


TODAY

1. **Introduction to SEABAT:** Why are we here, What did we learn 10 - 11



2. **Key technology:** Power Electronics, Software and Prototype 11:30 - 12:30



3. **Demo-Tour:** Manufacturing, Safety, Testing, Sizing and Integration +  13:15 - 15

4. **Networking:** Meet the experts +  15 - 16

5. **The future:** Road to Market and Panel Discussion 16 - 17

6. **Closing:** Networking +  17 - 18



SEABAT

SOLUTIONS FOR LARGE BATTERIES FOR WATERBORNE TRANSPORT

GA NO: 963560

ROAD TO MARKET

SEABAT FINAL EVENT

AFTERNOON SESSION

IMPACT



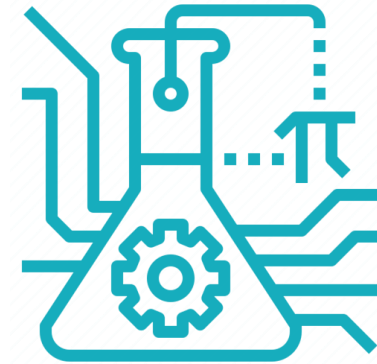
Lifetime cost

- TCO -15 à 60%
- Weight - 0 à 15%
- Volume + 0 à 10%



Future proof

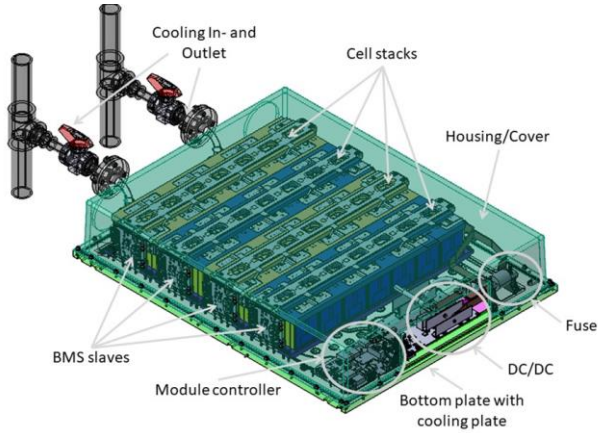
- Scalable
- Optimizable
- Emissions - 0 à 15%



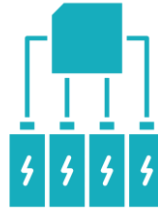
Proven technology

- Simulated
- Built
- Tested

A COST-OPTIMAL MARITIME BATTERY



Modular



Hybrid battery



Optimized

... HOW TO START BOARDING?



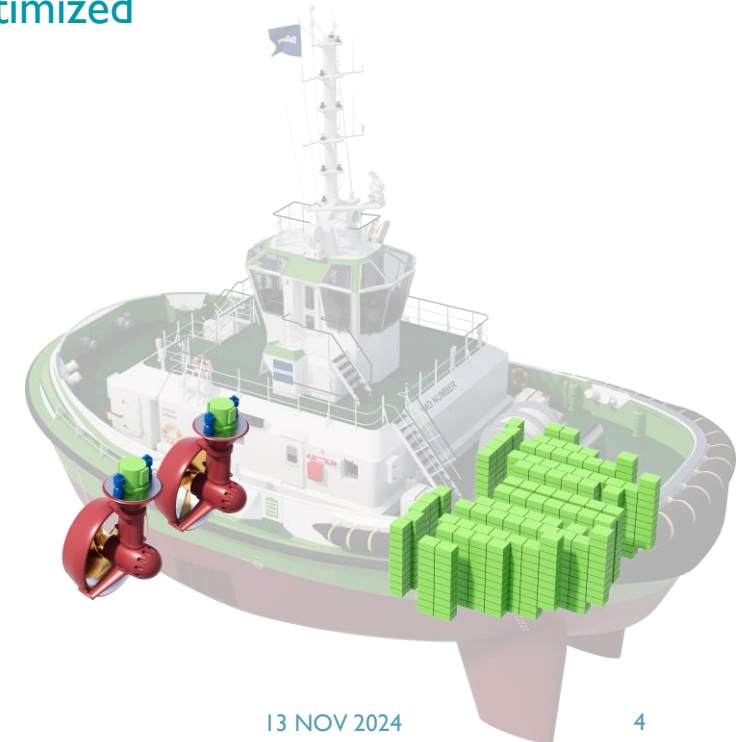
Value



Market



Next steps



ADDED VALUE



A modular and hybrid battery solution



Targeted vessel types



CAPEX & Footprint



Operational cost & efficiency

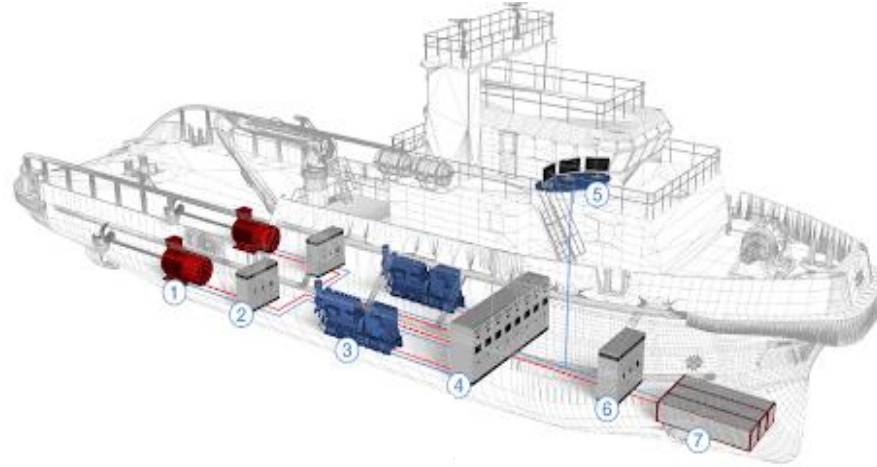


Re-Use in engineering & commissioning



Repair & Maintenance

NUMBERS ON THE E-TUG – SIGNIFICANT TCO REDUCTION



CAPEX & Footprint

-28%



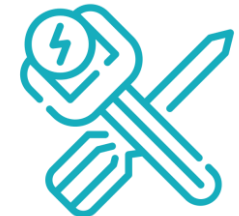
Operational cost
& efficiency

-26%



Re-Use in engineering
& commissioning

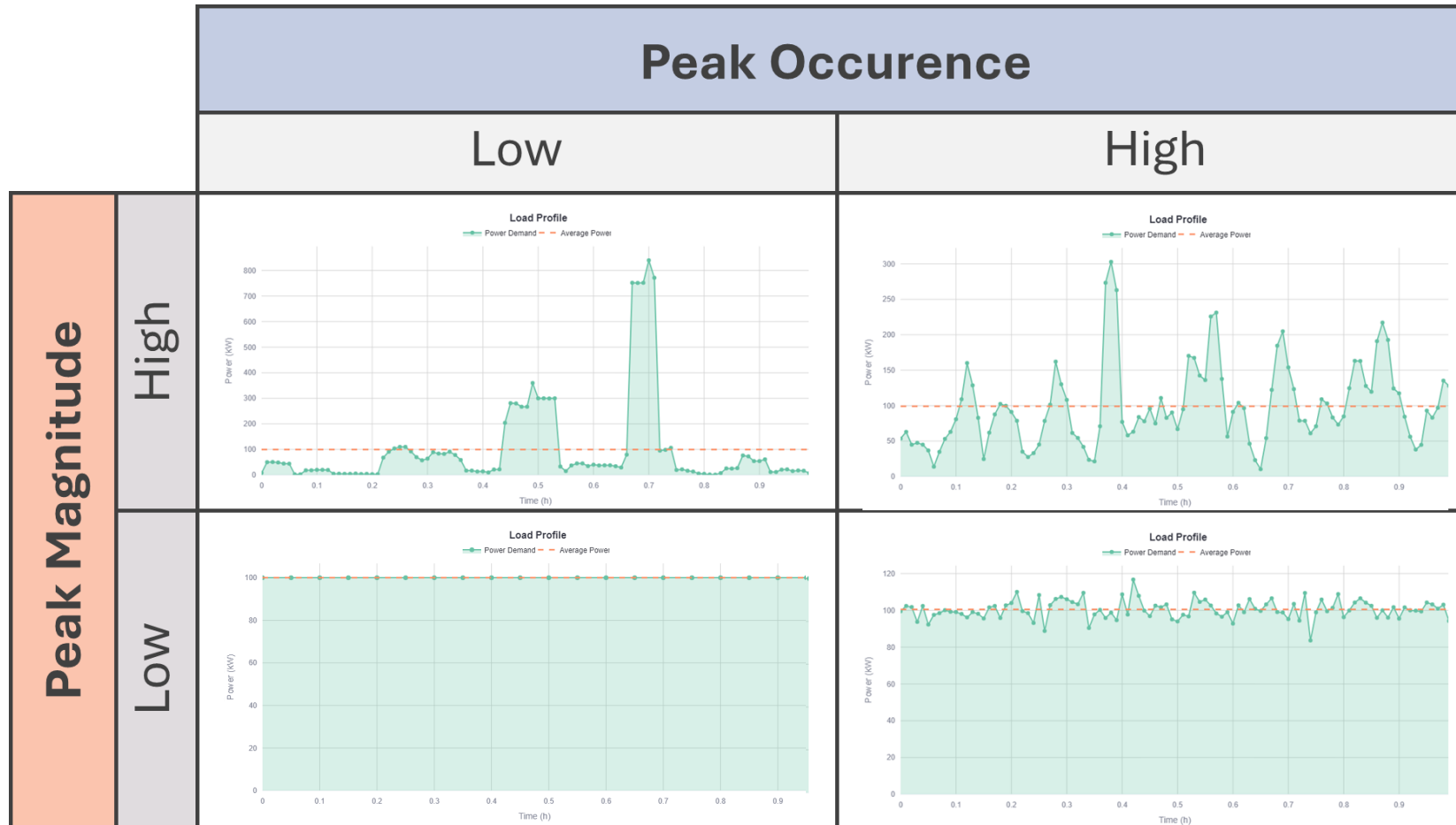
-15%



Repair & Maintenance

w/o downtime

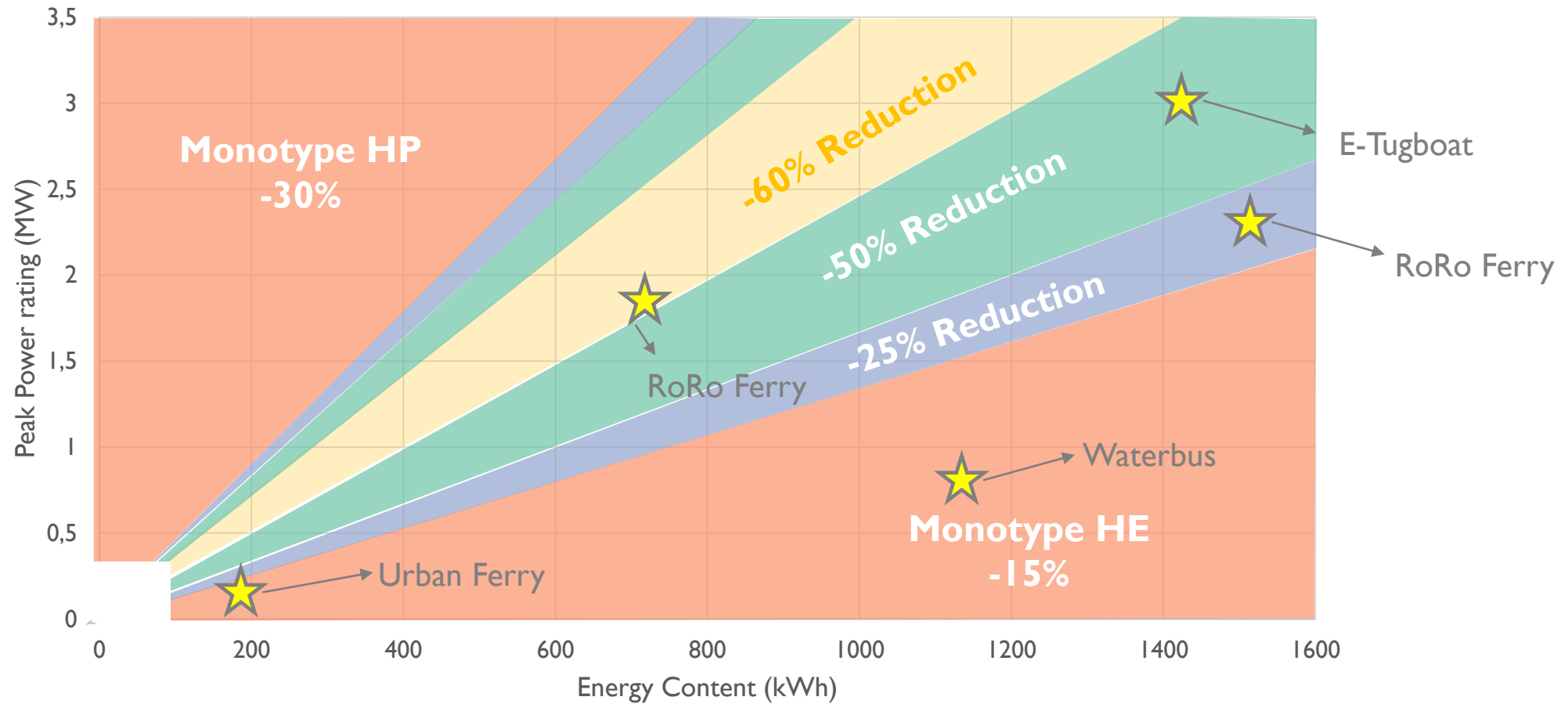
... AND IT'S SCALABLE FOR ANY LOAD PROFILE



VALUE OF HYBRIDIZATION & MODULARITY



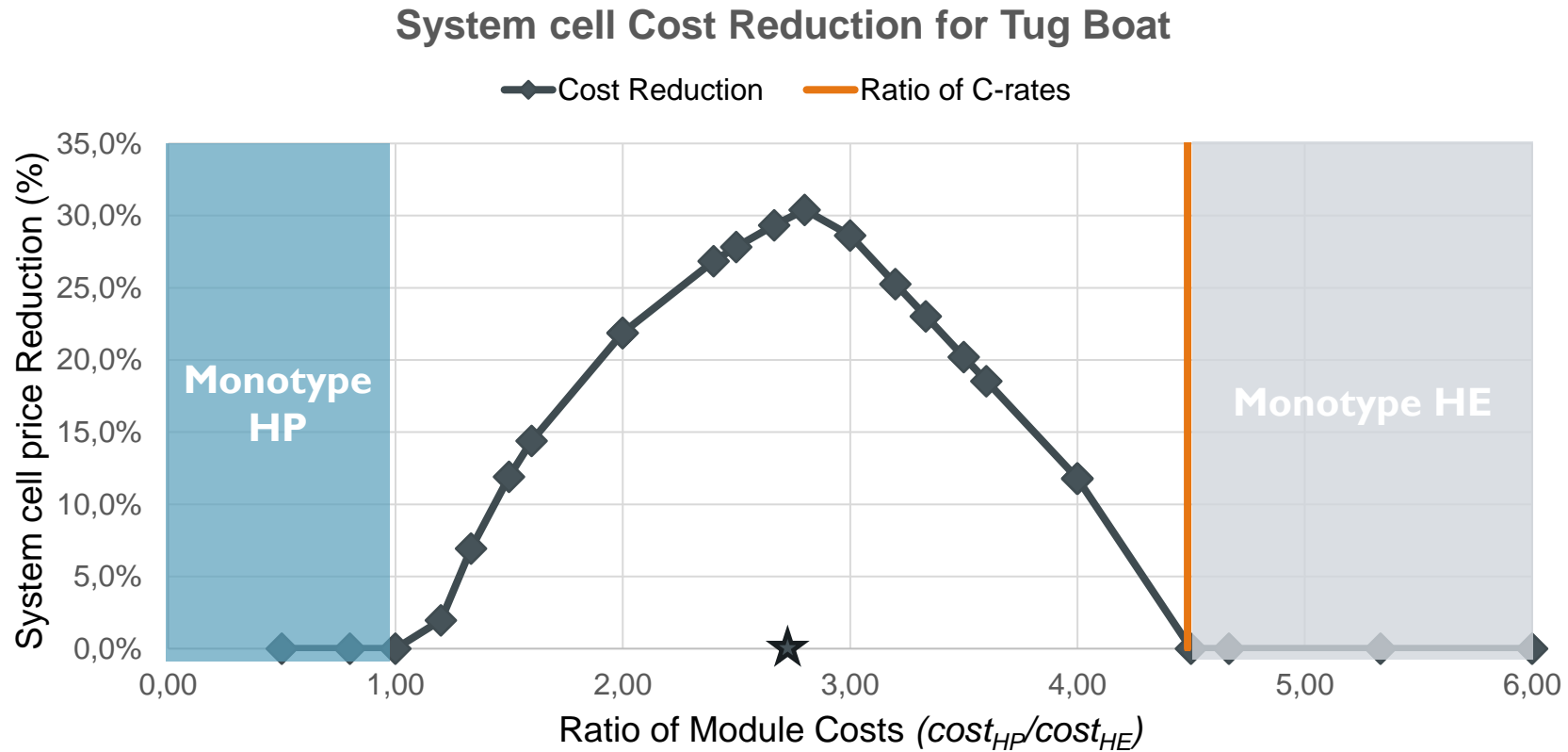
TCO Cost Reduction with Hybrid ESS



RESILIENCE TOWARDS CELL PRICING



- Impact of battery cell prices HP over HE cell price ratio

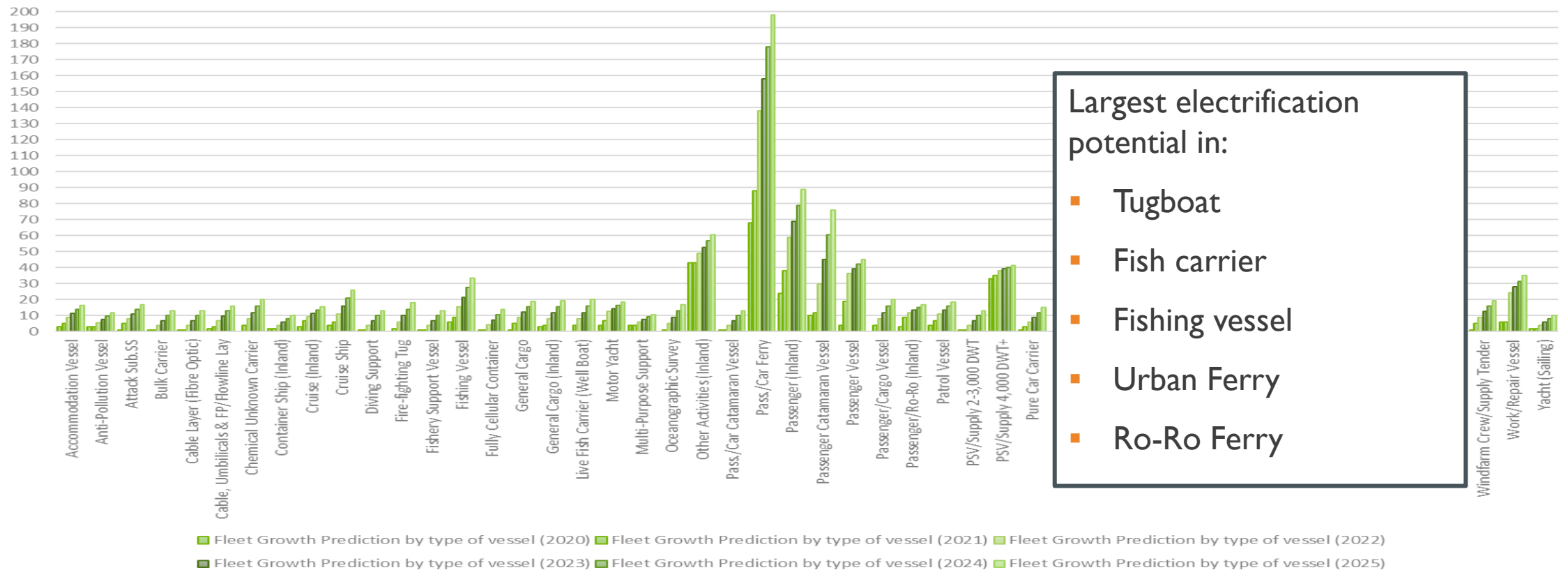


BATTERY POWERED SHIPS

Analysis of ships equipped with batteries from different data sets and prediction of growth potential



Fleet Growth Prediction per type of vessel from 2021 to 2025



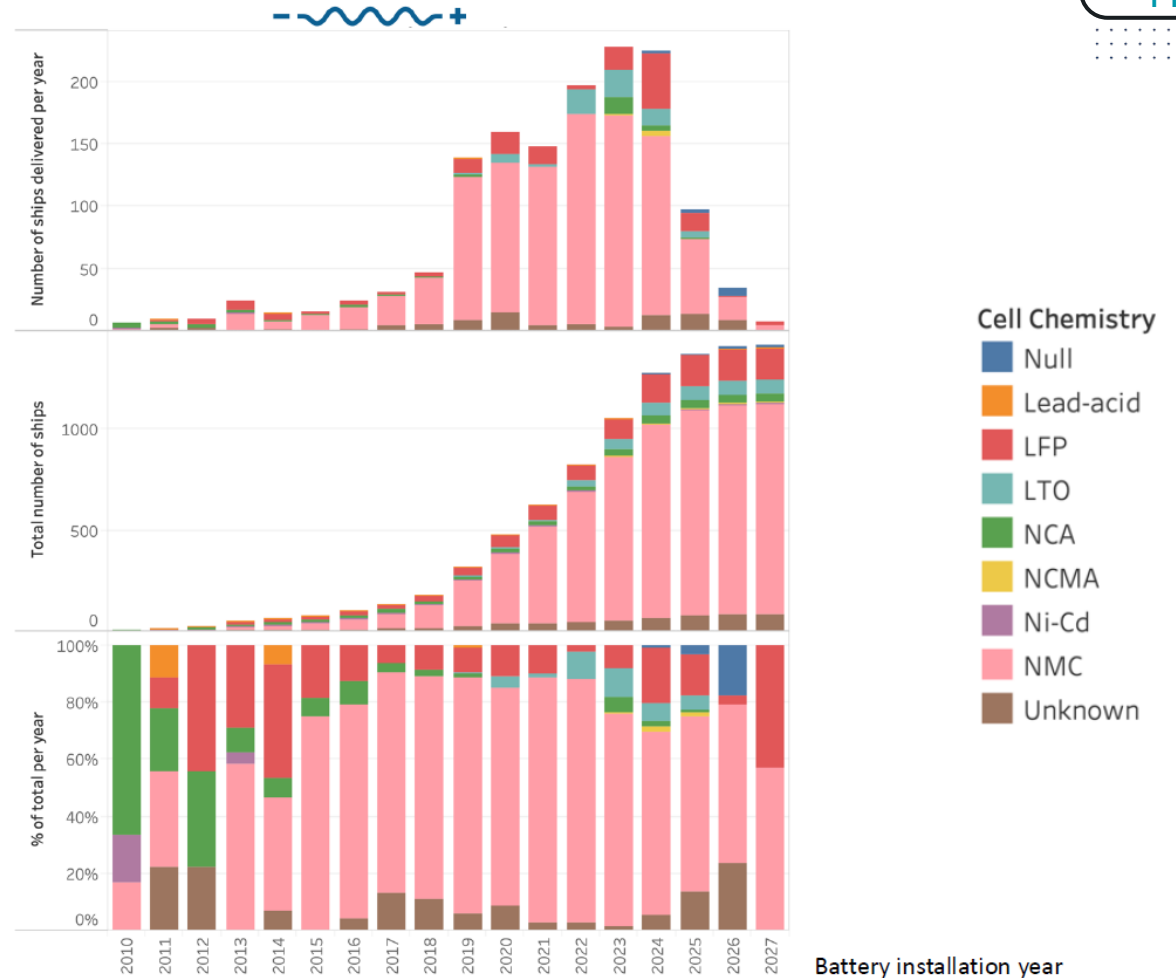
MARKET INFO ON REGISTERED INSTALLATIONS



Reference: Maritime Battery Forum

YoY double digit growth

NMC and LFP dominant



MARKET INFO ON REGISTERED INSTALLATIONS

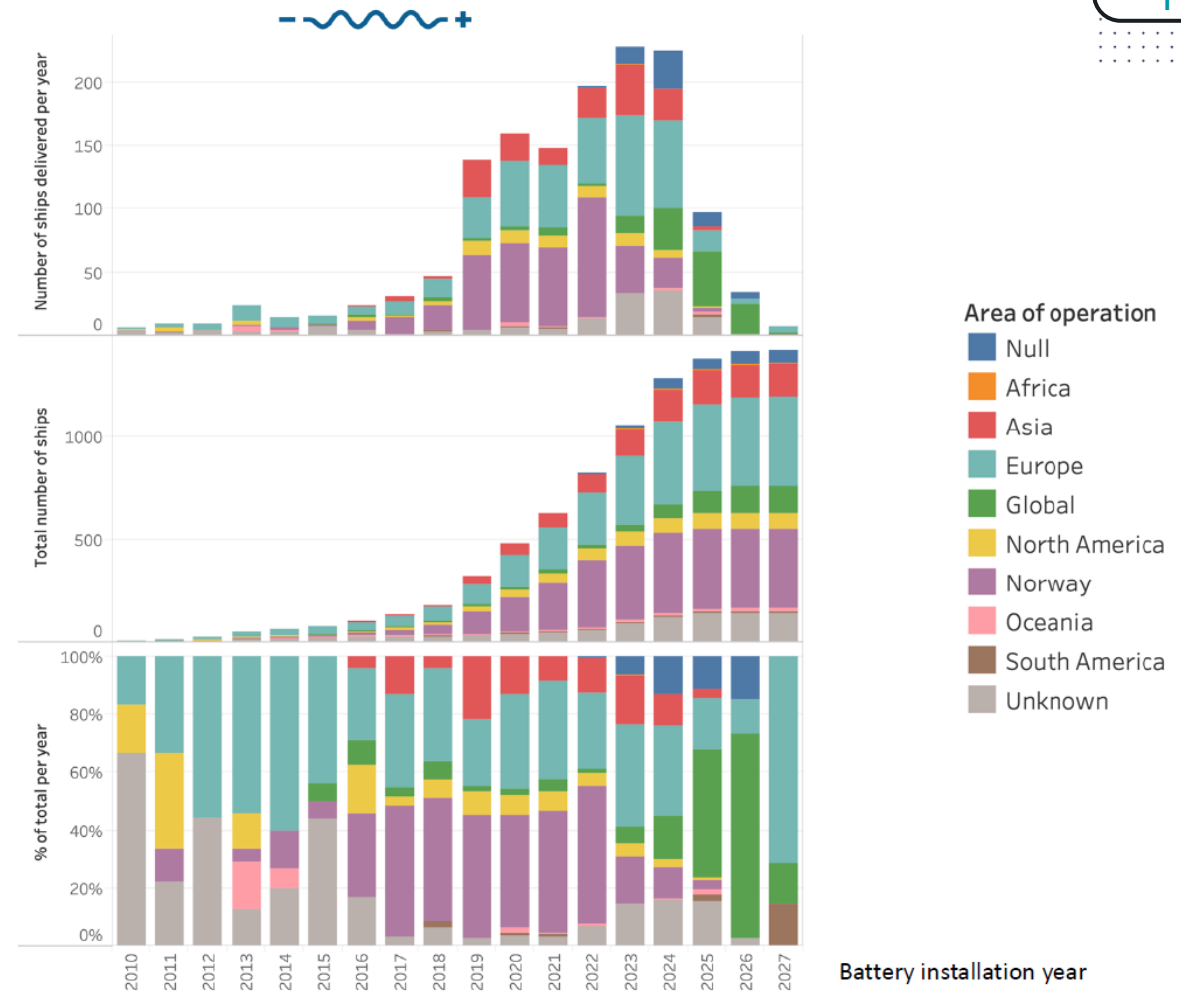


Reference: Maritime Battery Forum

YoY double digit growth

NMC and LFP dominant

>50% is Norway and Europe

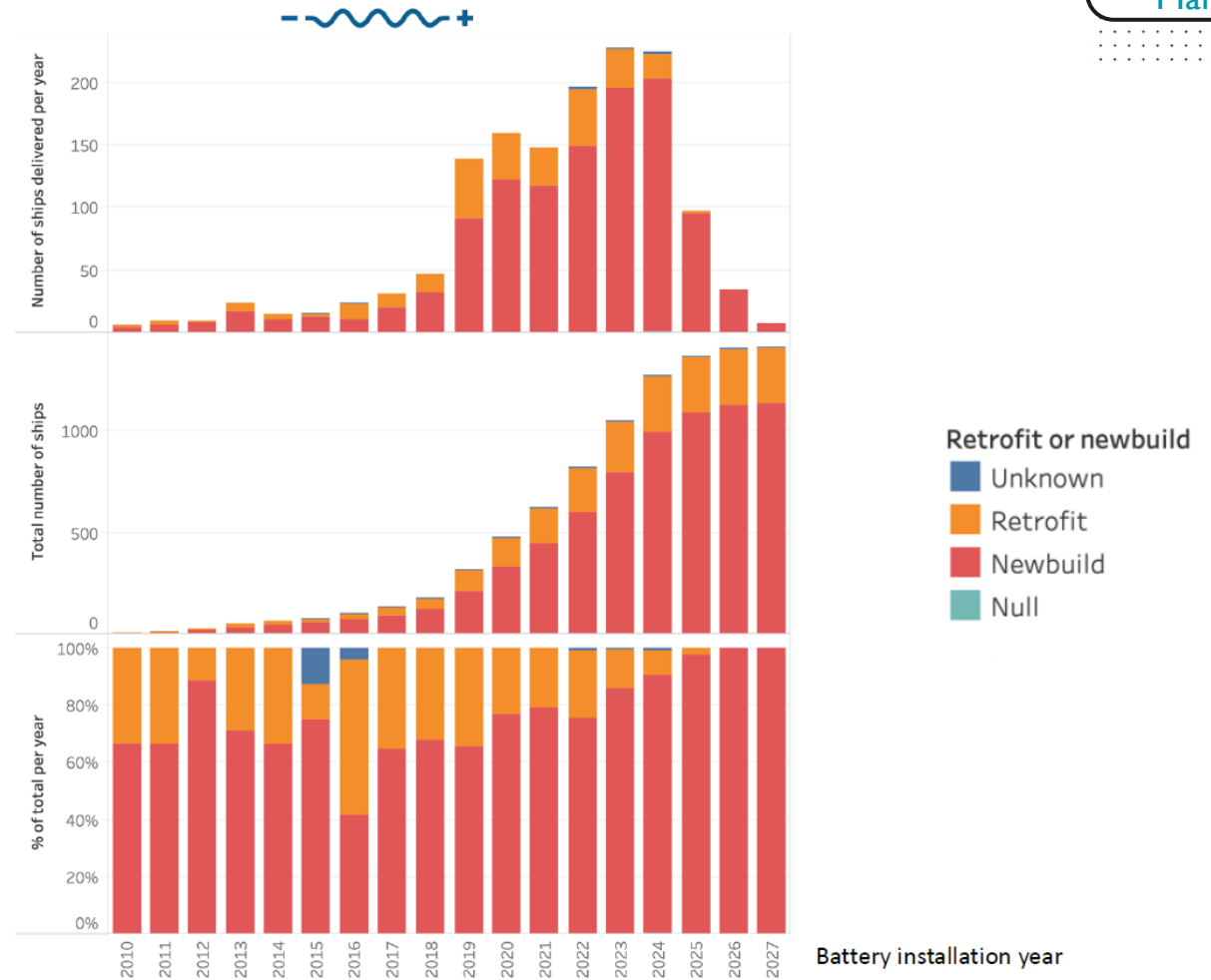


MARKET INFO ON REGISTERED INSTALLATIONS



Reference: Maritime Battery Forum

- YoY double digit growth
- NMC and LFP dominant
- >50% is Norway and Europe
- 20-80 split Retrofit and new build



ADDRESSABLE MARKET



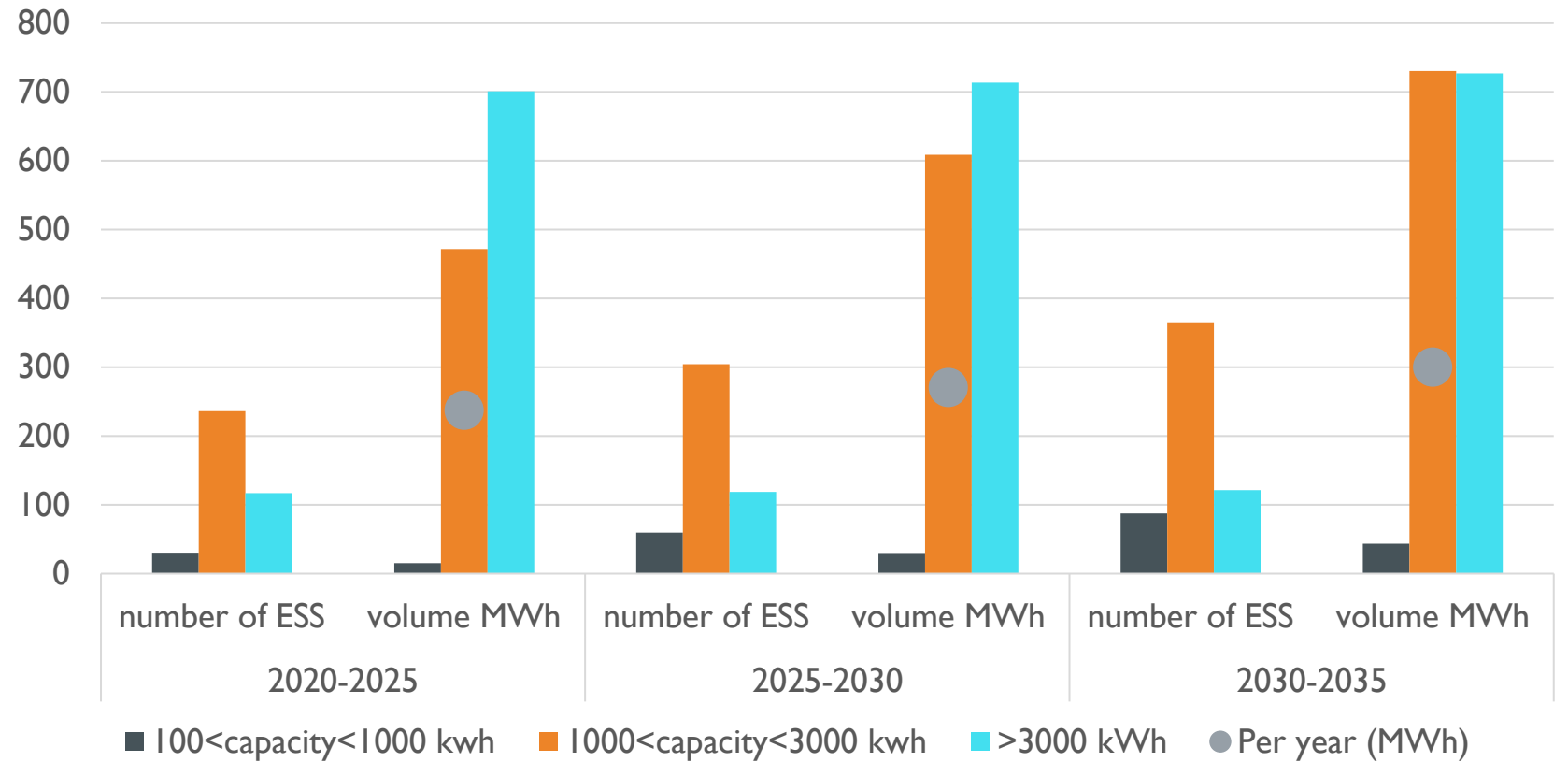
YoY market size 238 – 300 MWh

Average installation size grows from 3 to 4MWh

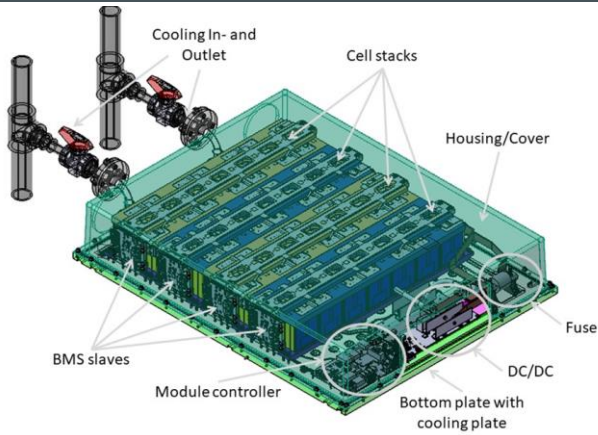
> 120 mio€ market

Few players on the market

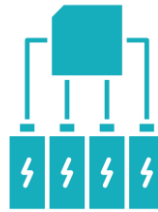
AVG - Market share of ESS - Forecast
n° of ships vs MWh



A COST-OPTIMAL BATTERY SYSTEM



Modular



Hybrid battery



Optimized

... HOW TO START BOARDING?



Value

TCO Reduction > 25%



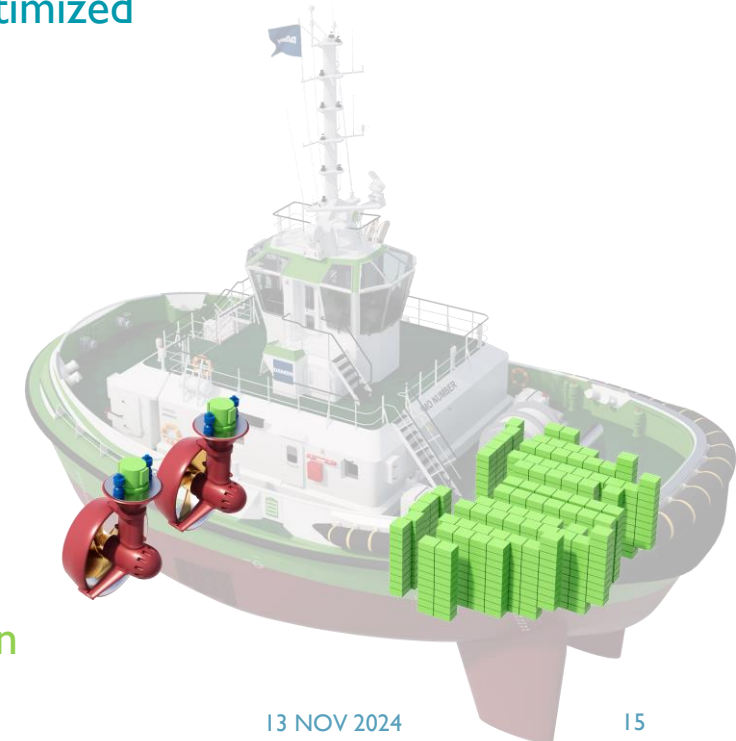
Market

> 120 mio€ yearly
> 10% growth YoY



Next steps

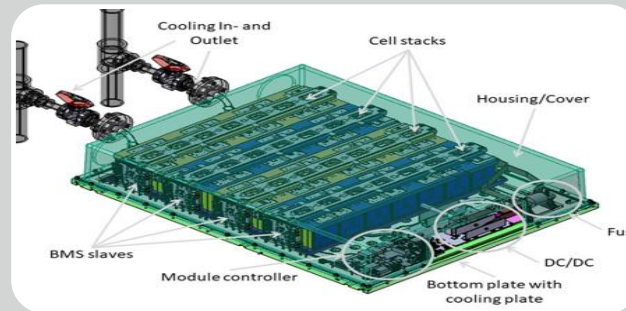
Increase TRL
Path to market introduction



WHAT'S AHEAD



→ Increase to TRL 7-8 on module level



Module design

- Volumetric and gravimetric density
- Robustness of HW design (EMI, vibration, ...)
- Controls diagnostics
- EMS function integration

Industrialization

(to > 1k units/ year)

- Manufacturability (housing, cooling,...)
- Further automation
- Investment in production tooling

WHAT'S AHEAD



→ Increase to TRL 7-8 on Battery system level

- Pilot actual sea-going application
 - HESS integration
 - Electrically
 - Thermally
 - Mechanically
 - Validation commissioning trajectory
 - Battery room
 - Certification trajectory
 - DC-bus and EMS integration



WHAT'S AHEAD



→ Let's work together

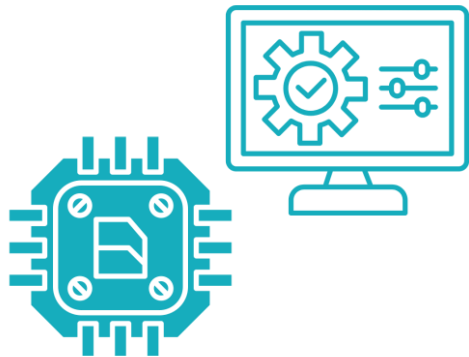


Maritime Electrification
Ecosystem



End Users

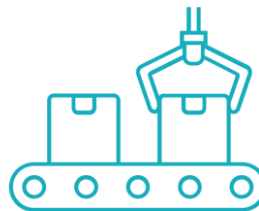
High power
High energy



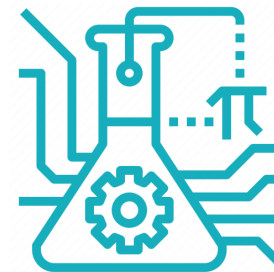
Technology providers



Integration



Manufacturing



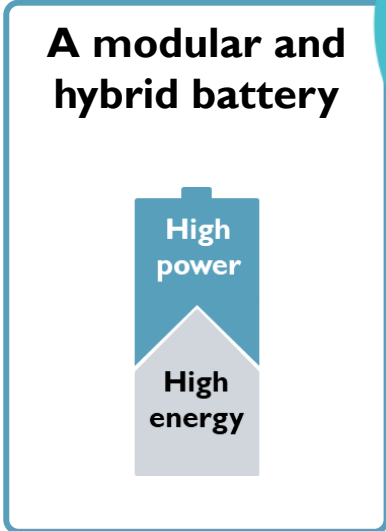
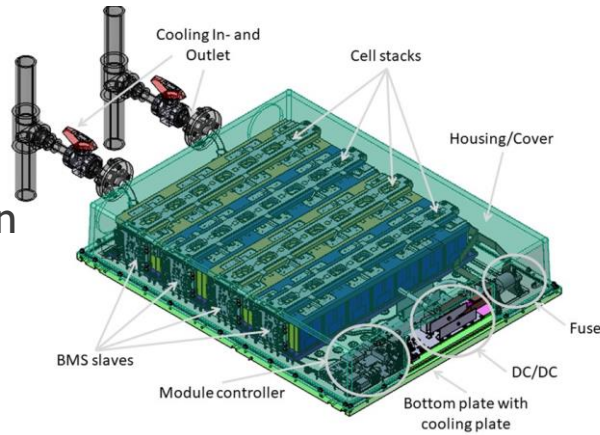
Testing



Certification &
type approval

WHAT'S AHEAD TO START BOARDING

- Sound economic basis
- Plan towards TRL 7-8 & Industrialization
- Pilot actual sea-going application
 - Certification trajectory
 - Full integration
- Project definition with Eco-System



PANEL DISCUSSION

➔ What are the next steps for maritime battery systems?

Technology provider



Jeroen Stuyts

Manufacturing



Deniz Süzen

Integration



Andrea Colavitto

Shipyard



Andreas Hjellbakk

Certification



Pieter Van Den Ouden

