CURRENT DIRECT

SEA BAT

SUSTAINABLE ENERGY DAY ORGANISERS

TOWARDS 2030: RESHAPING THE EUROPEAN ENERGY SYSTEM

#EUSEW2021

SUSTAINABLE ENERGY WEEK

EUSEW.EU
EUENERGYWEEK
@EUENERGYWEEK

TWO INNOVATIVE SOLUTIONS TO REDUCE THE COST OF LARGE BATTERIES FOR WATERBORNE TRANSPORT

JOINT WEBINAR H2020 FUNDED PROJECTS: CURRENT DIRECT & SEABAT

SUSTAINABLE ENERGY WEEK

SUSTAINABLE ENERGY DAY ORGANISERS
TOWARDS 2030: RESHAPING THE EUROPEAN ENERGY SYSTEM
#EUSEW2021

AGENDA

01 H2020 LC-BAT-11-2020: Reducing the cost of large batteries for waterborne transport

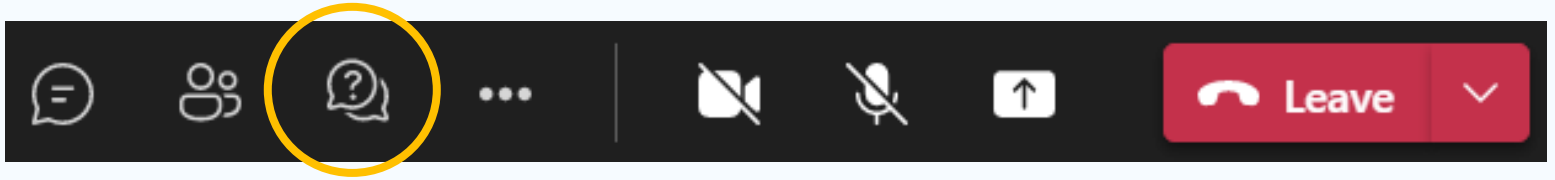
Call introduction and underpinning rational

02 Current Direct & SEABAT projects

Solutions towards the electrification of the European waterborne transport sector

03 Roundtable and Q&A session

Q&A



Peter Crawley
EC: Policy Officer

01 H2020 LC-BAT-11-2020: Reducing the cost of large batteries for waterborne transport

SUSTAINABLE ENERGY WEEK

SUSTAINABLE ENERGY DAY ORGANISERS
TOWARDS 2030: RESHAPING THE EUROPEAN ENERGY SYSTEM
#EUSEW2021

Context:

LC-BAT-11-2020

“Reducing the cost of large batteries for waterborne transport”

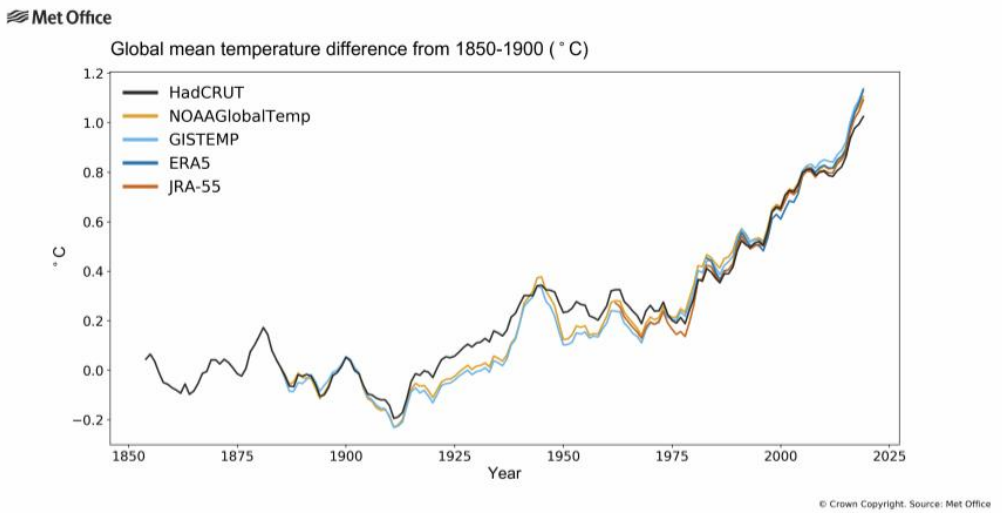
Peter Crawley (DG RTD)
Policy Officer Waterborne Transport
Unit D3 Low Emission Future Industries

Challenge

European Commission

WORLD METEOROLOGICAL ORGANIZATION

The world is heating!



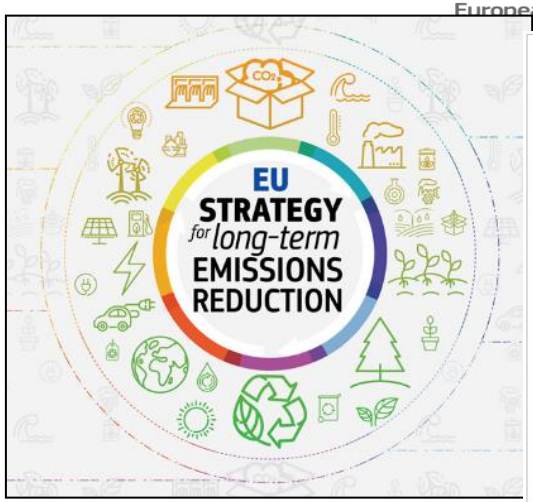
Five-year running average of global temperature anomalies (relative to pre-industrial) from 1854 to 2019 for five data sets: HadCRUT.4.6.0.0, NOAAGlobalTemp v5, GISTEMP v4, ERA5, and JRA-55. Data for 2019 to June

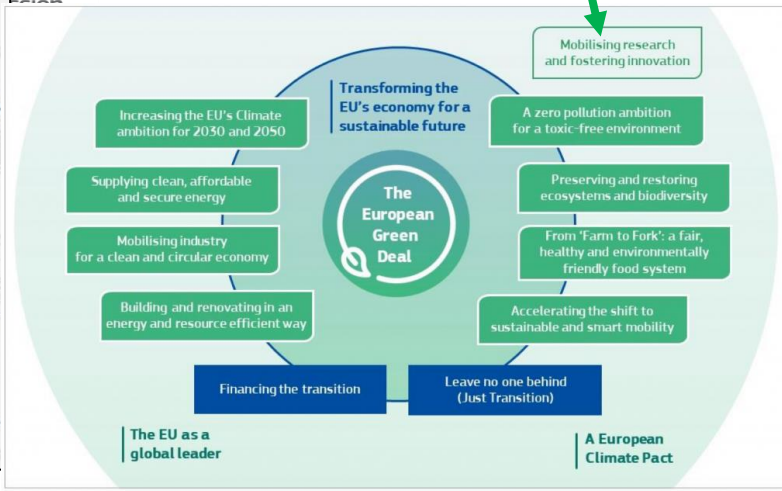
2015-2019:

- Warmest on record.
- CO2 increasing 20% faster than before.
- CO2 remains (centuries in air, longer in sea).
- Fastest Sea level rise 5mm/yr (2007-2016 4mm/yr, since 1993 average 3.2 mm/year).

Ambition

limit global temperature increase to well below 2°C, try to limit increase to 1.5°C





*"Becoming **the world's first climate-neutral continent by 2050** is the greatest challenge and opportunity of our times. Action needed now!"*

By 2030; 55% less EU GHG emissions, zero emission ships market ready.

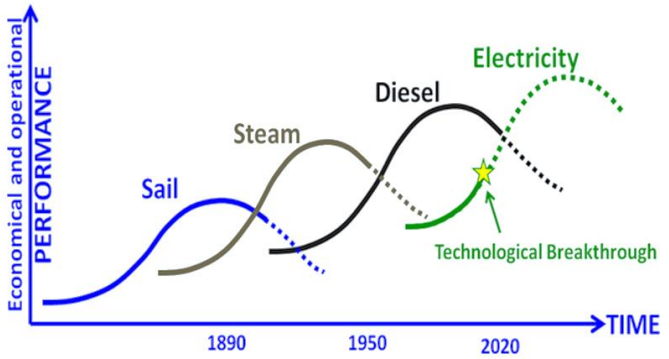
By 2050 at least 90% less transport emissions.

Basket of measures:

- Mix of legislative and non legislative measures to support positive choices (eg Innovation fund, CEF, Horizon, ETS, ETD, AFIR, FuelEU Maritime….)
- **Mobilising Research and Innovation- Horizon Europe Zero Emission Waterborne Transport Partnership.**

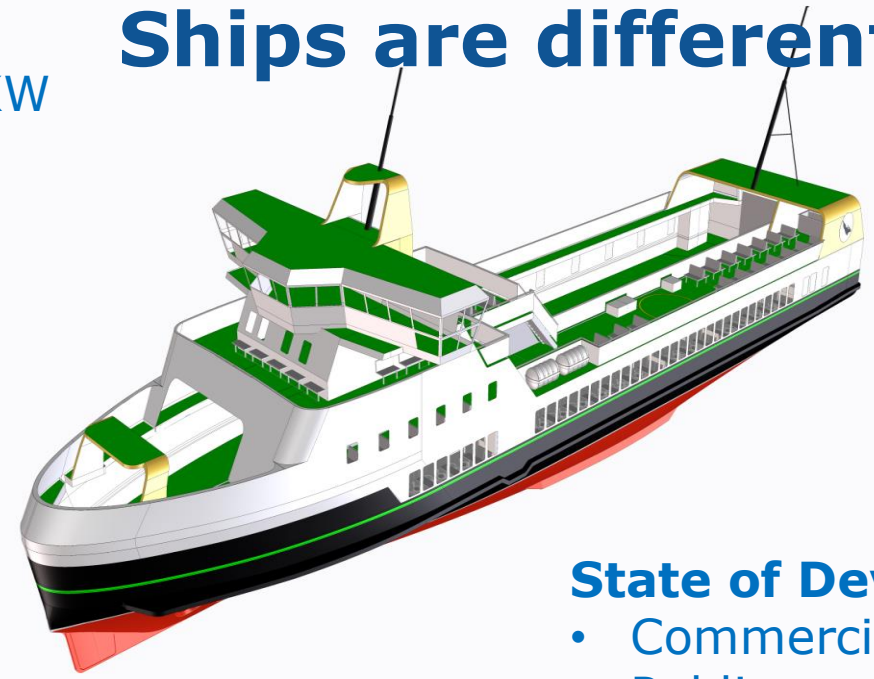
Electric Ships

150 years of Evolution



Car: 30 KWh
200Kg
Charge 20 KW

Ships are different



Ship Batteries:
250 times more power
&
400 times heavier

Charging Power:
200 times more

Safe: Confined spaces, fire, certified

Large charging cycles.

<u>Life Time Cost is Key</u>

State of Development:

- Commercial; battery hybrid's for peak shaving
- Public support; 100% battery ferries.

LC-BAT-11-2020: €20 million, two projects
Reducing the cost of large batteries for waterborne transport

- *Maritime Batteries exponentially **more expensive** than automotive batteries.*
- ***Increasing Market** for large batteries used within battery electric ferries and diesel battery hybrid vessels.*
- ***Europe leads** in battery electric shipping.*
- *Power density secondary to **cost.** Space usually not critical.*
- *Reducing battery cost is **pivotal to their take up** to green waterborne transport*
- *Battery packs and cells tailored to the needs of waterborne transport (safety, certification, cost) **reinforces Europe's competitiveness** and its lead within an accelerating global market.*

Thank you!

AGENDA

01 H2020 LC-BAT-11-2020: Reducing the cost of large batteries for waterborne transport

- Call introduction
- Underpinning rational

02 Current Direct & SEABAT projects

Solutions towards the electrification of the European waterborne transport sector

03 Roundtable and Q&A session

Shaun White
Current Direct: technical project manager

Current Direct:

Swappable Container Waterborne Transport Battery

CURRENT DIRECT™

EU Sustainable Energy Week

Shaun White
Technical Project Manager

The Current Direct project is funded by the European Commission's Horizon 2020 program. Grant number 963603.

Towards

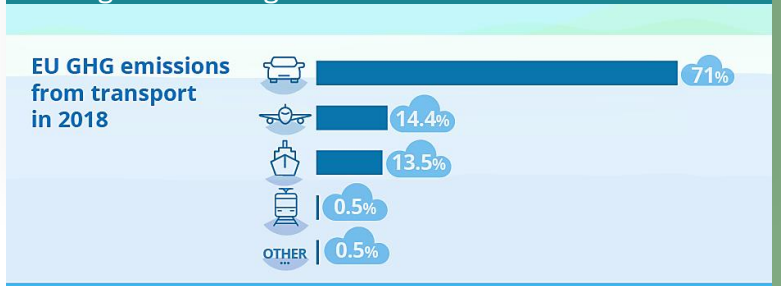
European Commission Goals

13.5%

Today

The waterborne transport contribution to GHG emissions relative to the total EU transport sector.

Maritime transport emits about **2.5%** of global greenhouse gas emissions.



The European Maritime Transport Environmental Report (EMTER)

-50%

Future

The EU waterborne transport GHG reduction target for 2050 relative to the emissions levels in 2008.

Phase out GHG emissions entirely by the end of the century if possible.

3

Main Challenges

1. Market specific safety, certification, and regulatory requirements.
2. Supporting infrastructure to facilitate fast energy transfer.
3. Lack of drivers enabling economies of scale to accelerate market adoption.

Context

- Research and innovation project funded by the European Commission's Horizon 2020
  - H2020-EU.3.4. - SOCIETAL CHALLENGES - Smart, Green and Integrated Transport (€ 6,339.40 million)
  - LC-BAT-11-2020 - Reducing the cost of large batteries for waterborne transport (€ 21.50 million)
  - Current Direct - Swappable Container Waterborne Transport Battery (€ 11.98 million)
- Swappable containerized batteries connected to an Energy as a Service Platform
- **Significantly reduce the total lifetime cost of waterborne transport batteries**
- **Cut GHG emissions of the marine transport sector**
- **Increase the installed energy of containerized energy storage systems**
- **Trigger investments for innovation, employment, and knowledge creation**

Strategic Objectives

Innovative Waterborne Transport Cell

SO1

Certified Battery System

SO2

Certified Integration Standards

SO3

Standardized Shore Infrastructure

SO4

Energy-as-a-Service Business and Financing Model

SO5

Standard Marine Battery Certification Methodology

SO6

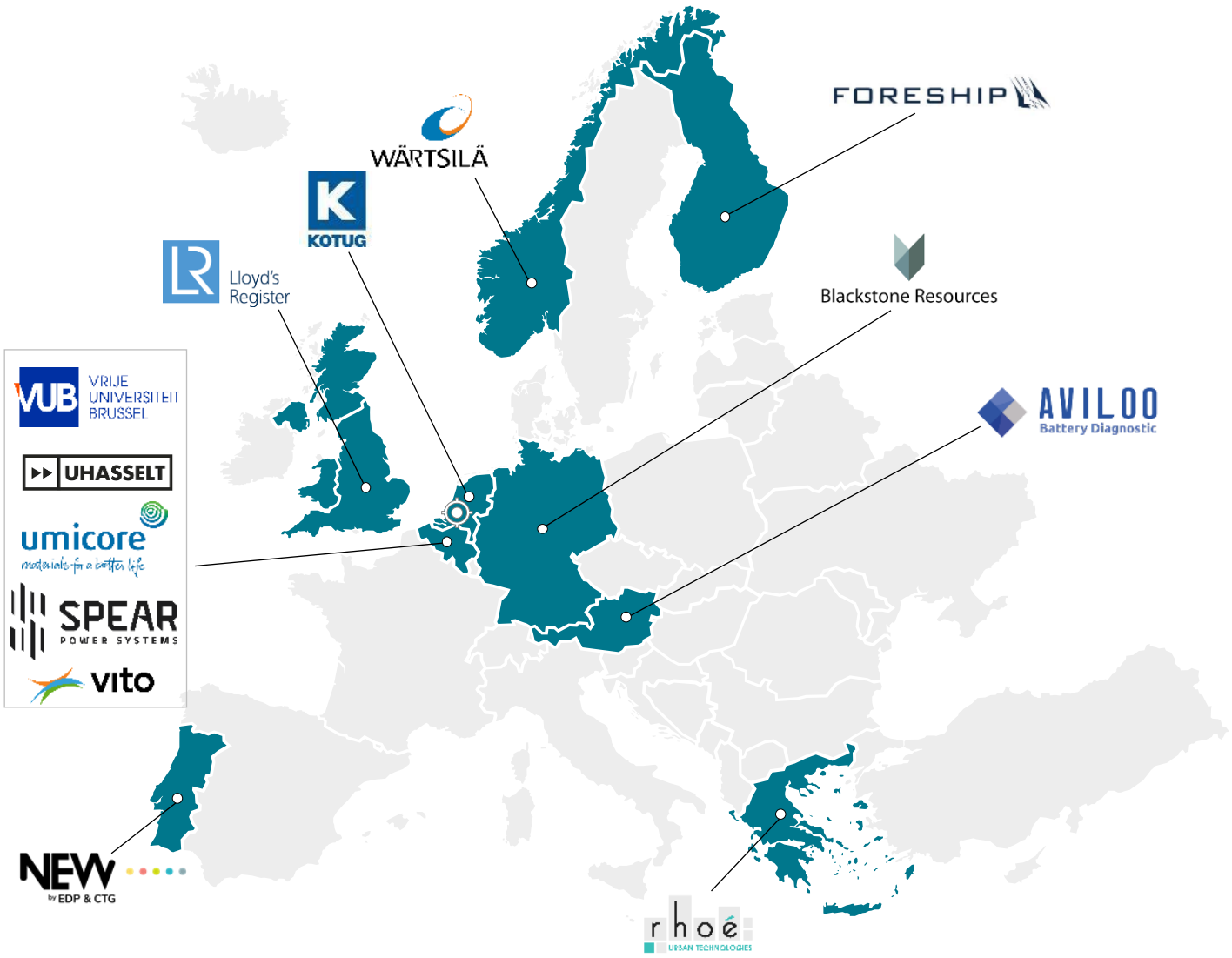
Operational Demonstrator

SO7

Dissemination and Stakeholder Management

SO8

Consortium



Key Facts

12 M€ Budget

36 Months (2021-2023)

13 Partners

9 Countries

1 Demo Site

11 Milestones

29 Deliverables

10 Work Packages

44 Tasks

Advisory Board

Port of Rotterdam

CARNIVAL CORPORATION&PLC

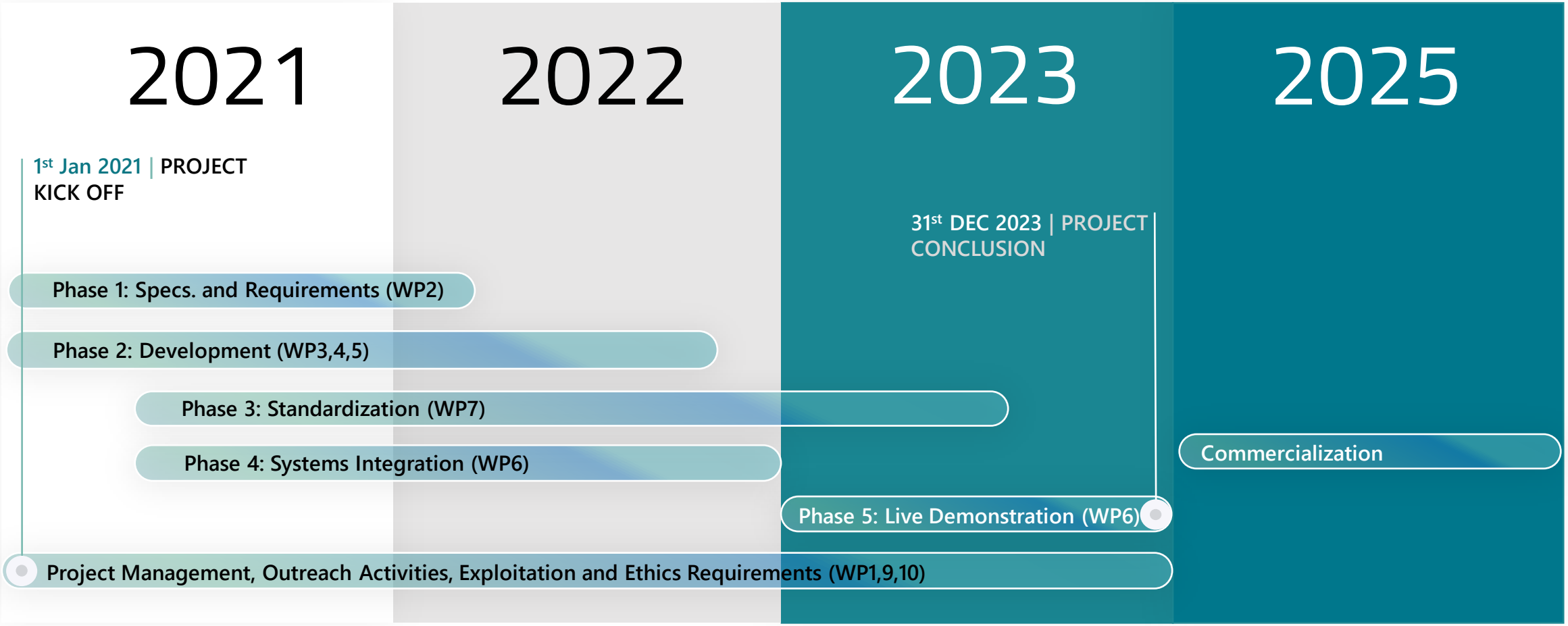
ENGIE

VATTENFALL

SOGESTRAN GROUP

IVR

Timeline


2021
2022
2023
2025
1st Jan 2021 | PROJECT KICK OFF
31st DEC 2023 | PROJECT CONCLUSION
Phase 1: Specs. and Requirements (WP2)
Phase 2: Development (WP3,4,5)
Phase 3: Standardization (WP7)
Phase 4: Systems Integration (WP6)
Commercialization
Phase 5: Live Demonstration (WP6)
Project Management, Outreach Activities, Exploitation and Ethics Requirements (WP1,9,10)

Swappable Waterborne Transport Battery

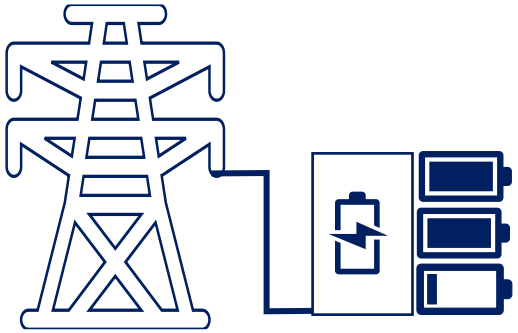
20ft Container

1MW, 3MWh

Energy-as-a-Service Platform

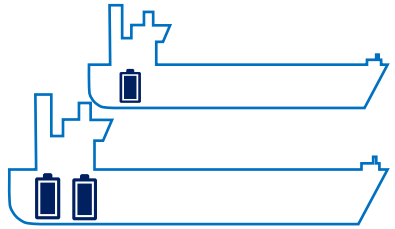
Interfaces and Topology

Shore Side



Swapping Infrastructure

Vessel Side



- Mechanical and Structural Considerations
- National grid standards
- Supporting Infrastructure Grid Connection
- - Fire Safety, regulatory
  - IEC/ISO
- Mechanical and Structural Considerations
- Swapping Movement and Reach
- Human Interface
- Safety, Redundancy, and Regulatory
- Electrical and Machinery Interfaces
- Vessel Retrofit

Vessel Integration

Demonstration

- 12-month Demonstration
- Major European Port
- Modular Hybrid Demonstration Vessel

Electrification

- Zero Emission Operation Mode – Battery
- Hybrid Operation Mode – Battery + ICE
- Hybrid+ Operation Mode- Battery + FC

Industry Collaboration

- Zero Emission Services
- Modular Vessel Design Concepts

We look forward to working with you!

Shaun White
Current Direct – Technical Project Manager
swhite@spearps.com

CURRENT DIRECT™ Revolutionize the way we move goods and people by water with the use of swappable containerized batteries connected to an Energy as a Service Platform

www.currentdirect.eu

www.linkedin.com/company/currentdirect

The Current Direct project is funded by the European Commission's Horizon 2020 program. Grant number 963603.

Jeroen Stuyts
SEABAT: Project coordinator

SEABAT:

Solutions for large batteries for waterborne transport

EU SUSTAINABILITY WEEK

SEABAT

26 OCT 2021

SEABAT

SOLUTIONS FOR LARGE BATTERIES FOR WATERBORNE TRANSPORT

GA NO: 963560

INTRODUCTION TO SEABAT

- Context
- Approach
- Market analysis
- Hybrid battery

INTRODUCTION TO SEABAT

- Context
- Approach
- Market analysis
- Hybrid battery

CONTEXT

SEABAT - Solutions for largE bAtteries for waterBorne trAnsporT

- Quick facts
  - 4 years, 10M€, 15 partners
  - Coordinator
    Flanders Make [BE]
  - Major partners
    Avesta Battery & Energy Eng. [BE] Imecar electronic [TR] Ikerlan [ES]
- Objectives
  - Full-electric maritime hybrid battery concept
  - 35-50% lower TCO
- Results
  - Validated hybrid battery solution (300kWh at TRL5, 1MWh virtually)
  - Roadmap for type approval
  - Strategy for standardization

INTRODUCTION TO SEABAT

- Context
- Approach
- Market analysis
- Hybrid battery

APPROACH

- Overall
- Objectives
- Value chain

Analyse market for waterborne transport

Develop modular full-electric hybrid topology

High power

High energy

- Cost
- Modularity
- Flexibility
- Scalability
- Fast charging
- ...

Build 300kWh system, validate for 1 MWh and beyond

Validated solution for batteries of >1 MWh for waterborne transport

APPROACH

- Overall
- Objectives
- Value chain

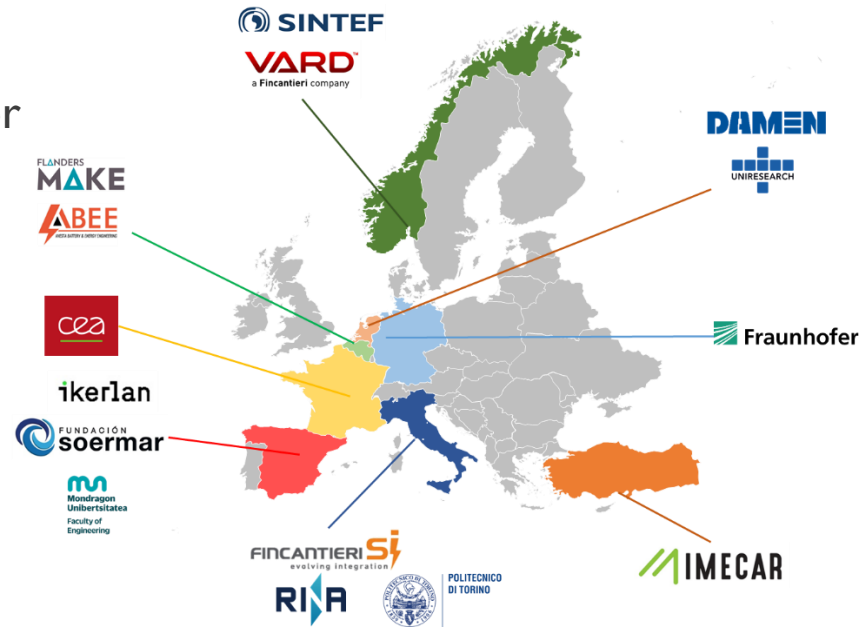
- Full-electric maritime hybrid battery concept
  - System architecture
  - Modular HE & HP subsystems
  - Novel converter concepts
  - Flexible Battery Management System
  - System integration & validation
- 35-50% lower TCO
  - Proven reduction of production process costs in industrial pilot
  - Reduce CAPEX, OPEX & consider End-of-Life

APPROACH

- Overall
- Objectives
- Value chain

- Design and development of
  - Power electronics, energy storage systems & control thereof
  - Reliable, cost-effective components & safety assessment
- Design and production of battery packs
- Power systems testing
- End users
- Research and technology transfer
- Technology qualification
- Project management, dissemination & exploitation

- Stakeholder group

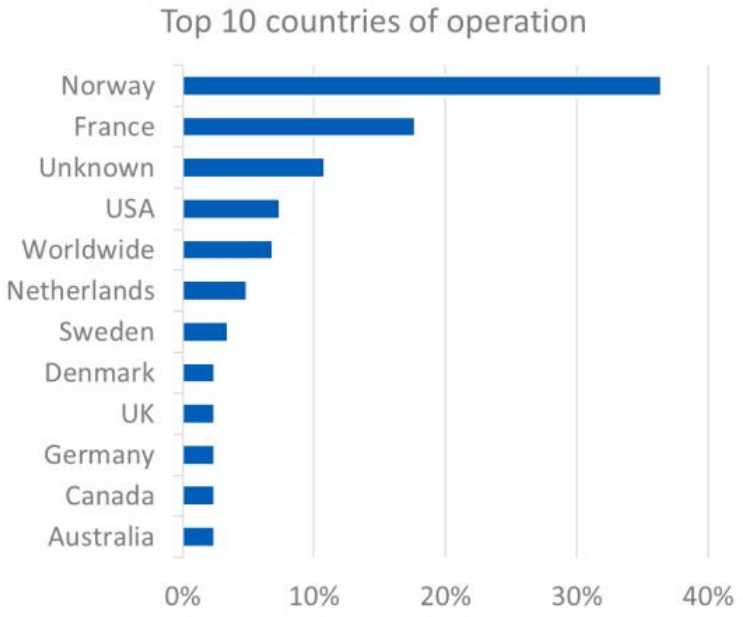


INTRODUCTION TO SEABAT

- Context
- Approach
- Market analysis
- Hybrid battery

MARKET ANALYSIS

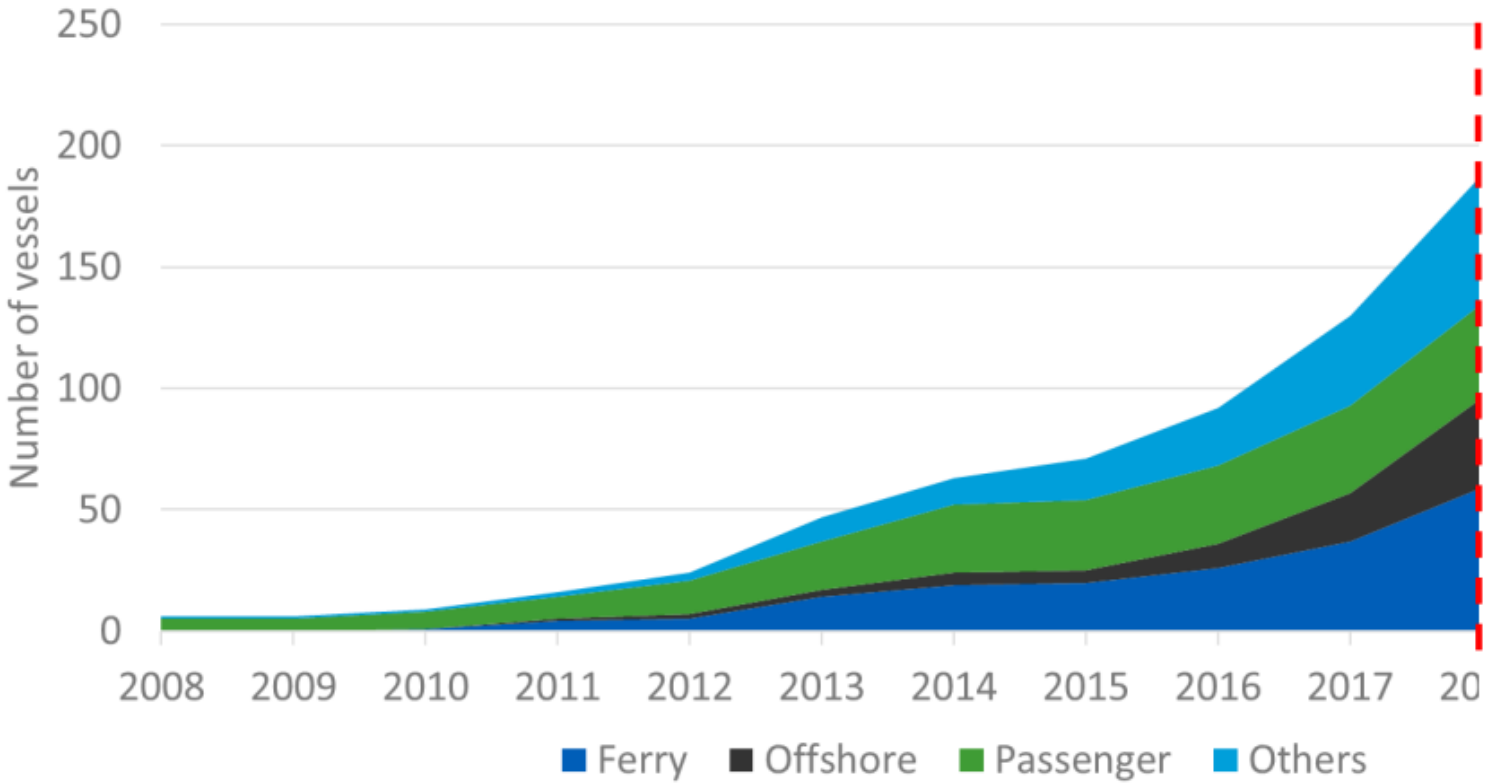
- Per country
- Per type
- Forecast
- Application matrix
- Use cases



Source: maritime battery forum

MARKET ANALYSIS

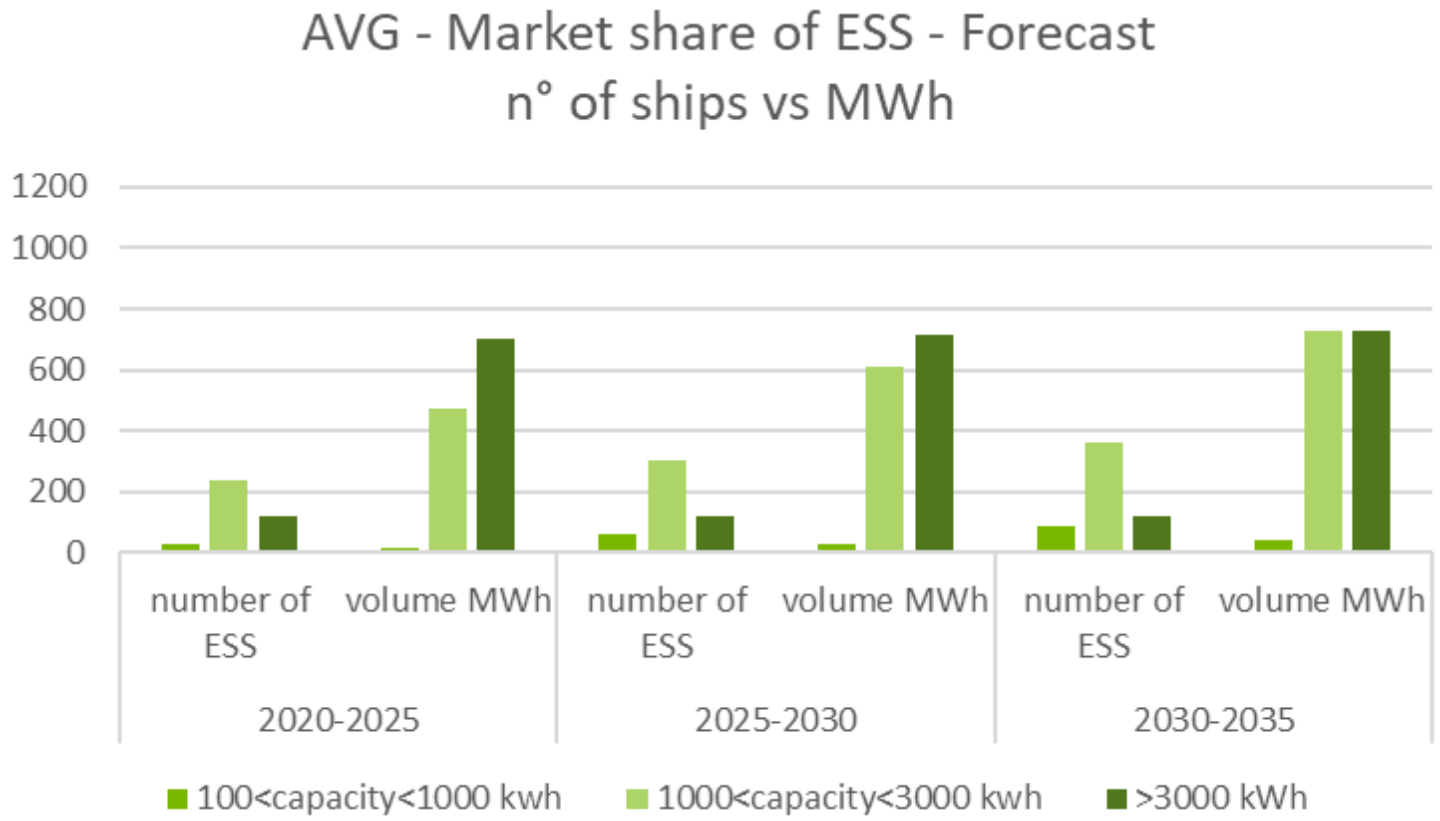
- Per country
- Per type
- Forecast
- Application matrix
- Use cases



Source: maritime battery forum

MARKET ANALYSIS

- Per country
- Per type
- Forecast
- Application matrix
- Use cases

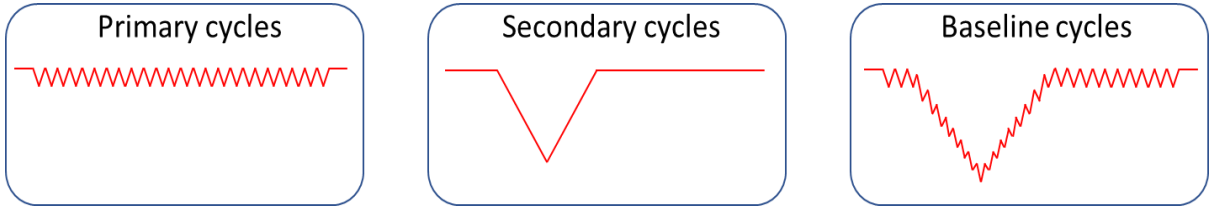


Source: SEABAT D1.2 Market evolution and potential within 5, 10, 15 years for different marine applications

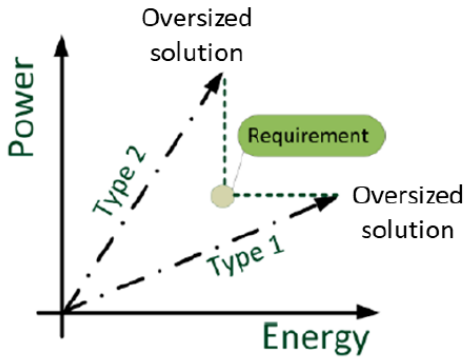
MARKET ANALYSIS

- Per country
- Per type
- Forecast
- Application matrix
- Use cases

- 34 vessels analyzed in depth
- 2 analyses
  - Cycle analysis



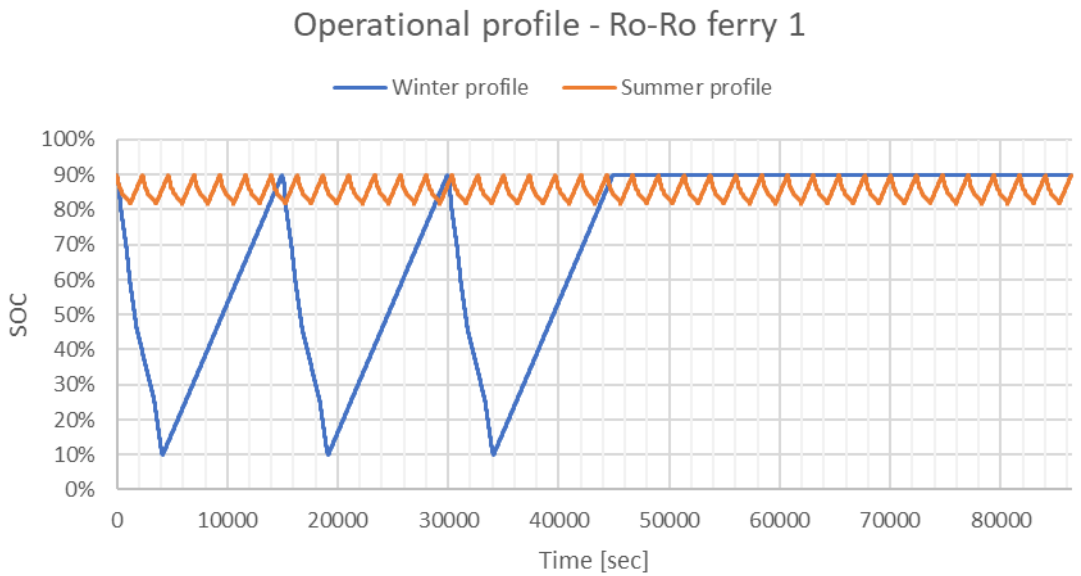
  - C-rate optimization



MARKET ANALYSIS

- Per country
- Per type
- Forecast
- Application matrix
- Use cases

- Cycle analysis
  - Ro-Ro ferry
  - Urban ferry
- C-Rate optimization
  - Ro-Ro ferry
  - Harbor tug
  - Waterbus



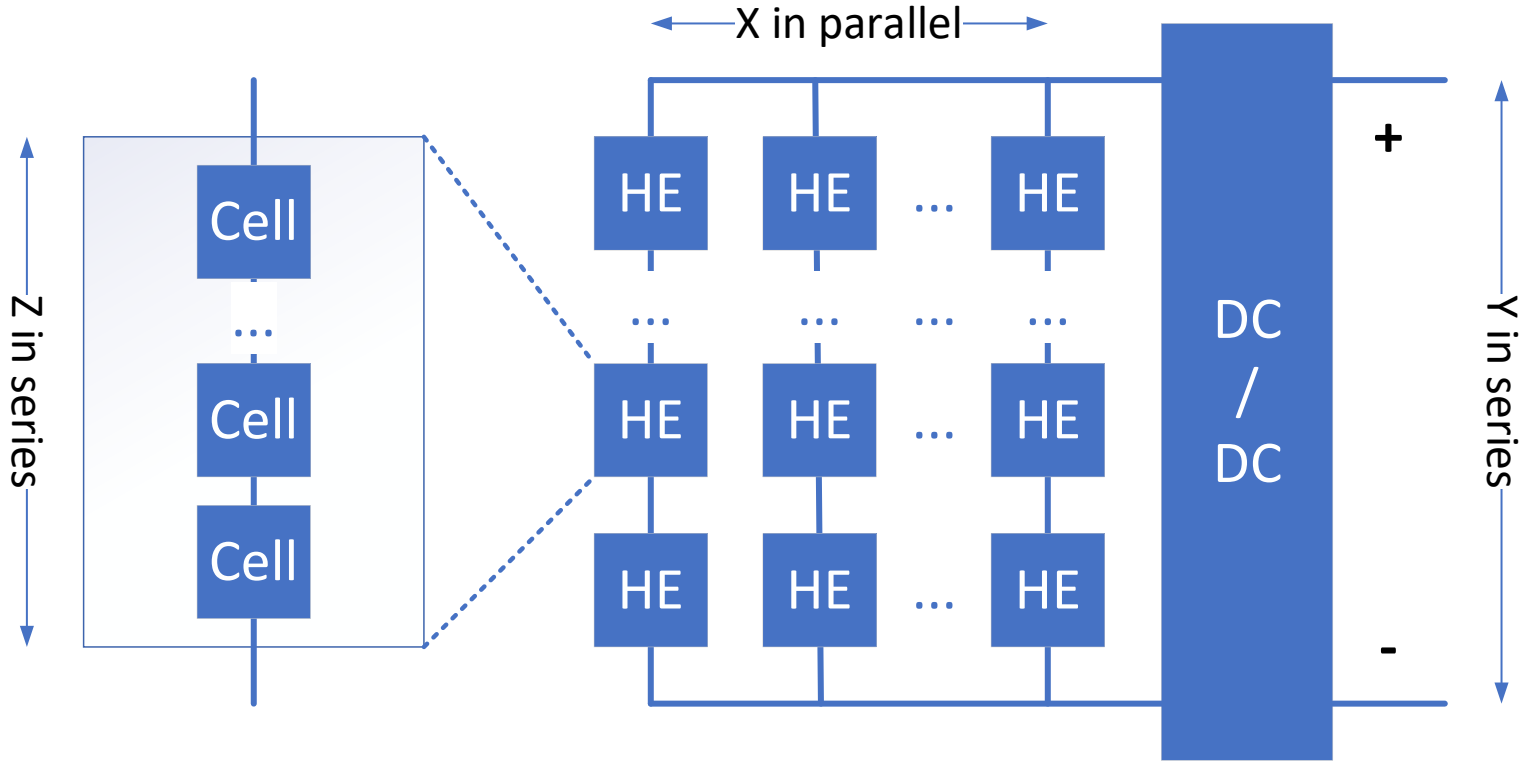
Source: SEABAT D2.1 Application Matrix

INTRODUCTION TO SEABAT

- Context
- Approach
- Market analysis
- Hybrid battery

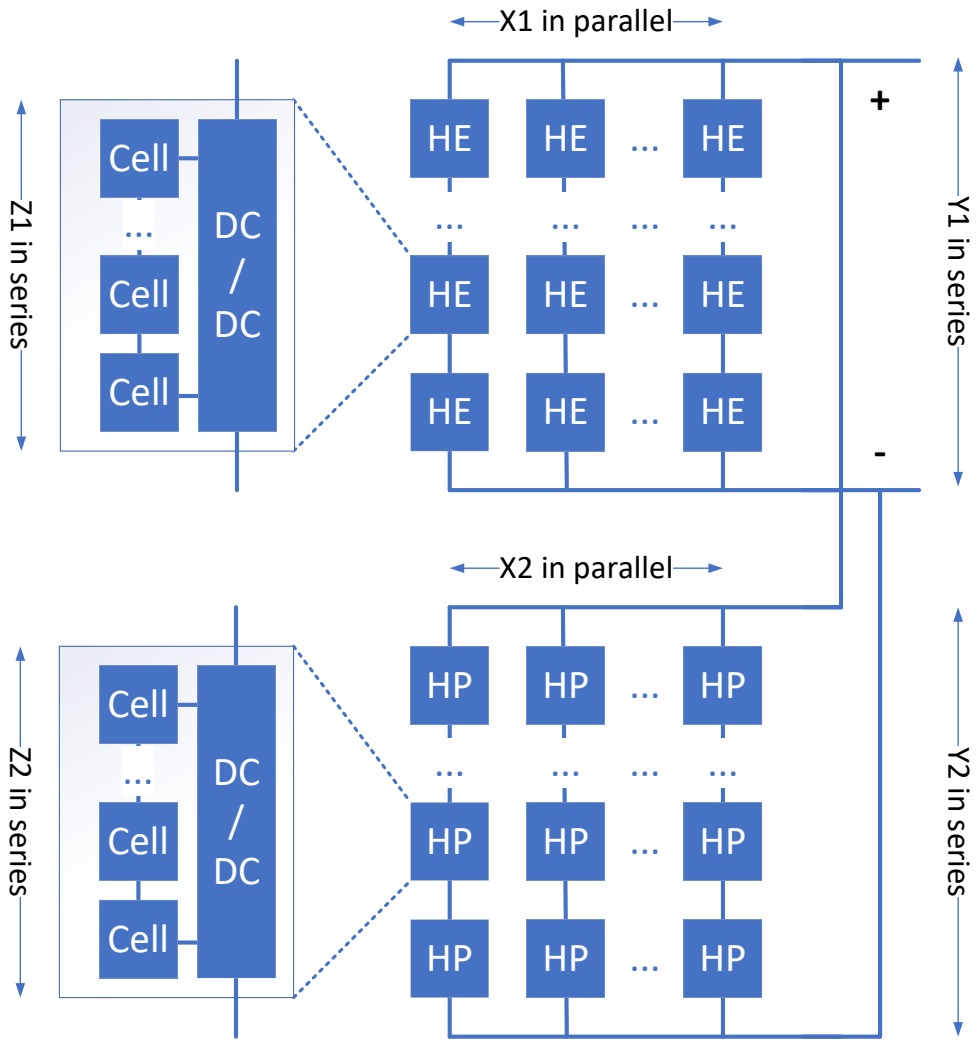
HYBRID BATTERY

- Baseline
- Module-level converter
- Partial power configuration
- Discrete



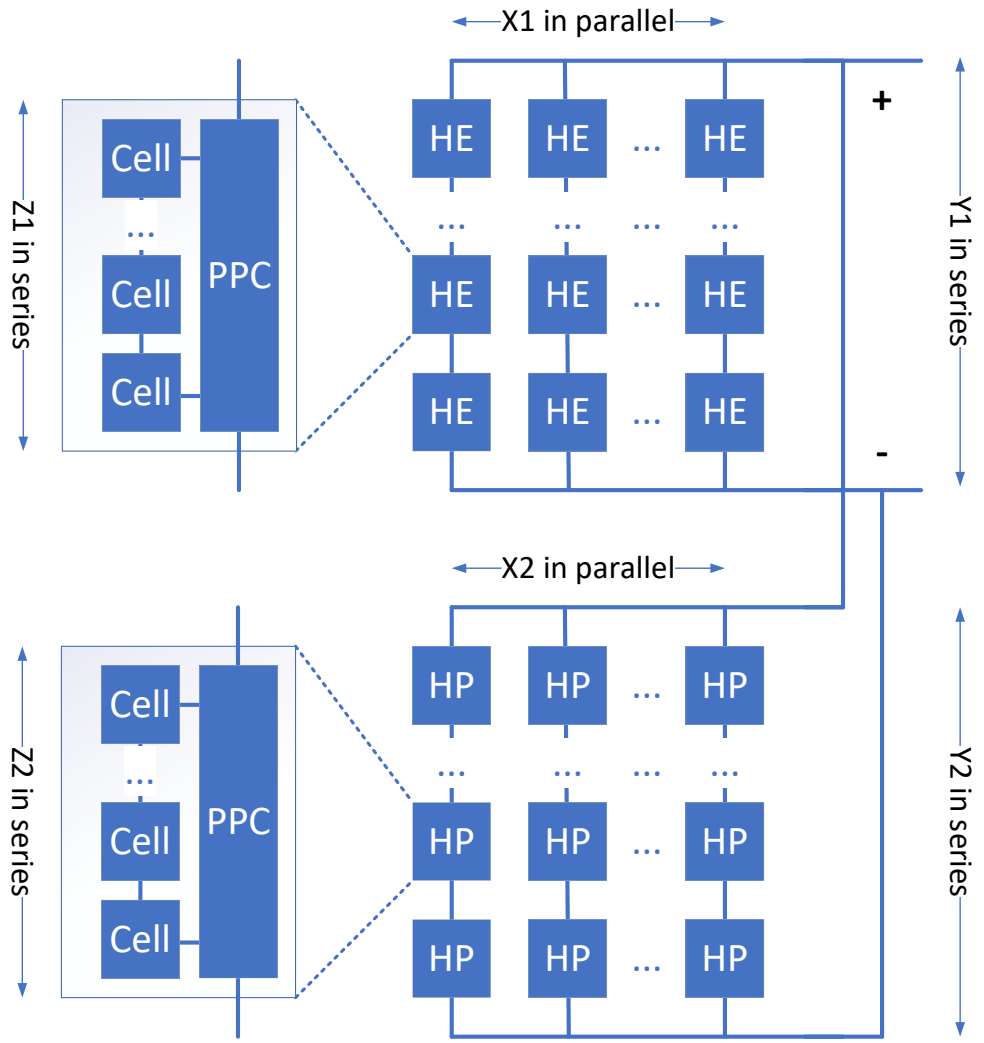
HYBRID BATTERY

- Baseline
- Module-level converter
- Partial power configuration
- Discrete



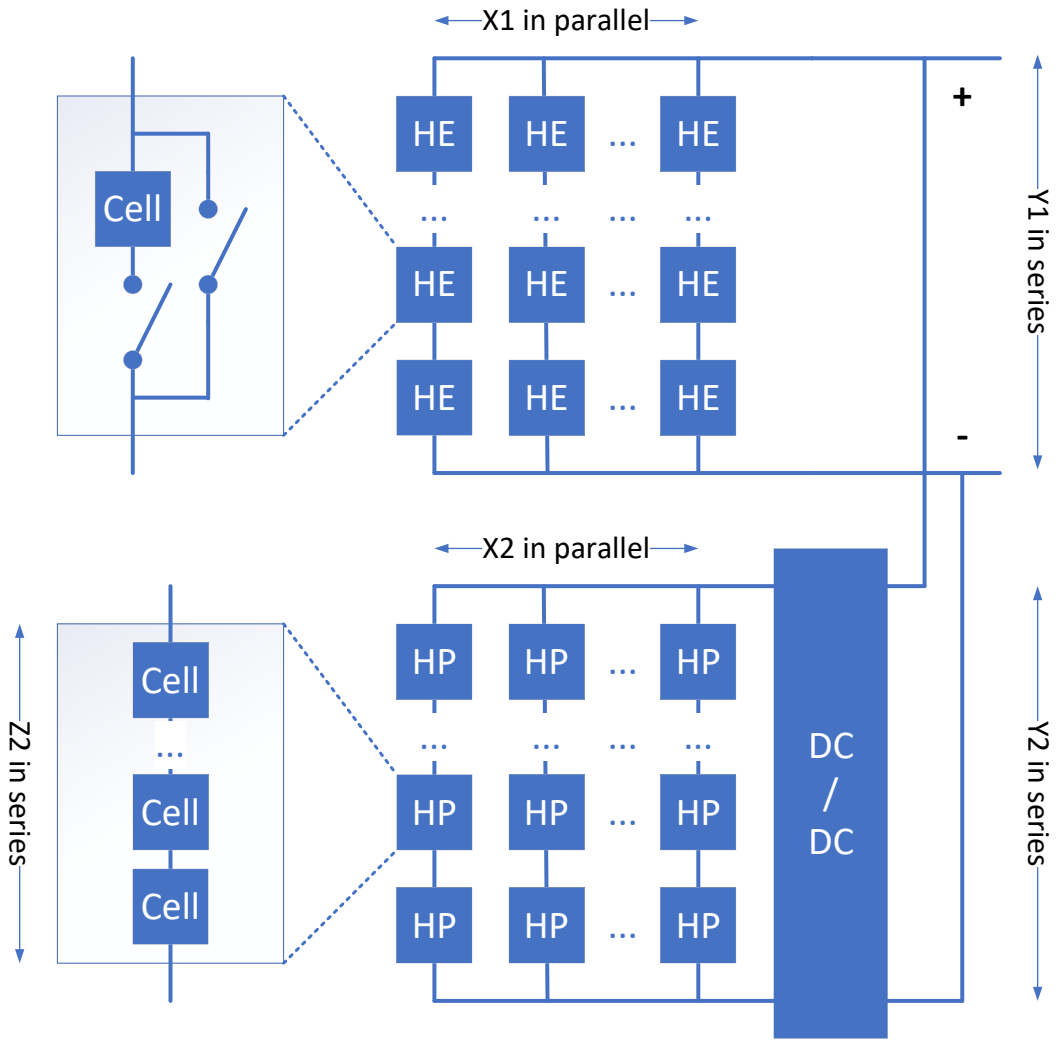
HYBRID BATTERY

- Baseline
- Module-level converter
- Partial power configuration
- Discrete



HYBRID BATTERY

- Baseline
- Module-level converter
- Partial power configuration
- Discrete



SEABAT

SOLUTIONS FOR LARGE BATTERIES FOR WATERBORNE TRANSPORT

GA NO: 963560

FOLLOW US

SEABAT-H2020.EU

JOIN THE STAKEHOLDER GROUP

CAYETANO HOYOS

QUESTIONS TO COORDINATOR

JEROEN STUYTS

AGENDA

01 H2020 LC-BAT-11-2020: Reducing the cost of large batteries for waterborne transport

- Call introduction
- Underpinning rational

02 Current Direct & SEABAT projects

Solutions towards the electrification of the European waterborne transport sector

03 Roundtable and Q&A session

ROUND TABLE AND Q&A

Shaun White
SPEARPS

Jeroen Stuyts
FM

Tommaso Orlandini
EDP NEW

Aimilios Mouchtaropoulos
Rhoé

Cayetano Hoyos
SOERMAR

EUSEW.EU
EUENERGYWEEK
@EUENERGYWEEK

Tommaso.orlandini@edp.pt

www.currentdirect.eu
www.linkedin.com/company/currentdirect
https://seabat-h2020.eu/

SUSTAINABLE ENERGY WEEK

SUSTAINABLE ENERGY DAY ORGANISERS
TOWARDS 2030: RESHAPING THE EUROPEAN ENERGY SYSTEM
#EUSEW2021