Vestland
County Council

Electrification of Inland Waterways & Future Qualifications Needed

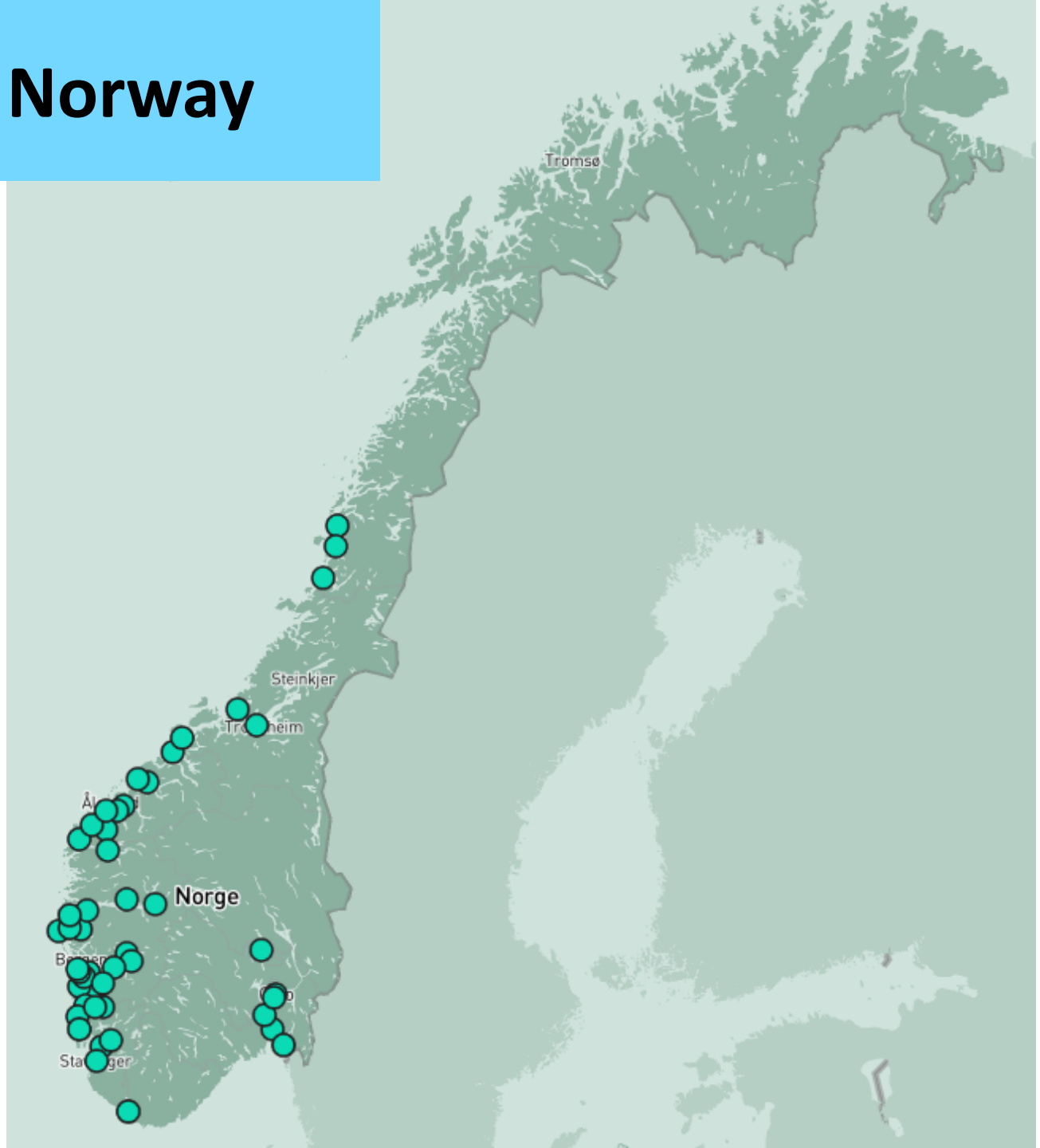
Maritime electrification: *Lessons learned from the Norwegian market.*

Dagfinn Husjord, PhD

Electrical ferries in Norway

51 ferry connection (crossings)
– established from 2018 – 2022.

A total of 76 electrical ferries build

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Electric ferries in Vestland County

18 ferry connection (crossings)

21 ferry vessels

6 contracts - mostly 10,5 year contracts.

40 ferry docks

Investment in infrastructure 66,4 million EUR

Total expected power consumption 80 GWh/year

- Results:
  - ✓ *60 % energy use reduction.*
  - ✓ *88 % greenhouse gas emissions (GHG) emission reduction.*

Ferry connection and vessel design

- Timetables
  - *10-45 minutes crossing*
  - *12-14 knots speed*
  - *8-10 minutes charging*
- Capacities
  - *12-130 vehicle units*
- Hybrid electric systems
  - *80-100 % electric mode under normal conditions*
  - *Alternative biodiesel mode*

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Land infrastructure

- Construction on 37 docks:
  - *Grid upgrade*
  - *Eventual battery bank*
  - *Rectifiers*
  - *Charging tower with automatic plug*

- Different transmission depending on battery solution and energy need:
  - *High and low voltage (22kV, 400V, 590V, 690V)*
  - *Charging power usually between 1750kW and 6000kW*

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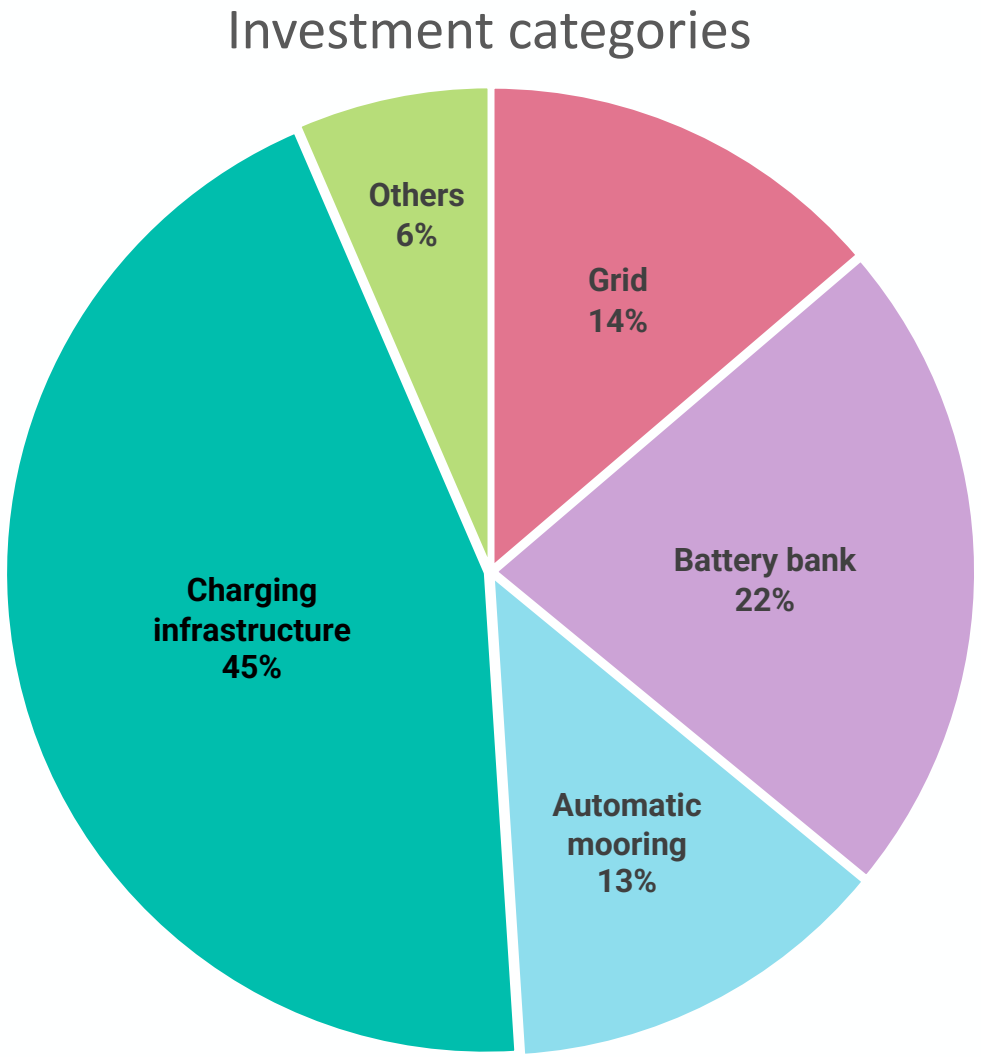
County Council

Land infrastructure investments

- On-shore investments: 75 million EUR
- 40 % support from state founding organization Enova SF*
- Cost crack related to power grid investments.



*Enova SF is a state enterprise owned by the Ministry of Climate and Environment. Enova contributes to reduced greenhouse gas emissions, development of energy and climate technology and a strengthened security of supply.

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Some challenges and delays in establishing charging stations.

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High Speed Craft vessels (HSC)

Tenders will be issued this year.

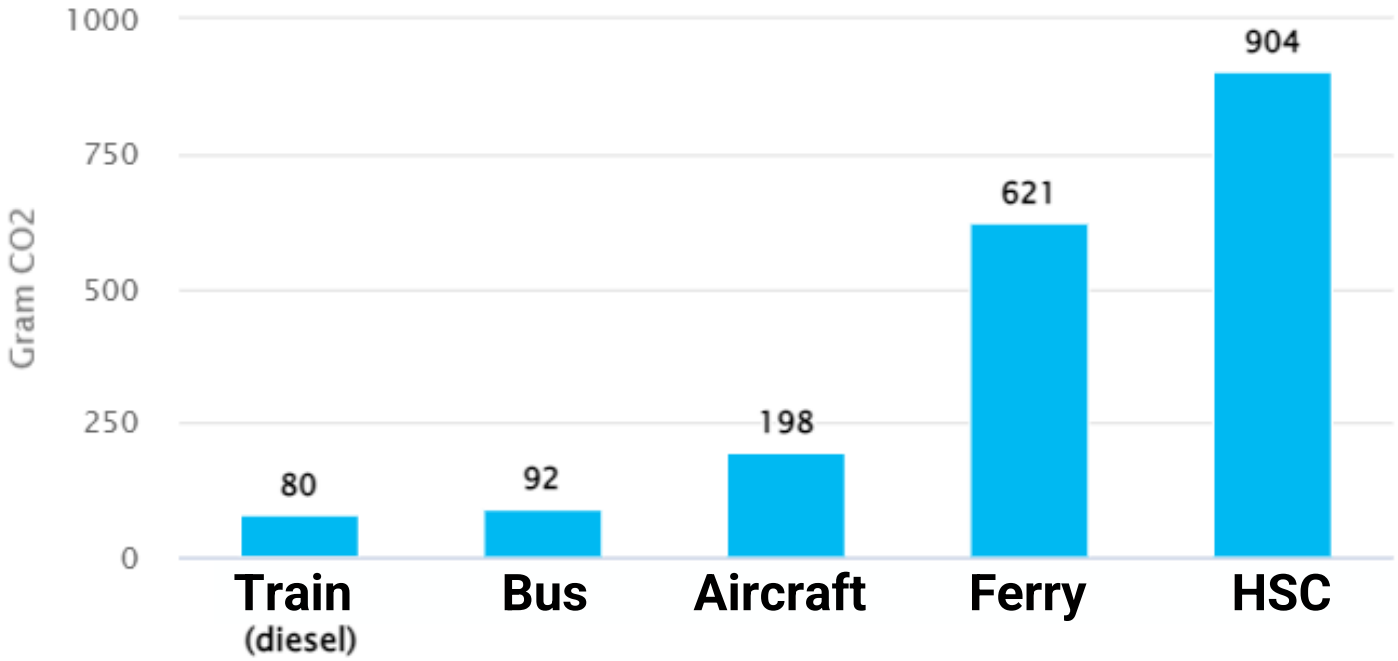
Plan to have the first vessel on the water in 2026.

High Speed Craft vessels (HSC) – high emissions

Goal - 85 percent emission-free HSC transport.

co_2 emissions per kilometer.

Grams of co_2 emitted to transport a person one kilometer.



High Speed Craft vessels (HSC) – electric or hydrogen

Price for Vestland County: - About 150 million EUR.
- Extra cost of 10 million EUR, annually.

Tender contracts – 15 years.

Charging time about 15 minutes in ports.

ILLUSTRATION: LMG MARIN

Illustration: Brødrene Aa.

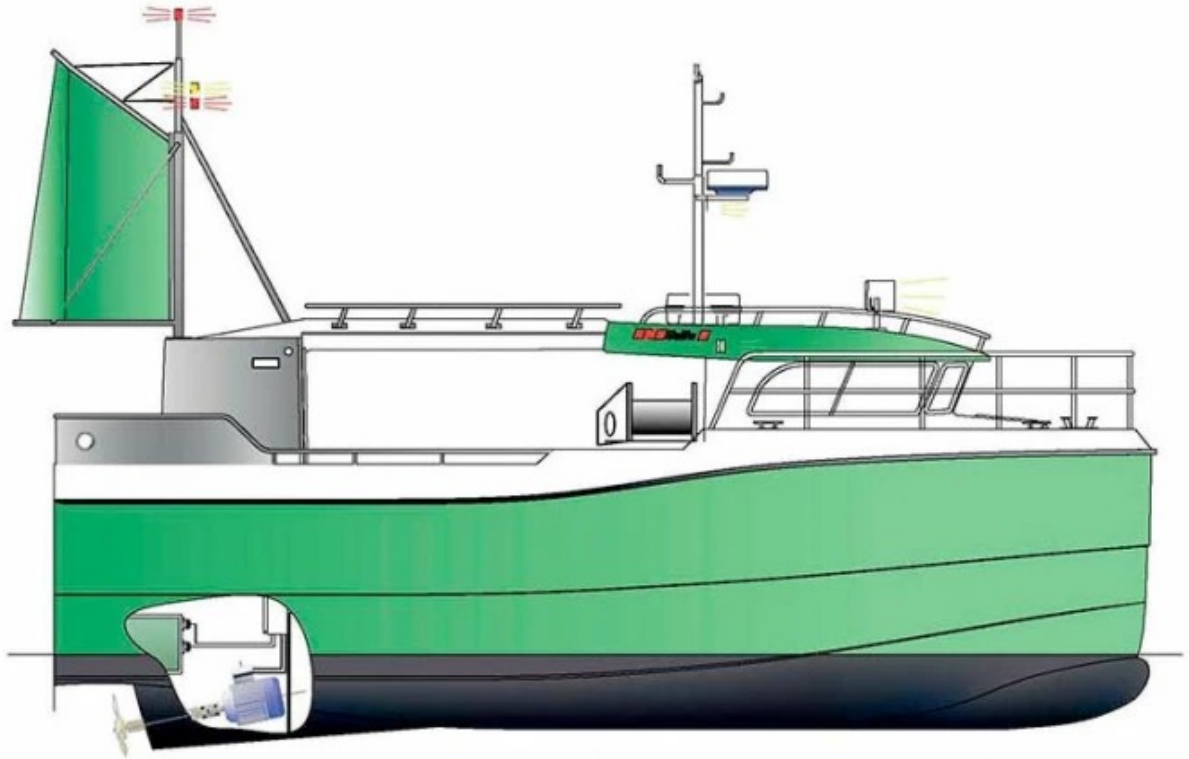
Hybrid-Electrical fishing vessel

The words first electrical fishing vessel:
FV “Karoline” built in 2015.

Fisherman Bent Gabrielsen.

"Will electrify 3,000 fishing boats over the next ten years"

Bellona, Nelfo,
The Electrical Association and Siemens



Elmax – Selfa Arctic

MS «Color Hybrid»

Hybrid - The battery pack has a capacity of 4.7 MWh

The MV “Yara Birkeland” is a fully electric and autonomous container ship, with zero emissions.

Battery pack: 6.7 MWh

Hybrid bulk carrier MV «Aasfjell»

Battery pack: 339 kWt

Several different
Hybrid Supply vessels

Skills and job roles:

- New and close collaboration between electrical power suppliers and the transport industry
  - ➢ E.g. in creating redundancy!

- The engineers on board have improved their expertise in battery and hybrid operation.
  E.g.:
    - ➢ The transition from water cooling to air cooling.
    - ➢ Increased knowledge and operational skills in **monitoring control systems**.
      - ✓ Chief Engineers get specific courses from equipment suppliers.
      - ✓ Handling systems in case of errors
        > currently need assistance from equipment suppliers
    - ➢ Fire protection and safety > monitoring the temperature > thermal runaway.

Lessons learned

The infrastructure needed.

- **The infrastructure must be planned more carefully and better.**
- **Challenges in extensions of the Power Grid > Especially in non-urban areas.**
- **More land area needed for technical houses, grid and charging facilities.**

Going from diesel to electric power changes the flexibility.

> The shipping companies expect greater predictability.

Over all:

✓ **Large investments** in both vessels and shore side infrastructure needed.

✓ **Public strategy, policies** and long term requirements in tenders has proven key.

✓ **Public support in funding** and financing has been vital.

✓ Shore side **charging infrastructure** – ready in due time - has proven key.

✓ **GHG reductions are substantial**: Maritime electrification is successful for Norway!

Being a fast mover (first) > has resulted in higher expenses!

MF *«AMPERE»* is the world`s first battery-powered ferry.

- Has 1,040 MWh of lithium ion.
- Operational from May 2015.

Vestland County Council

Thank you and bon voyage!

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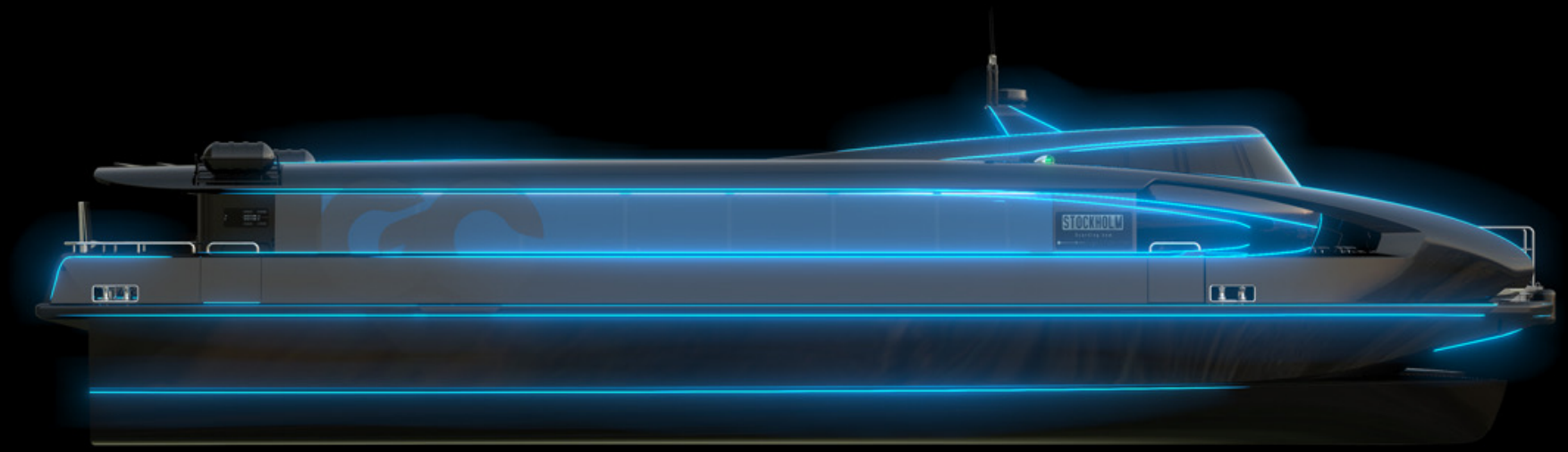
County Council



Green City Ferries

Upgrade to Zero-Emission Fast Ferries
and Create Opportunities for attractive Intermodality

Company Overview

About Green City Ferries

- Founded in 2014, Sweden.
- Parent company in Stockholm.
- Subsidiary in the US.
- Production facilities located in Härnösand, Sweden.

Resources

- The team has world-class knowledge in carbon fiber vessel production as well as in battery and fuel cell drivelines.
- We own the IP for this unique market-ready foil-supported catamaran built in light-weight carbon fiber.
- The vessel is designed by Teknicraft in New Zeeland.

An Attractive Alternative to Replace Car Commuting

Two Market Opportunities For GCF

1. Existing Diesel Ferry Replacement
2. New Sustainable Waterborne Mobility for Cities

One Zero-emission Vessel For The Planet

- High-Speed and Zero-emission
- Frequent departures with fast charging
- Minimal Wakes and Noise free

Strategic Technology Partnerships

" GCF have together with its exclusive alliances created based on proven technology the most energy-efficient, lightweight, ruggedized electric vessel on the market."

Emission-Free Power

BAE SYSTEMS

TOSHIBA

Echandia

Foil-assisted Hull Technology & Wave Piercers

STUDIO SCULLI

teknicraft design

Carbon Fiber Construction

VAXHOLM KOMPOSIT

Waterjet Propulsion

HAMILTON

Introducing **Beluga24**

The Beluga24 is a Premium 100% electric foil-assisted carbon fiber catamaran designed for comfortable high-speed operations and compliant with the international HSC-code and DNV high speed craft rules: +1A HSLC Passenger Battery E0 R4 or R3.

Freeboard - DNV R4	**Freeboard - DNV R3**	**Maximum draft with foil**	**Height**	**LOA (length overall)**	**Beam**
1.5 m (4.92 feet)	2.2 m (7.2 feet)	1.35 m (4.3 feet)	4.6 m (15.1 feet)	25.8 m (84.6 feet)	9.5 m (31.2 feet)

High-Speed

Emission-Free

Low Wakes

Lower Cost of Operations

Innovation based on **Proven Technologies**

Bringing together world class state-of-the-art technologies enables Green City Ferries to create an innovative and unique design with unrivaled performance

Carbon Fiber Construction

Foil-assisted Design

State of the Art Power

USP of the Beluga

Energy Efficiency & low wakes at High-Speed

*"Our Unique Selling Proposition is based on making the combination possible between **high-speed with low wake signature** and emission-free with our energy efficient hull and light-weight construction."*

USP = Unique Selling Proposition

Cost of Ownership
Based on forecasted local US Energy prices

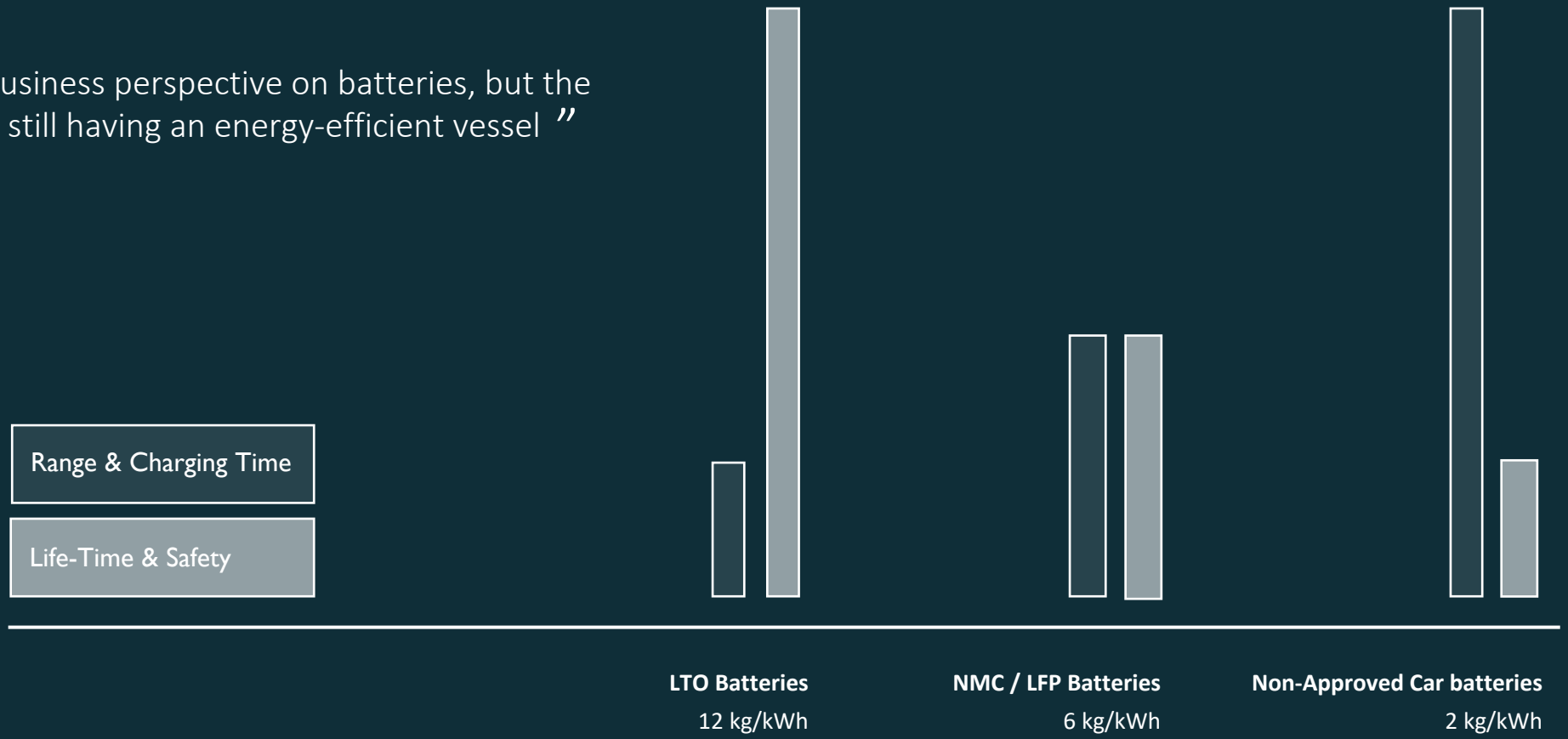
The Beluga24 consumes 50 % less energy in high speed than other traditional vessels.

Model Comparaison*	Beluga Electric	Beluga Hydrogen	Traditional Diesel
Operating Hours	3,500	3,500	3,500
Cruising Speed	28	28	21
Energy Usage	1,900,000 kWh	105,000 kg	666,000 L
Energy costs	4,37 c$/kWh	2 $/kg	1,4 $/L
Operation Costs	$ 83,000	$ 210,000	$ 935,000

** This comparison is made on a particular case including subsidized hydrogen*

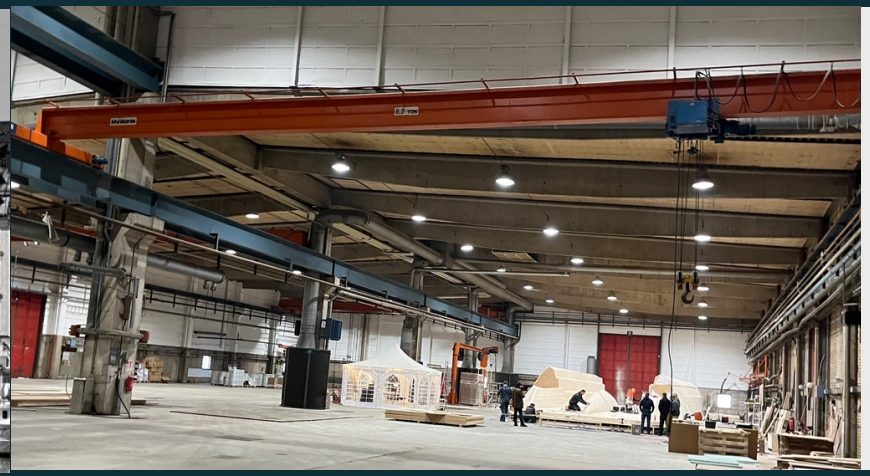
Batteries
Weight & Ranges

” Our business perspective on batteries, but the Key is still having an energy-efficient vessel ”



GCF in a **Nutshell**

"At the heart of our solution lies the Beluga24, a Premium commuter vessel based on proven technology and the most energy-efficient and technically advanced vessel of its type on the market today."



Green City Ferries AB

With the headquarter located in the old part of Stockholm in Sweden

GCF Production AB Sweden

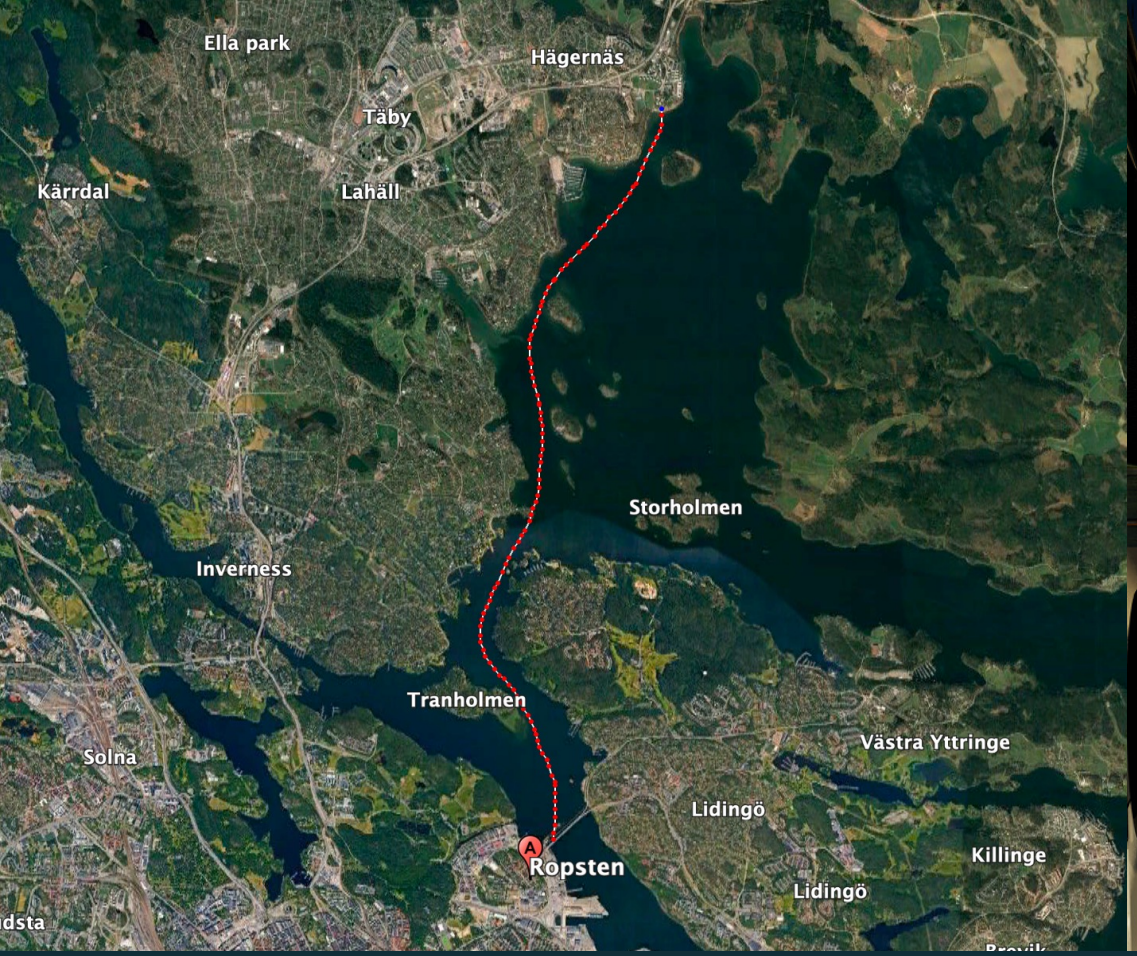
Standardization and serial production in our own cat factories will ensure our capacity and productivity development as well as scalability

Green City Ferries – Americas

GCF Inc have been set up during Q4 2022 with local representatives on the East and West coast.

Boatplan
Stockholm

"The current vessel fleet is in average 40 Years old and emits about 40.000 tons of yearly CO2 which correspond to about 50% of the yearly emissions from the Region of Stockholm"



Starting **2024**

Routes in Stockholm (Täby-Ropsten)

Starting **2024**

Routes in New York

"New York Cruise Lines plans to operate first zero-emissions electric ferry in NYC"

Marinelog, November 03, 2022

albatts
Alliance for Batteries Technology, Training and Skills

Alliance for Batteries Technology, Training and Skills
2019-2023

LUKAS FOLBRECHT
Czech Automotive Industry Association / Work Package leader

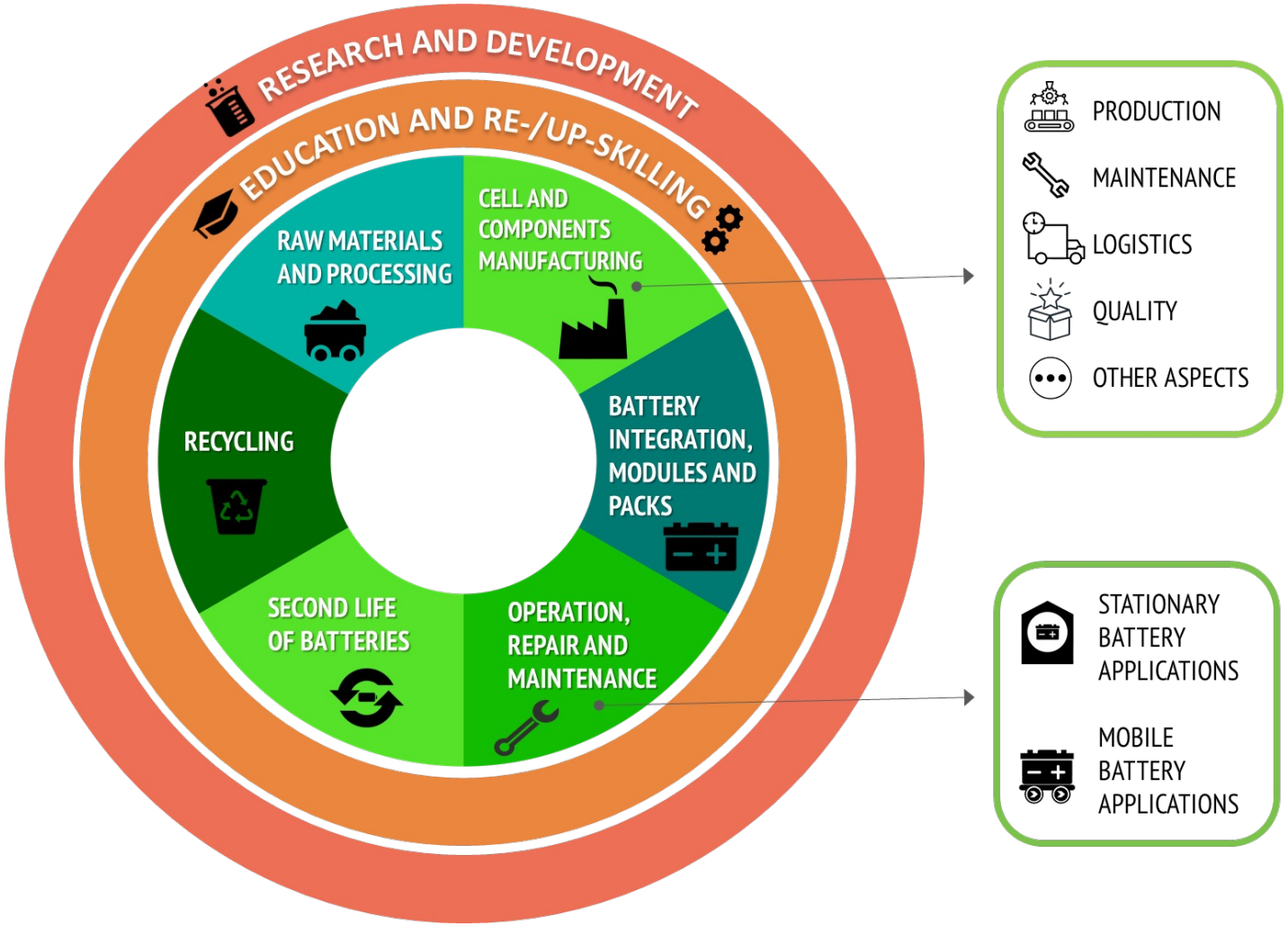
Co-funded by the Erasmus+ Programme of the European Union

What is **ALBATTS**?

- **20 Partners in 4-year** (2019-2023) Erasmus+ funded project
- What job roles, skills and competencies are missing to develop the **battery industry in the EU**
- How to address **re/upskilling,** update **curricula,** develop **training materials**, train-the-trainer **guidelines** etc.

Co-funded by the Erasmus+ Programme of the European Union

ALBATTS Focus



Co-funded by the Erasmus+ Programme of the European Union

albatts
Alliance for Batteries Technology, Training and Skills

To get involved with the albatts stakeholders group:

Stakeholder registration **here**

Thank you

Follow us on:

Web: https://www.project-albatts.eu

LinkedIn: LinkedIn

Facebook: Facebook

Twitter: Twitter (@ALBATTS1)

Mail: info@project-albatts.eu

Presenter
Lukas Folbrecht
folbrecht@autosap.cz

Co-funded by the Erasmus+ Programme of the European Union

“Vessel for the future, build today”

“Developing sustainable fleet for inland waterway’

THE ALBATTS WEBINAR

Chris Kornet 26-01-2023

Concordia DAMEN

AGENDA

- 1. Introduction Concordia Damen
- 2. Future-proofness vs. current challenges
- 3. Future proof shipbuilding
- 4. Examples from practice
- 5. What does this mean for you?

- ‘Concordia’ founded in 2001
- Joint venture ‘Concordia Damen’ since 2018
- Outfitting and repair facilities in Werkendam
- Partnership with yards in Eastern-Europe, China & South-America
- Operates global, with local respresentatives in in Eastern-Europe, China & Paraguay

1. OVER CONCORDIA DAMEN

HISTORY CONCORDIA DAMEN

2001 - Founding CONCORDIA SHIPYARDS

2010 - 100 ships delivered by Concordia Group

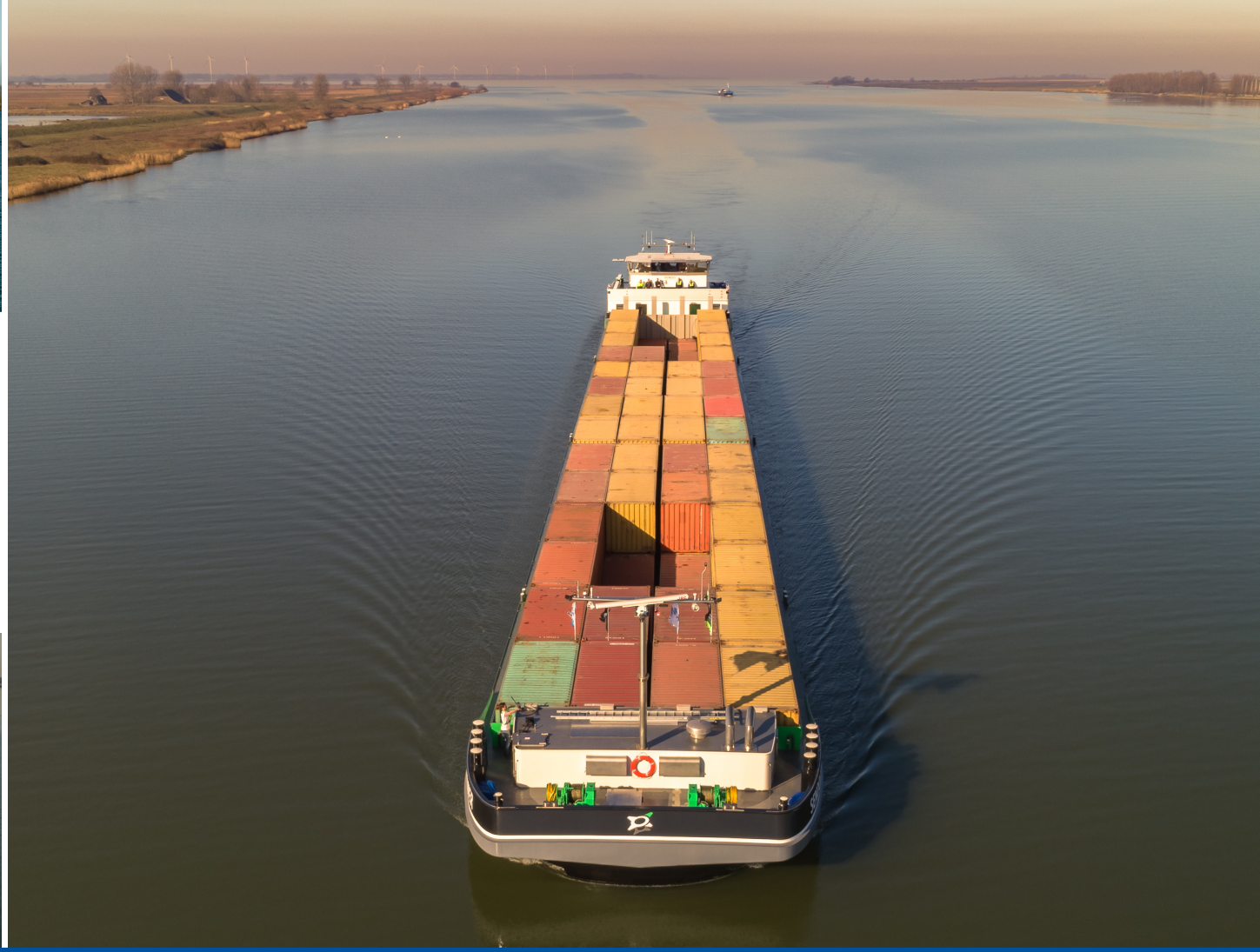
2010 - CONCORDIA GROUP
- SHIPBUILDING
- SEA-SERVICE
- SHIPPING
- BROKERAGE

2018 - CONCORDIA DAMEN joint venture (50-50) starts

2019 - Delivery of Sendo Liner: first inland vessel to sail emission free using battery pack

2021 – delivery CS901 First LNG-electric driven tanker of series of 20

2022 – delivery CS860 MS A-Rosa Sena 135m cruise passenger ship



DRY CARGO VESSELS

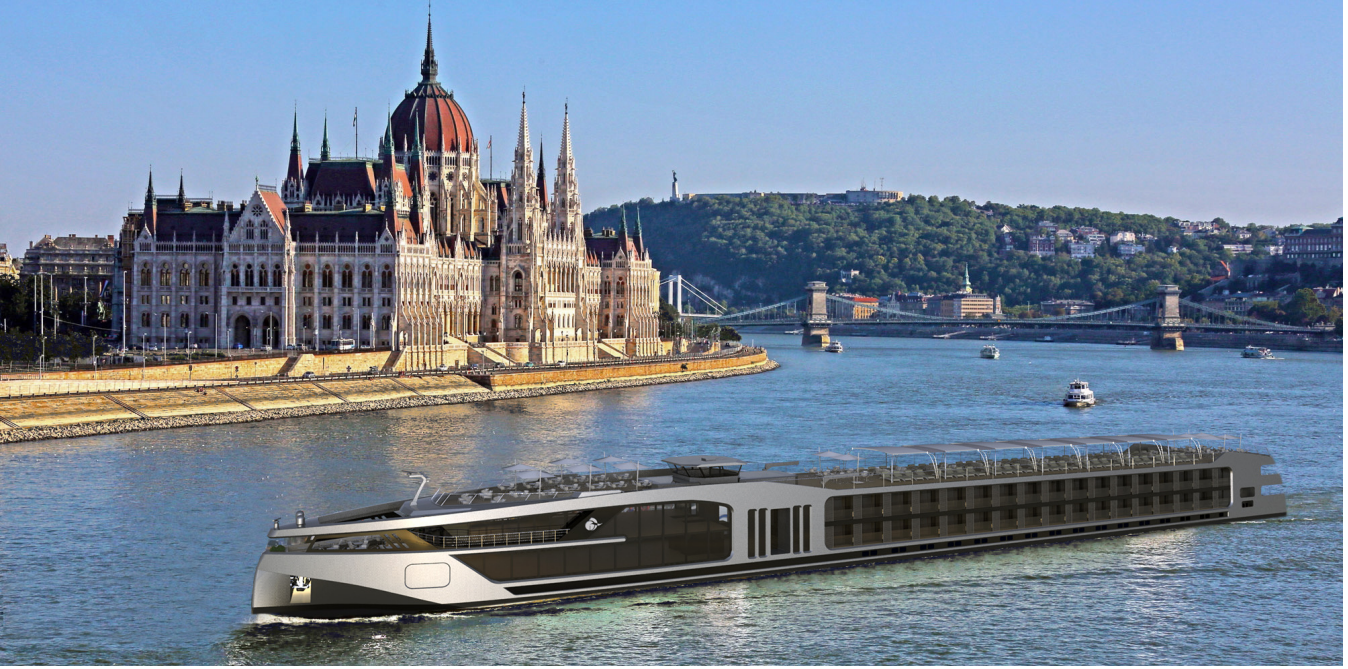
Concordia DAMEN

TANKERS

Concordia DAMEN

PUSHERS

Concordia DAMEN

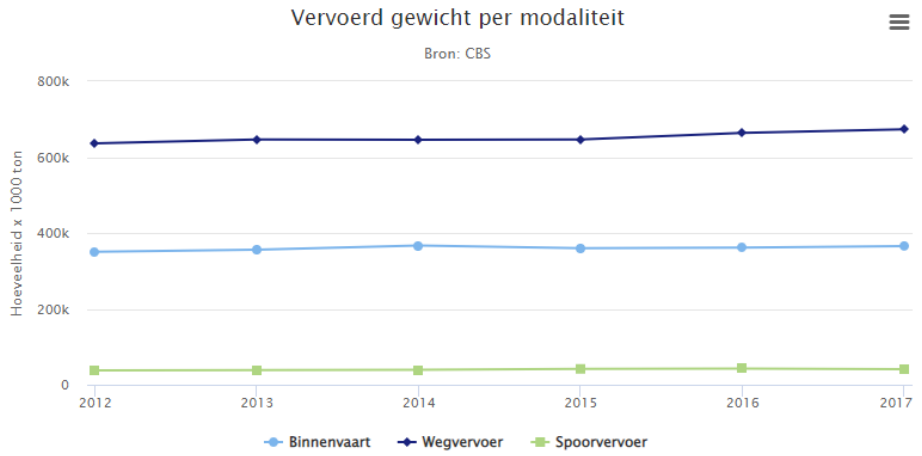


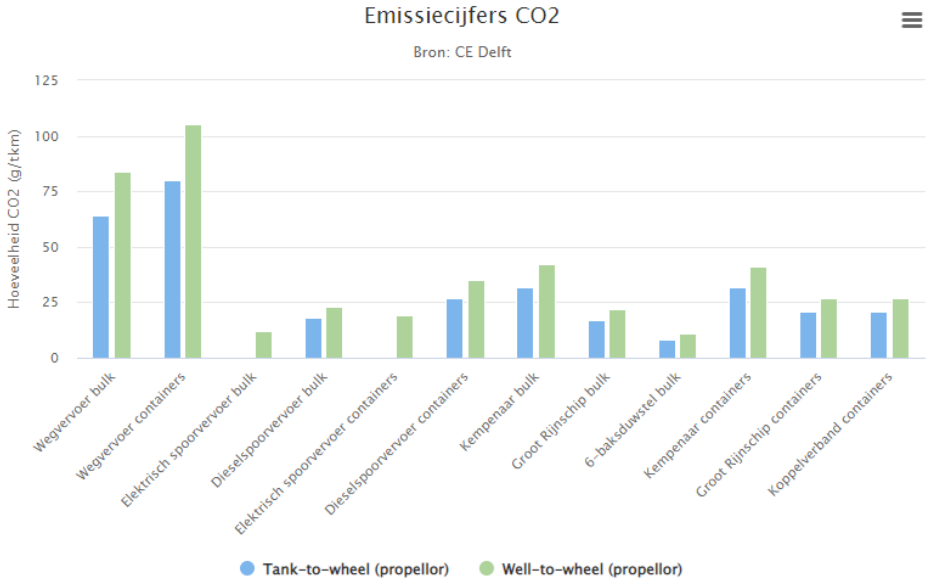
RIVER CRUISE

Concordia DAMEN

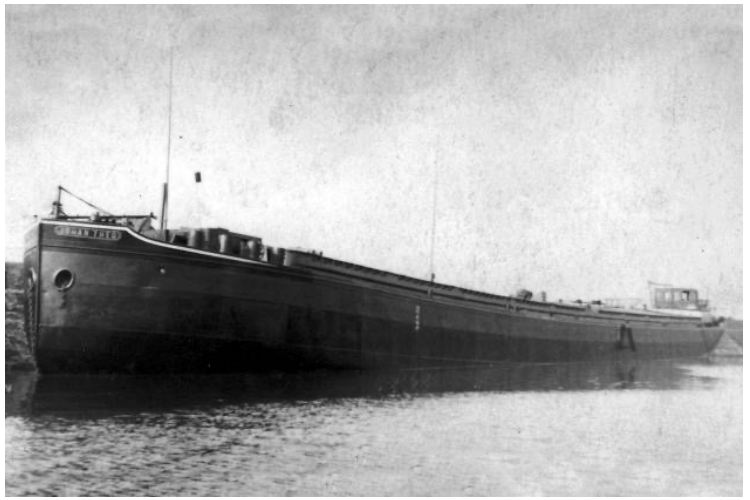
FACTS, FIGURES AND CHALLENGES

- Almost 8.000 inland waterway vessels with NL registration
- Appr. 35% market share of total transported weight
- Most cargo transported by:
  - 4.400 dry cargo ships
  - 1.150 tankers





- What is the real meaning of futureproof or sustainable?
  - Long or short life cycle?
  - 100 years ago



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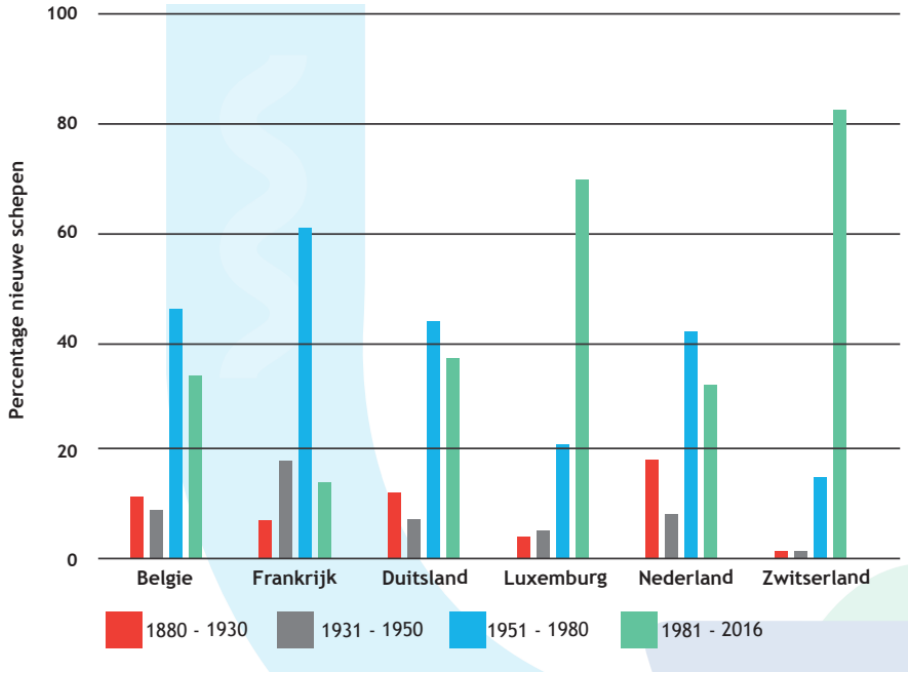
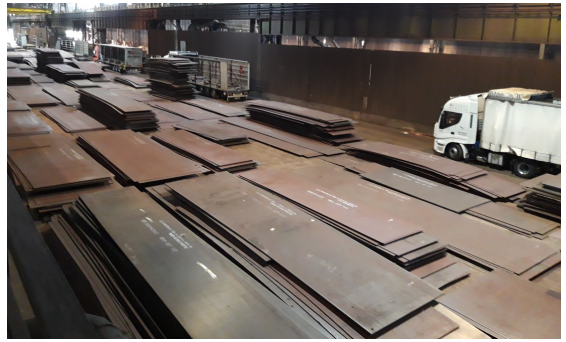
- Same vessel still operational



- What is sustainable? Circularity?
  - 800 ton totall weight
  - 95% steel (or stainless steel, aluminium enz.)
  - 99% recycle



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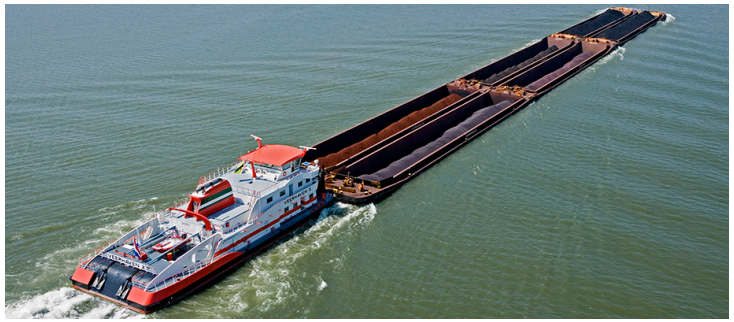
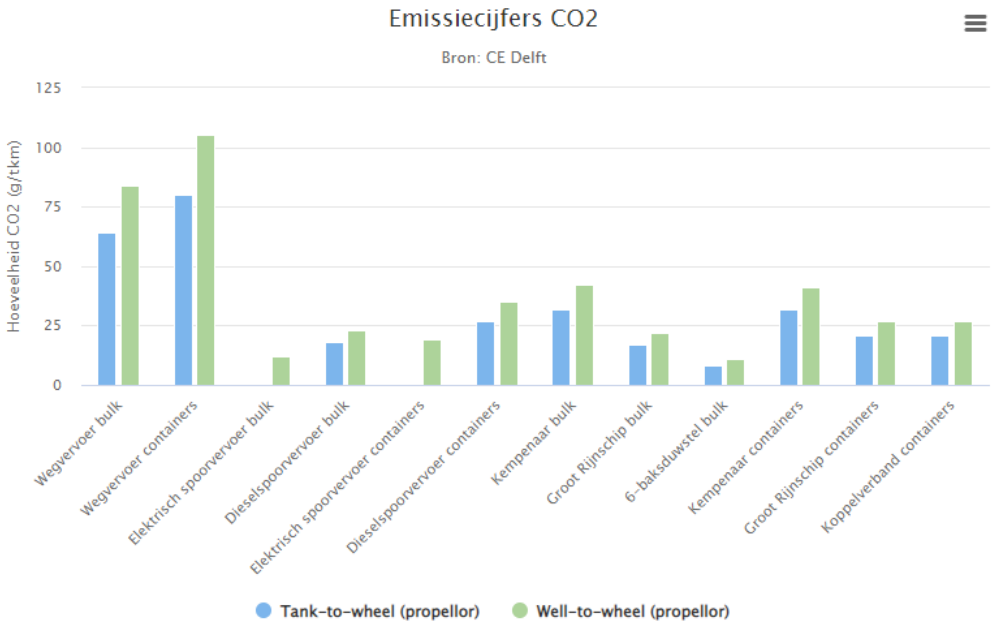
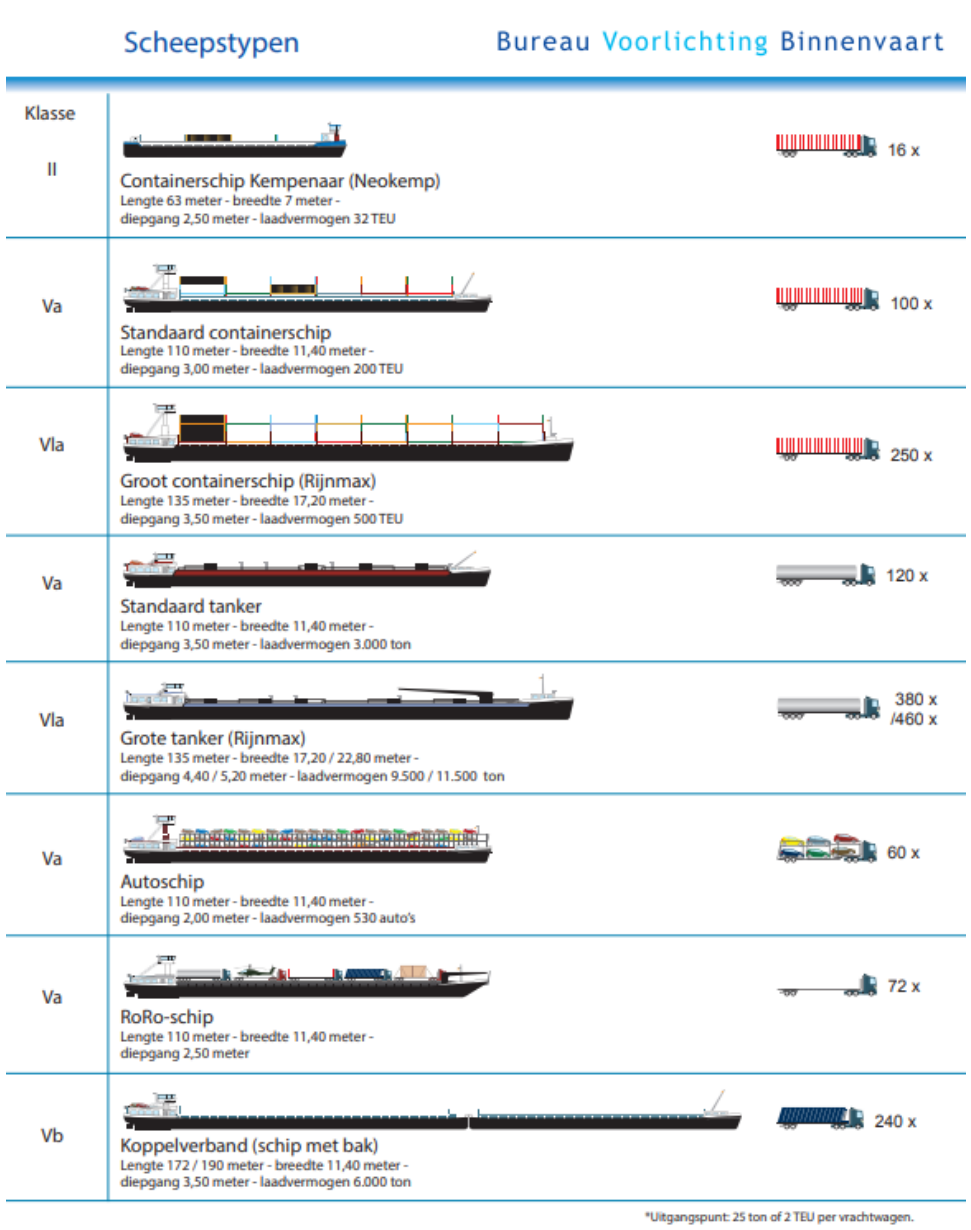


- What is sustainable?
  - Low emission→ CO2
  - 3,5 x less CO2 emissions than trucks





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Future of fuel?

	Supply chain	Storage	Conversion	Ship implementation	Operation
Compressed H2	Available but not green	Complex	PEM: Tests ICE: Tests	Very large Ventilation	Zero-emission with PEM
Liquid H2		Complex		Large Properties unknown	Complex
Ammonia		Safety	Not available (HS)	Safety No rules	Additional safety Some emissions
Methanol		Easy	ICE: Tests	Guidelines available	Additional safety Some emissions
Bio-diesel	Available	Drop-in	Drop-in	Drop-in	Business as usual

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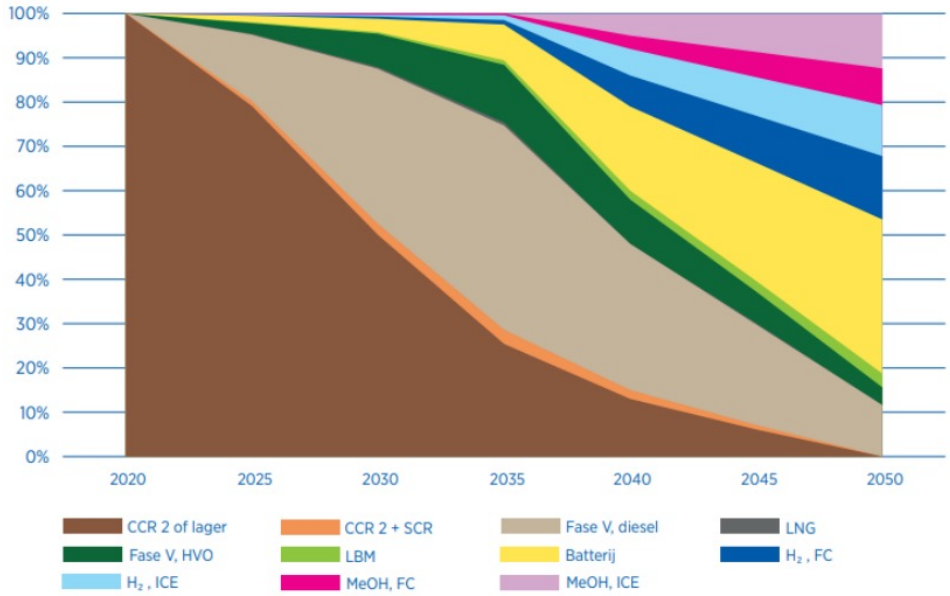
Future of fuel

Afbeelding 8

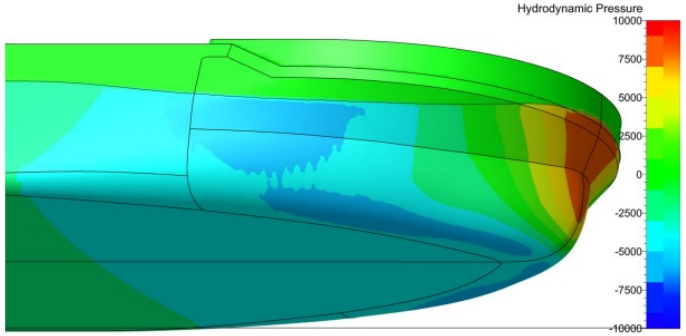
INNOVATIEF TRANSITIETRAJECT: ONTWIKKELING VAN DE TECHNOLOGIEËN TUSSEN NU EN 2050



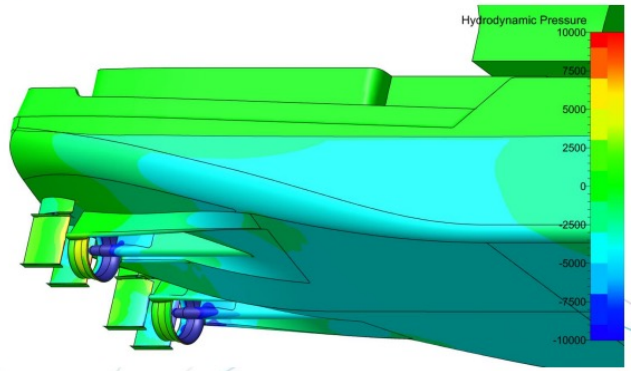
CCR wil report about the progress of the implementation and about the urge to actualise the roadmap around 2025, and will, if necessary, review the roadmap and plan of action around 2030.

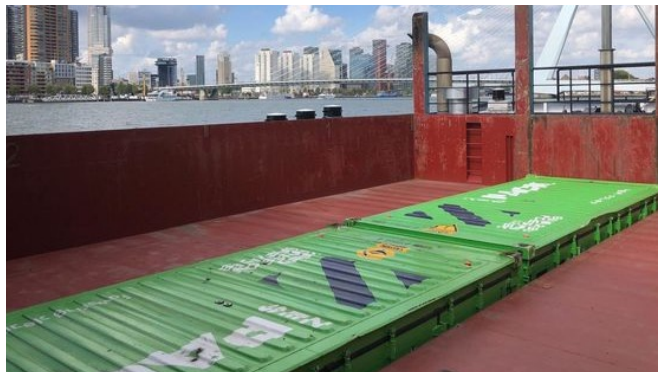
3. SUSTAINABLE FUTURE

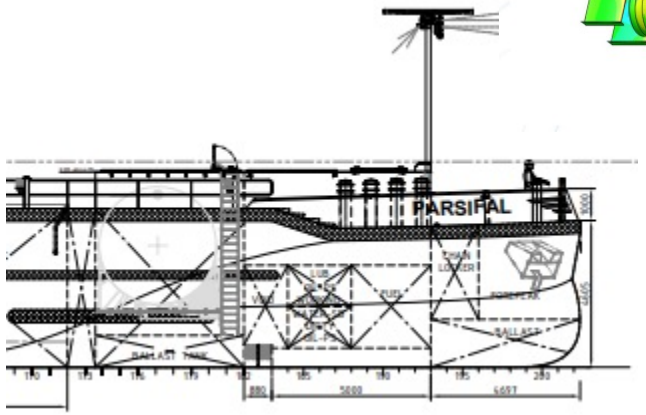
- Optimized hull forms: modulair & efficient
- Lower lightship weights
  - Fit for purpose
  - Modular engine rooms
  - Electric propulsion platform
  - Implementation of future fuels and batteries.’



The stern has its almost undisturbed water line, resulting from little pressure differences. The nozzles show their characteristic low-pressure flares at their front, delivering thrust. The curved nozzle outer surfaces deliver increased pressure, contributing to thrust as well. All together is the stern as intended: calm and nozzles delivering their desired thrust. Counteracting are only the rudders’ leading edges. This is rather inevitable though, since their action during course corrections desire a profile nose capable of handling a variance in angles of attack.



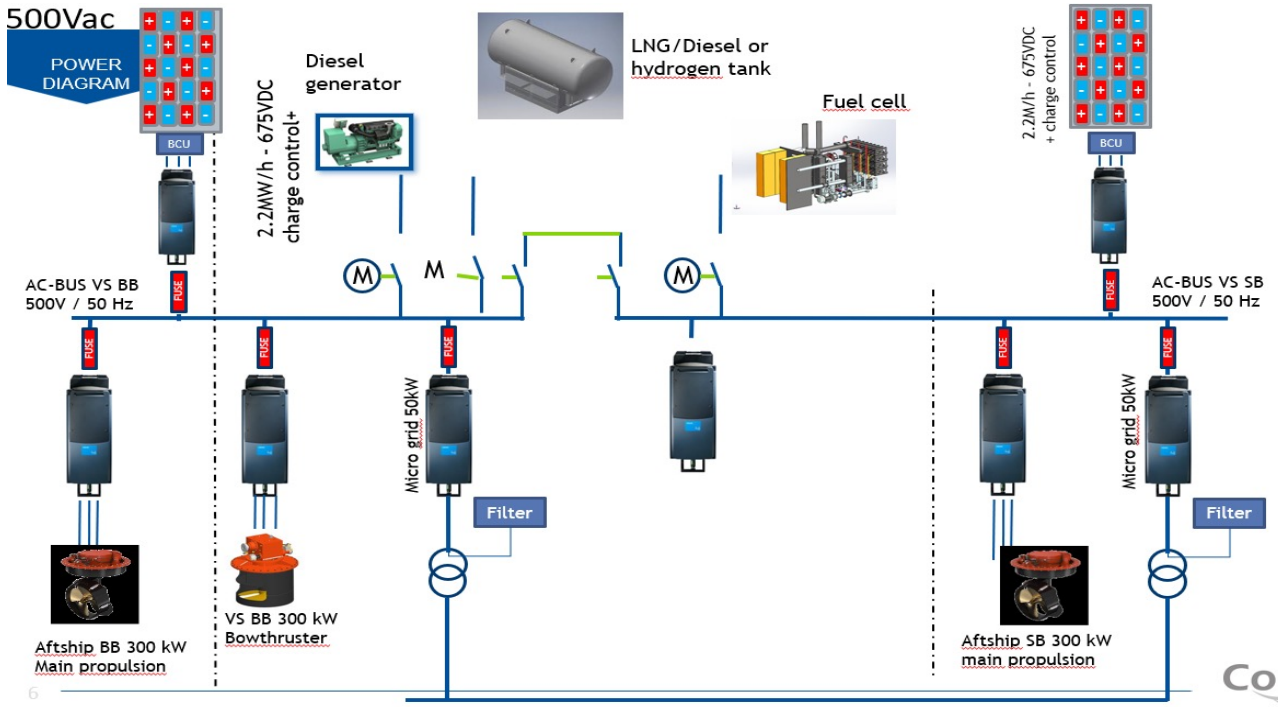




Concordia DAMEN

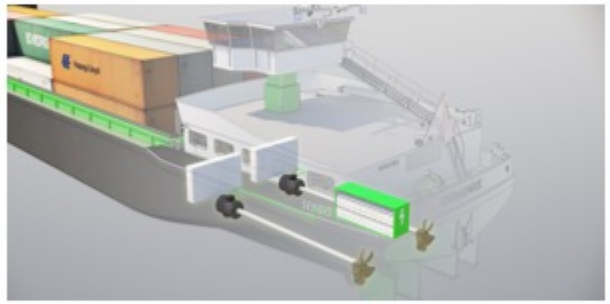
- Electric platform:

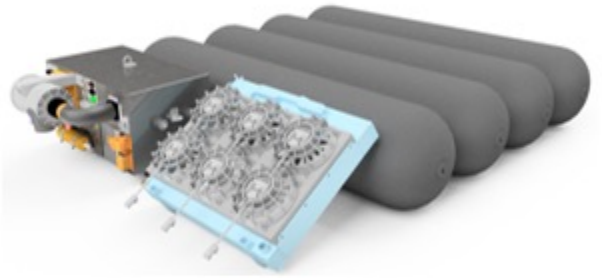
  - Main engines and bowthrusters, all electric
  - Power supply from gensets, batteries, fuel cells or engines powered by alternative fuels
  - Powermanagement systems between power supply and power demand

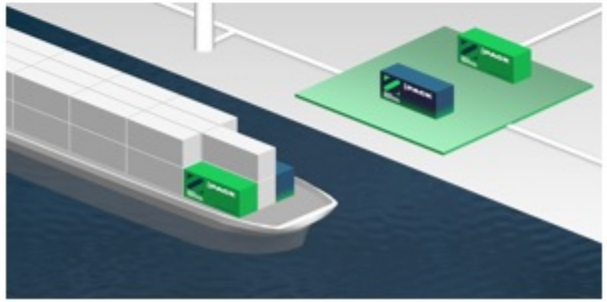
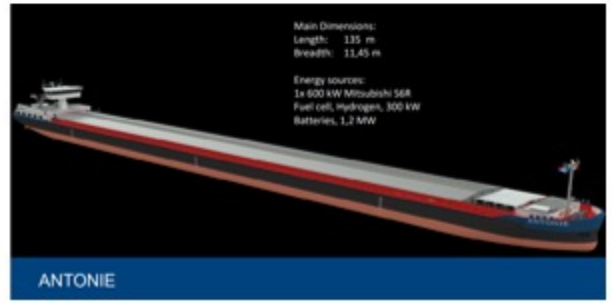


- Main propulsion: Z drives or shaftline, but always E-motor
- Bowthruster: Gride E-motor
- Gensets: Diesel/LNG/Hydrogen in container
- Battery (Option): Battery packages
- Hydrogen or LNG in container
- Fuel cell







4. FUTUREPROOF VESSELS

Concordia DAMEN

Recently delivered

- Sendo Liner (container)
  - Hull optimized
  - Diesel-electric/ low hp
  - 540 kW battery pack (3 hrs zero emission)
  - 30% less fuel consumption per container
- A-Rosa Sena (river cruise)
  - Optimized hull
  - Diesel-electric
  - 1 MW battery pack
  - Emission free overnight / no shore connection needed
  - Lowest emission p/pax
- Antonie (dry cargo/bulk)
  - Diesel combined with:
  - H2 fuel cells (900kw)
  - 1 MW battery pack
  - (almost) zero emission on fixed route Rotterdam - Delfzijl
- Ab Initio (training vessel)
  - Diesel combined with:
  - H2 fuel cells (45kw)
  - 272 KW battery pack
  - 4 hrs emission free
  - Solar panels for hotel load

Concordia DAMEN

THANKS

albatts
Alliance for Batteries Technology, Training and Skills

Electrification of Europe´s Inland Waterways

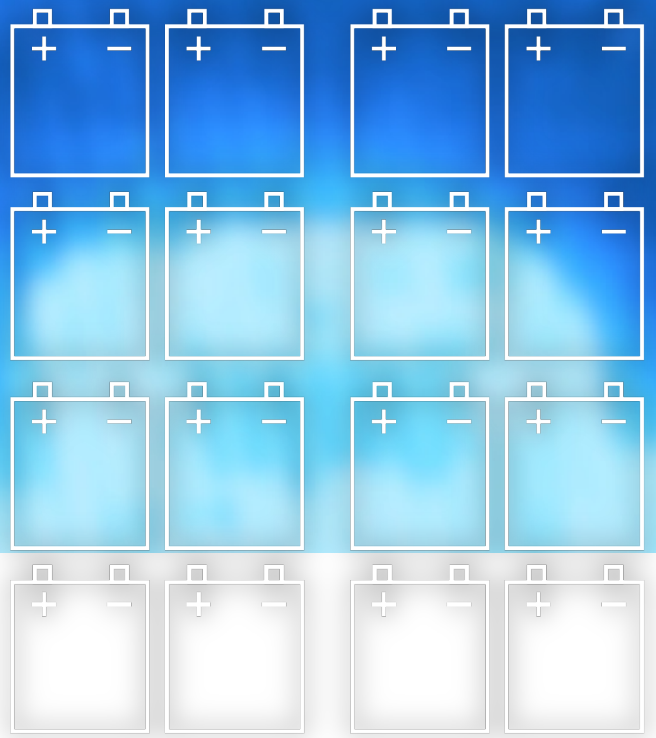
- impact on job roles and skills

©Prague Boats

Bella Bohemia Sightseeing vessel (Prague)

Josefin Klindt, Sales Account Manager, EST-Floattech

EST-Floattech
Intelligent Energy Storage Solutions

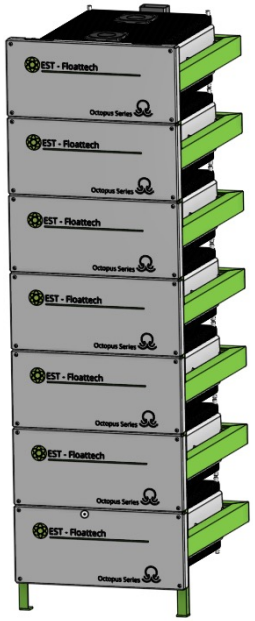


Agenda

- EST-Floattech – Who we are
- Bella Bohemia – Short Facts
- Bella Bohemia – Integration of a battery system - from concept to delivery of an electric sailing boat

EST-Floattech – Who we are

Head Office & Production in Badhoevedorp



EST-Floattech B.V.
Badhoevedorp, the Netherlands

- **Production**
- **Engineering / R&D**
- **Project Management / Service**
- **Sales**
  - **Germany**

- Developing and manufacturing proven DNV-certified Li-NMC modules for high energy and high power maritime applications.
- Battery expert since 10 years with over 200 projects and more than 50 MWh battery capacity installed
- Battery installation on various ship types like passenger vessels, ferries, yachts or coasters
- Customized containerized solutions

EST-Floattech
Intelligent Energy Storage Solutions

Bella Bohemia – Short Facts

- First fully electric catamaran sightseeing vessel in Prague
- Up to 250 seats
- 116 kWh battery capacity for silent and emmission free sailing
- Vessel lenght 25,09m, width 9,60m

©Prague Boats

- Built 2019 at Bolle Shipyard in Derben near Berlin, Germany
- Operated by PRAGUE BOATS s.r.o
- PRAGUE BOATS operates total fleet of 20 boats

EST-Floattech
Intelligent Energy Storage Solutions

Bella Bohemia – Integration of a battery system - from concept to delivery of an electric sailing boat

Questions to be asked:

Power availability in the port for charging stations?

Local Authorities / Ship Owner / Energy Supplier

Does the battery system fit into the planned ship with regard to size, available space and battery weight?

Naval Architect / Shipyard / Design Office

How often does the ship needs to be charged?

Battery Supplier / Ship Owner

Are there any safety measures for passengers and crew to be considered?

Class / Battery Supplier / Consultant

Can the vessel still maneuver in case of malfunction of the battery system?

Class (ES-TRIN) / Battery Supplier / System Supplier

How to transfer the vessel from shipyard in Germany to Prague without charging stations in between?

Shipyard / System Integrator

Better to refit available vessels in the fleet or to go with newbuilds?

Ship Owner / Design Office / System Integrator

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Time for questions!

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Josefin Klindt EST-Floattech Hamburg Office

Happy to assist with further upcoming questions. Contact me on LinkedIN or via j.klindt@est-floattech.com

EST-Floattech
Intelligent Energy Storage Solutions

A system change to power clean inland shipping corridors

ALBATTS Webinar
Michiel Smit – Business Developer

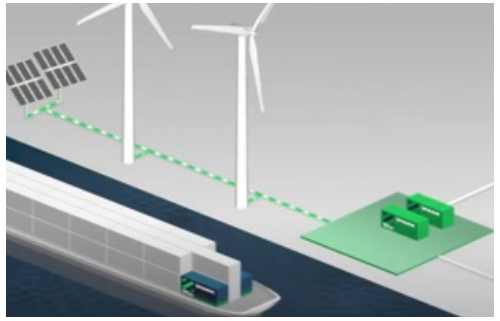
ZERO EMISSION SERVICES

Zero Emission Services

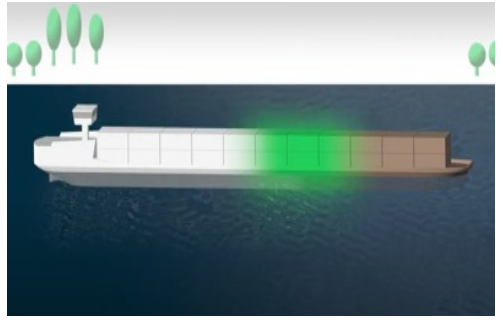
New energy concept for inland shipping

Exchangeable **energy containers**

Charging infrastructure & **grid balancing**



Pay per use business model



Powering clean corridors.

ZESpacks 2.0 – Swappable Modular Energy Containers

- **Zero emission energy**
  Charged with certified renewable energy
- **Future proof**
  LFP Lithium-ion batteries, yet ready for using hydrogen fuel cells or other future energy carriers
- **Open access**
  Standardized open access interface to allow for rapid market adoption
- **Performance**
  1 MW power / 2.9 MWh / 2.6 MWh nominal* energy storage
  Sufficient for a range of 60 - 90 km per ZESpack
- **Safety**
  Lloyds Register - Approval in Principal (AiP)
- **Mobile / modular**
  Designed for maritime applications (including shocks / vibrations)
- **Asset standardization**
  MCS connector for vessel and docking station

1st ZESpack deliverd on June 17 2021

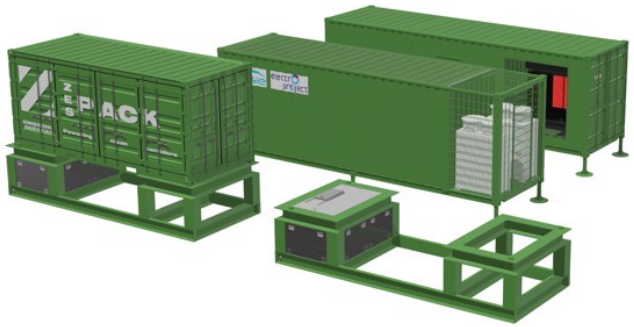
* 2.6 MWh is comparable with 43 Tesla's with a 60kWh nominal battery

Powering clean corridors.

First docking station operational in CCT Alpherium, Alphen a/d Rijn

Docking station 1.0

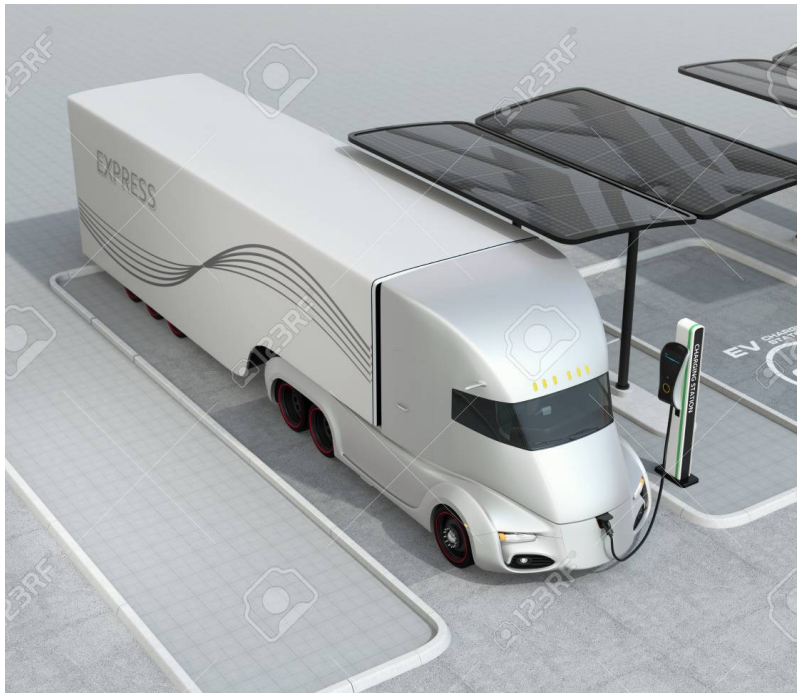
- Double (parallel) charging @ 1 MW
- 2 x ZESPacks charge in 2.5 hours
- Total area required 15 x 25 m



Docking station 2.0 in development

- **Hub**: Energy and transport converge at ZES charging stations: trucks, electric reach stackers and other modalities also have access to sustainable energy.
- **Grid stabilization**: Charging infrastructure combined with ZESpacks can support the energy grid.

Energy hub opportunities



Locally produced

Locally used

Reduced fuel & emissions jan-nov '22

- 176k l MGO
- 223 t CO2
- 7 t NOx

The Alphenaar

- LOA 90 m
- Breadth 10.5 m
- Capacity 104 TEU

- Main engine Oswald 2x544hp
- Bow thruster Veth-Jet 1x650hp

- Built in 2019
- Owner/operator CCT Moerdijk

- Sails daily, electrically as of 4 September 2021 between Alphen a/d Rijn and Moerdijk

- Uses 1 ZESpack one way, so 2 ZESpacks for a roundtrip

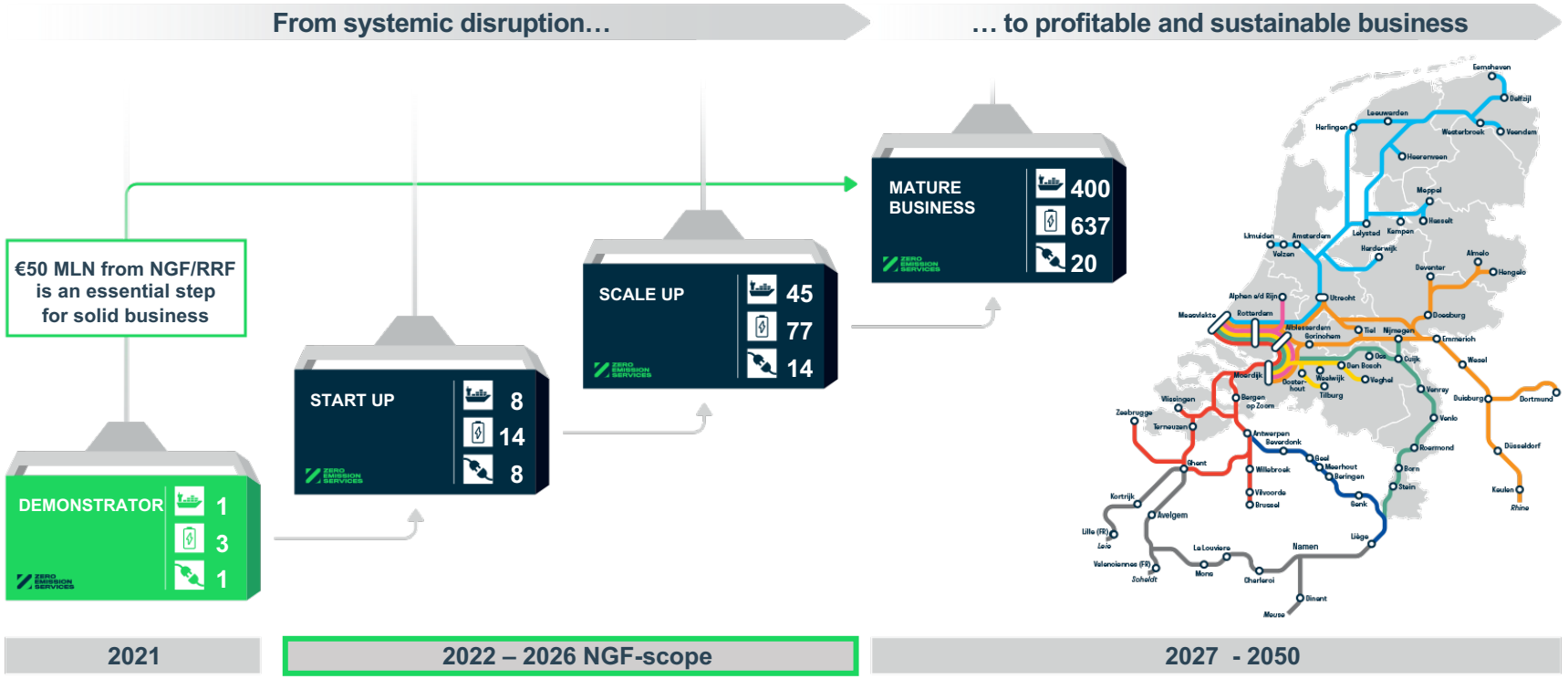
From systemic disruption to mature business

Nationaal Groeifonds subsidy

- 50 Mln to develop docking stations, batteries and electrification of vessels
- 16,5 Mln allocated for retrofitting and building new vessels to sail electric
- Subsidy covers 40-60% CAPEX investment directly related to sailing with ZESpacks

Development partners

- Fleet- & vessel owners
- Freight owners, terminals & forwarders
- Local- government support
- Grid operators



2021	2023	2024	2025	2026
Alphen a/d Rijn	Rotterdam	Amsterdam	…	…
	Alblasserdam	Maasvlakte	…	…
	Moerdijk	Nijmegen	…	…
	Den Bosch	Bergambacht		

Powering clean corridors.

Gamechangers necessary to achieve a systemic change

A few thoughts on what we believe to be gamechangers…

POLITICAL & CORPORATE INFLUENCE

- Rules & regulations stimulating transition
- National & European CAPEX/ OPEX subsidies
- Voluntary & regolatory emission markets
- Improving grid connections & energy contracts
- Willingness to pay the premium
- Being frontrunners & accepting lower returns
- ESG reporting with committed action
- Building consortiums, even with competitors

SKILLS & COMPETENCIES

- Never to old to learn & participate!
- Aspiration, drive & motivation to lead a change
- Practical & theoretical education & experience
- Hands-on engineering & servicing skills
- IT, cybersecurity & programming skills
- Impact-, lifecycles- & circularity assessments
- Thinking process innovation instead of old habits
- Thinking modular & system design

Scan the QR code for information, or send an email
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