consumption

Increased maneuverability
Electric power increases response and maneuvering capabilities

Reduced maintenance
Fewer moving parts and simpler to maintain

75-96 % of marine accidents can be attributed to human error

The different autonomy levels as per NMA

Sjøfartsdirektoratet
Norwegian Maritime Authority

1. **Decision support:** Advanced anti-collision radars, ECDIS, autopilot & track pilots. Crew in direct command of ship operations.

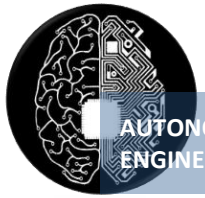
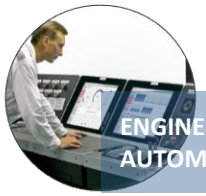
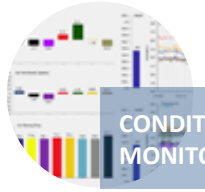
2. **Automatic:** Can complete demanding operations without human interaction, e.g. dynamic positioning or automatic berthing. The bridge crew is always available to intervene.

3. **Periodically unmanned**: E.g. at night in good weather and without much traffic. Crew onboard or in escort vessel will be alarmed if there are situations the system is unable to handle.

4. **Unmanned:** No crew onboard, but direct or indirect control from shore to handle complex operations. SCC continuously supervises operations and will take immediate control when needed.

5. **Fully autonomous:** The ship handles all situations by itself, no SCC or bridge personnel at all. Unlikely scenario in the medium term due to very high complexity and the need for vessel to be under someone's command and communicate with others.

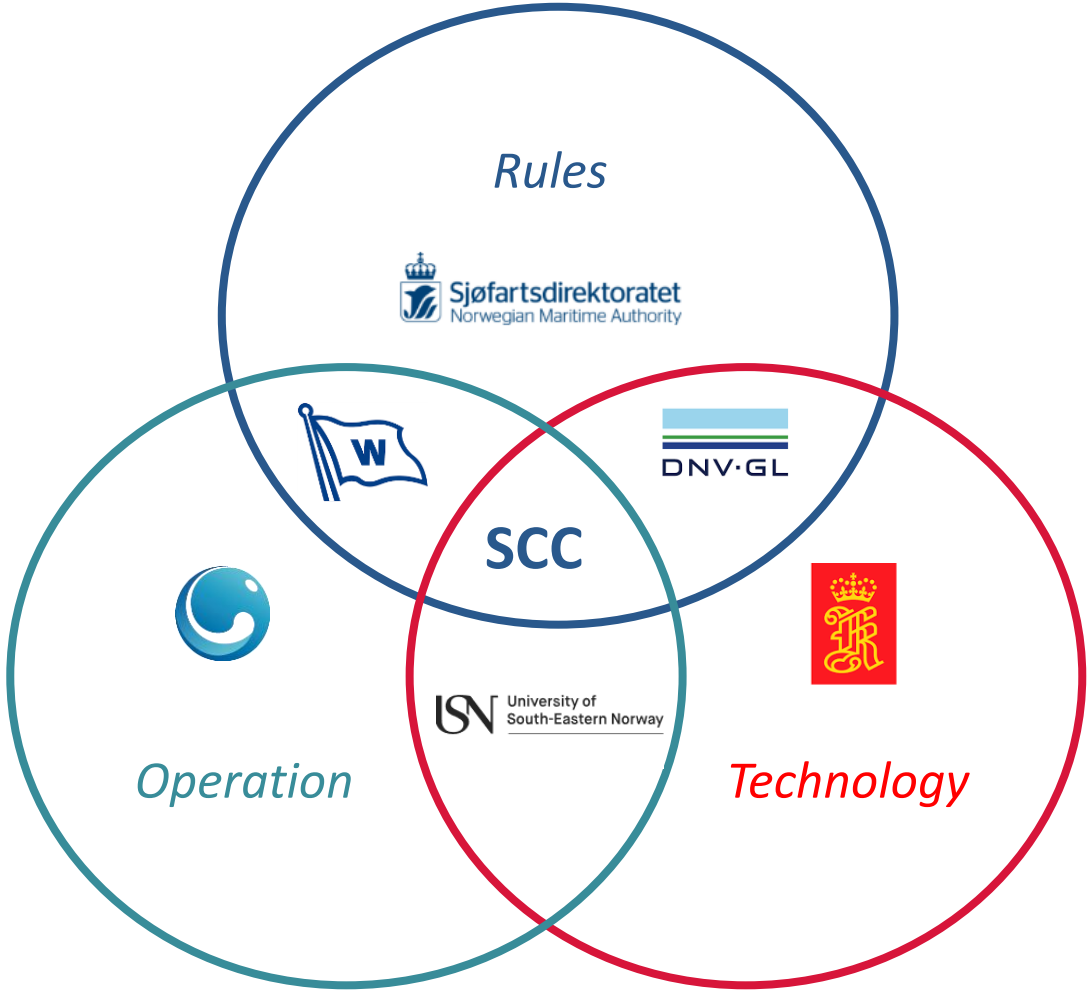
The technology behind a fully autonomous vessel

Sensors	Object identification	Route calculation	Maneuvering/ Dynamic Position	Automated power system	SCC monitoring & commands
 CAMERA	 SENSOR FUSION – SITUATION AWARENESS	 AUTONOMY ENGINE	 ADVANCED MANEUVERING FUNCTIONALITIES	 ENGINE AUTOMATION	 MARITIME BROADBAND RADIO
 RADAR				 BATTERIES	 KOGNIFAI
 GPS				 AUTOMATED MOORING SYSTEM	 SHORE CONTROL CENTER
 LIDAR				 CONDITION MONITORING	
...				 POWER AUTONOMATION	

Interplay between technology and operation is crucial to succeed

Main focus in the debate is on autonomy technology, but operation is equally important

- How will these vessels be operated?
- Under what rules and guidelines?
- Is a Shore Control Centre (SCC) required?
- What is the approval process for SCC?
- Competency required for SCC operators?
- Legal aspects
- Division of responsibilities
- Insurance



Transition from today's role-based approach to a goal-based approach is required to succeed with optimization

Role based approach

Who does what ?

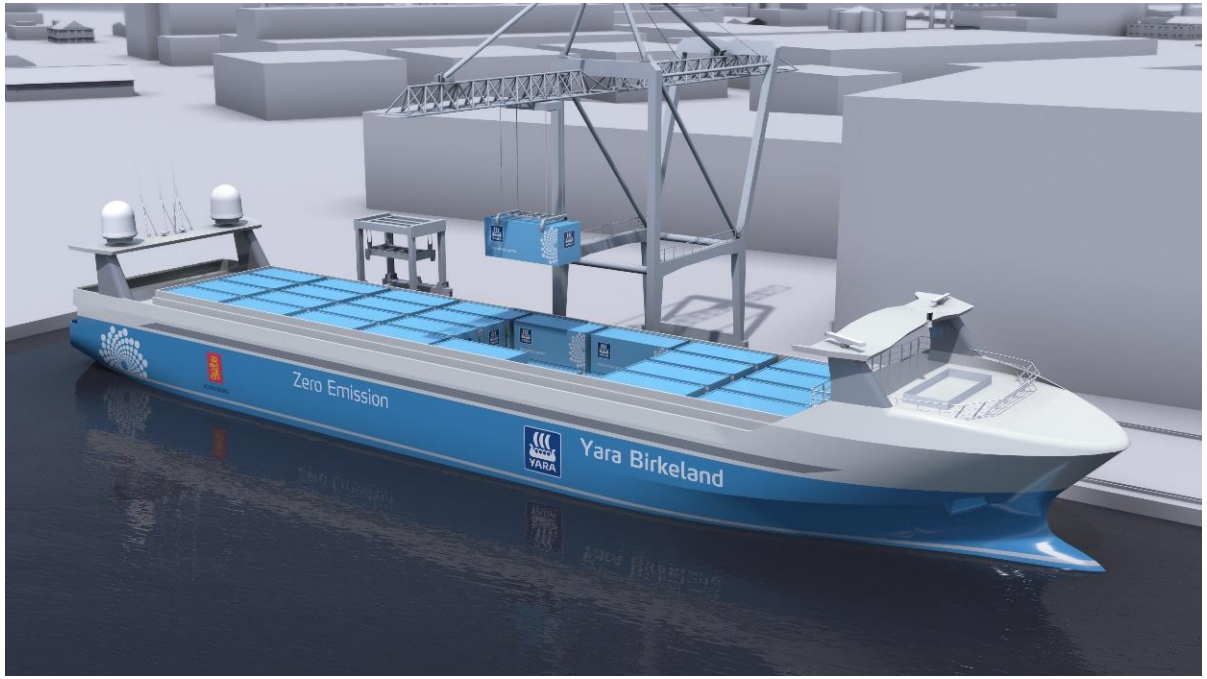
Function and goal based approach

Actions driven by objectives


Norway
United Kingdom
Ireland

Yara Birkeland

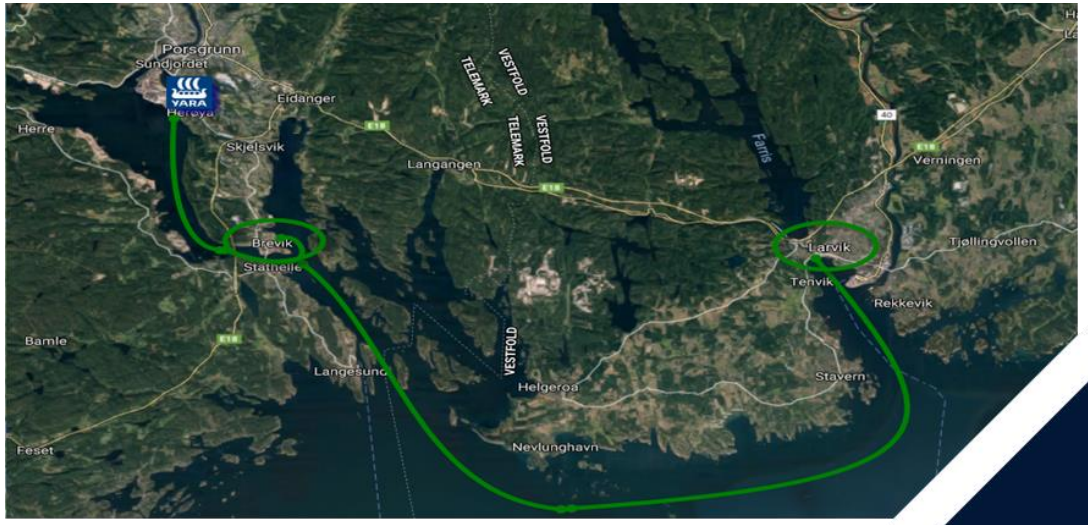
- a fully electric, autonomous 120 TEU feeder vessel

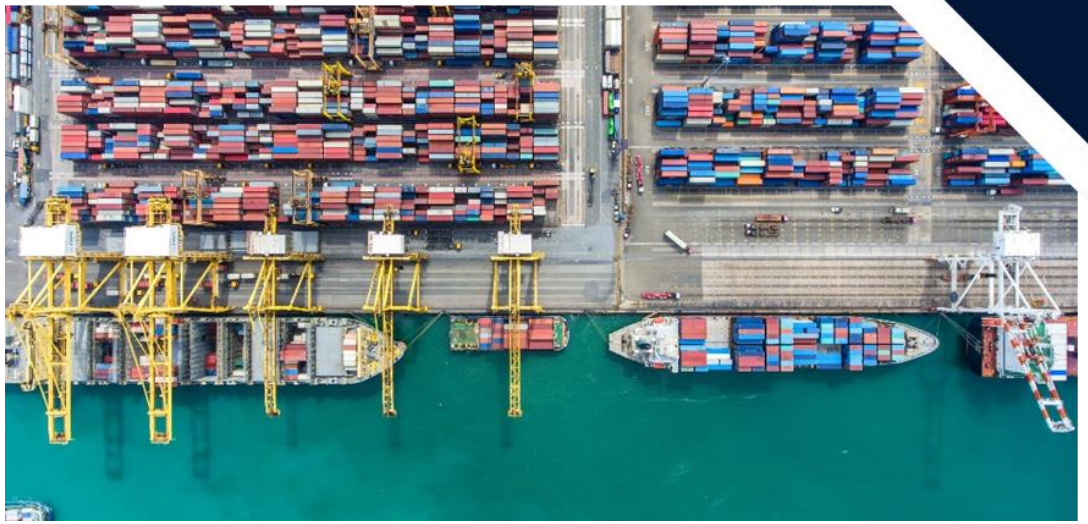


- Sailing between Herøya and Brevik/Larvik
- Replacing 25K-40K truckloads/year

- Length: 80 m
- Beam: 15 m
- Service speed: 6 knots
- Battery capacity: 6 MWh
- Delivery (Vard Brevik) in 2020
- Fully autonomous in 2022

Yara Birkeland - Sailing area and port infrastructure





Sail within 12 nm.

- Herøya-Brevik: 7nm
- Herøya-Larvik: 30nm

Every step from fertilizer production to discharge port will be automated, with fully electric solutions

- Self driving straddle carriers
- Automated loading and discharging
- Automatic mooring system
- Charging at Herøya (2,5 MW); connecting and disconnecting automatically

ASKO project;

- Zero emissions transport with autonomous fjord crossing

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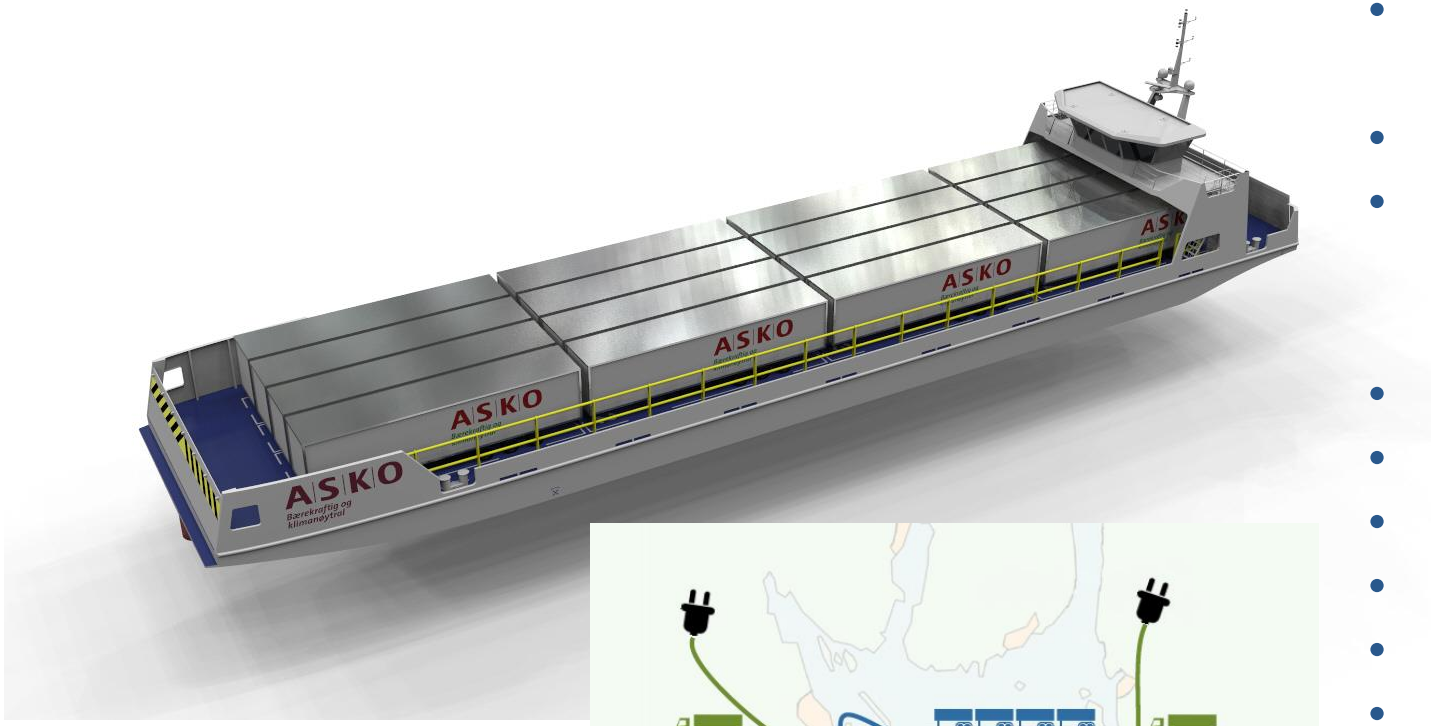
- Zero emissions transport with autonomous fjord crossing

ASKO project:

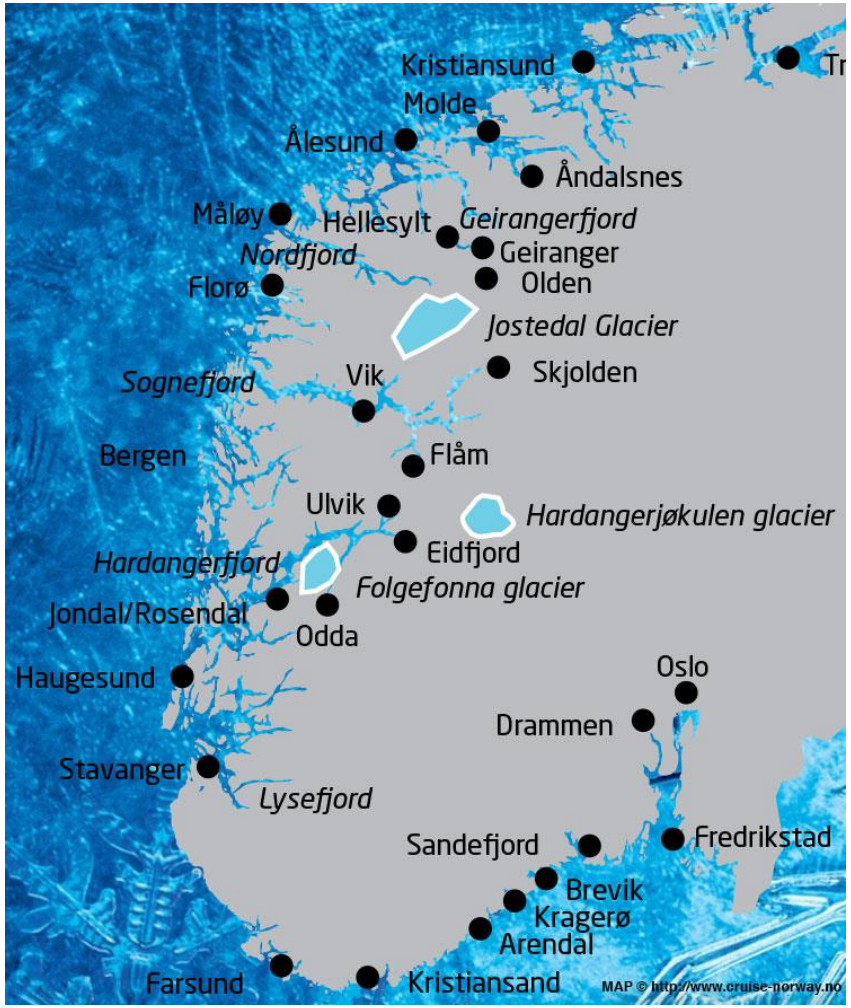
- Two fully electric autonomous RoRo feeders for 16 trailers



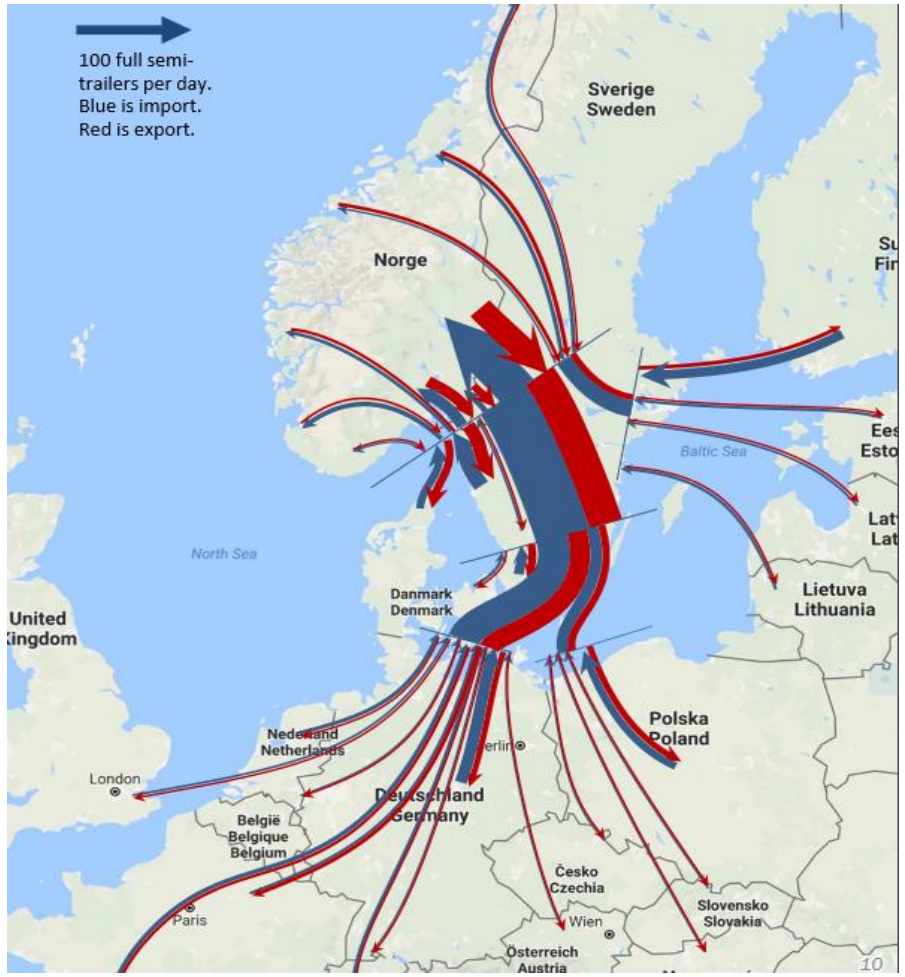
- Sailing between Moss, Holmestrand and Langøya (NOAH)
- Replacing 150 trucks daily
- CO2 emissions reduced by 5,000 tons / year

- Length: 66 m
- Width: 15 m
- Service speed: 8 knots
- Battery capacity: 1,7 MWh
- Target delivery: 2021/22
- Fully autonomous: 2024

Many geographical areas are suitable for this logistics solution



Seashuttle Project:
- Low emission and cost-efficient solution for longer distance



- Every day some 2 800 trucks pass between Sweden and Norway
- 50% of these are in transit trough Sweden from/to Europe

SeaShuttle will be a competitive option to trucks:

- Reduced manning (B0)
- Autonomous cranes onboard
- Autonomous container trucks in ports
- Reduced emissions with part hydrogen propulsion

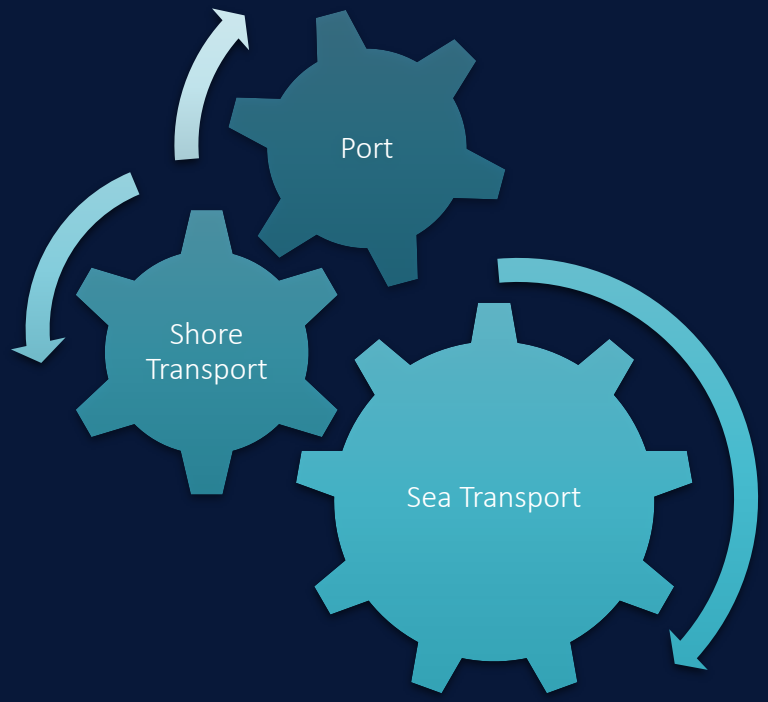
Seashuttle Project:

- semi-autonomous container vessel with hydrogen/fuel cells
- trading between Oslo, Gothenburg, Malmo and Poland

- Awarded € 6 Million in support from Norwegian government (PILOT-E)

- Project owner: Samskip
- Partners : Massterly
  Kongsberg
  HYON
  Kalmar
  FlowChange

Collaboration is Key



massterly

a Kongsberg Wilhelmsen joint venture

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