

IPN Project nr. 321559: **Optimizing Marine Battery** operations using **6** years' operational data from two commercially operating vessels (OMB6)

Inviting student projects for Research Council of Norway (RCN) funded new project OMB6

13:15 – 13:45 on 18th January 2021

TEK5380 - Maritime Battery Project Introduction

Wei He (OMB6 Project manager, Equinor)

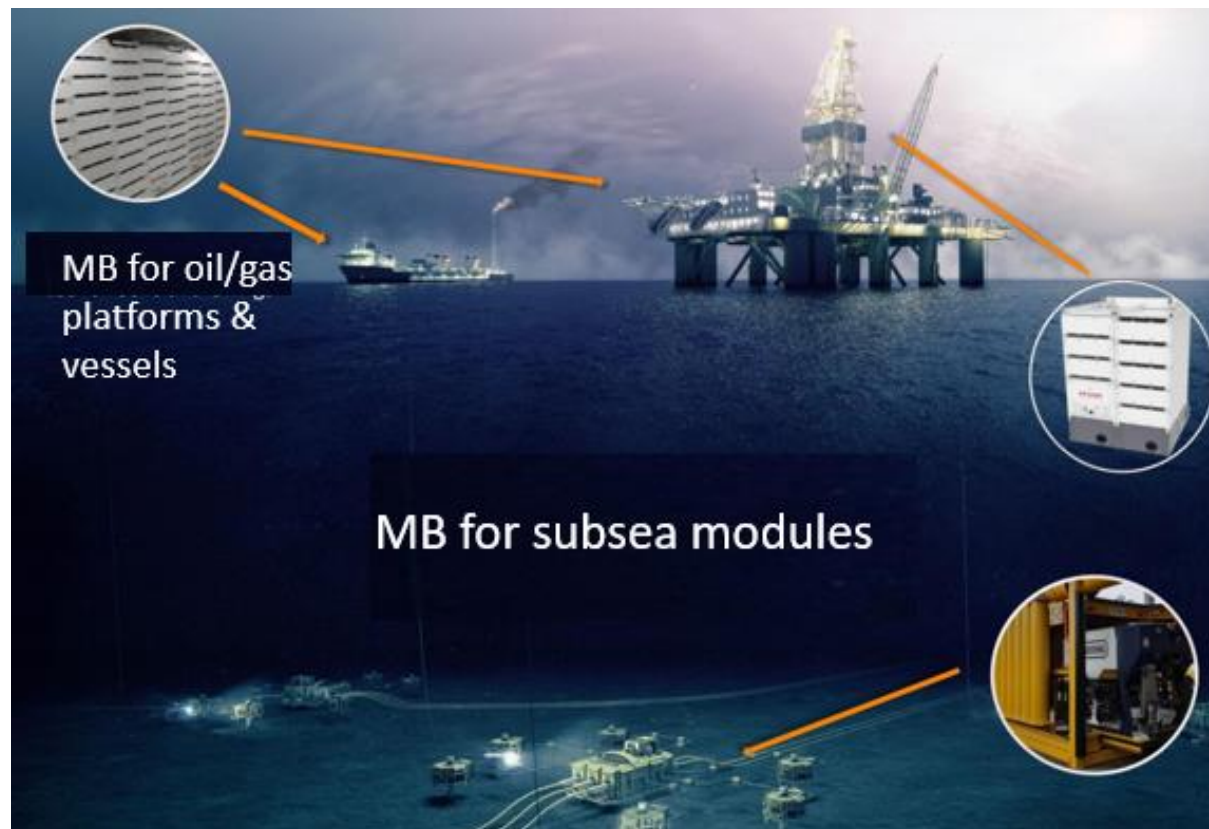
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- Introduction on Marine battery
 - Applications on offshore oil/gas platforms & wind farms
 - Marine battery productions in Norway
 - Special challenges
- Introduction on OMB6:
 - Key facts
 - Seven work packages
- Calling for student projects for OMB6

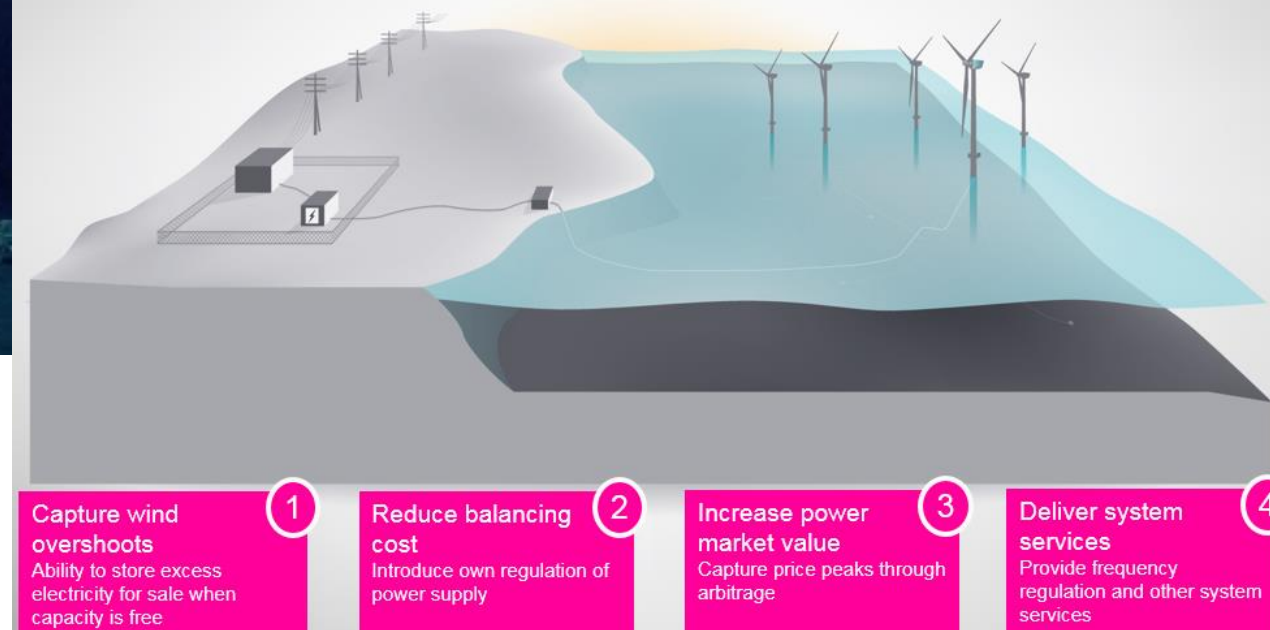
Marine battery applications on offshore oil/gas platforms & wind farms



Piloting Batwind concept @ Hywind Scotland

Floating Wind + Storage + Grid

- ✓ Increase the value of floating wind
- ✓ Start developing new business models around storage in Statoil



Marine battery productions in Norway

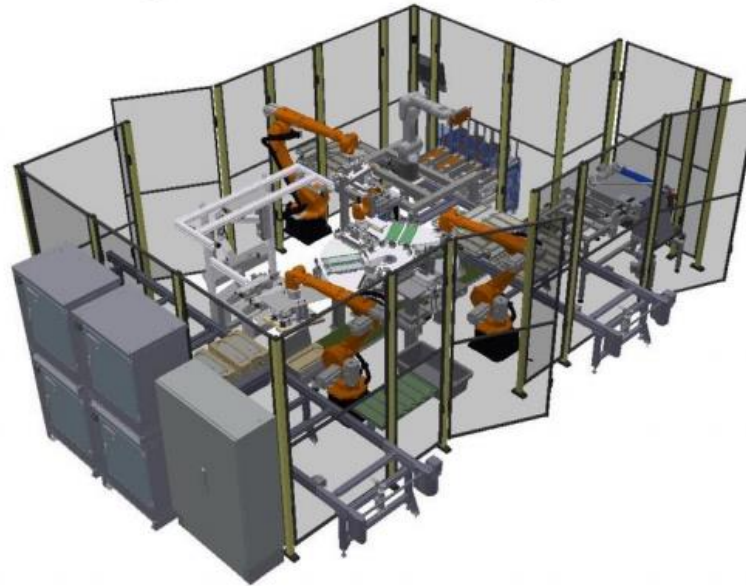
- One example from Corvus

Corvus  Energy

Scalable production capacity

Factory in Norway and Canada ensures reduced leadtime for delivery of parts and modules in case of major loss.

Loss Prevention



Manufacturing

- Robots delivered by Intek, Raufoss
- State-of-the-art modular solution
- Prepared for future atomation and digitalization (Industry 4.0)
- Designed for flexible production and scalability

Special challenges

- Batteries will be key enablers of maritime industry green transition:
 - The installation capacity on a single vessel represents is about 10 to 1000 times the capacity of a typical electric car (e.g. a platform service vessel (PSV) with power generation capacity of 10 MWh is 200 times that of an electric car with 50 kWh).
- A significant number of examples that battery electrified ferries, shipping using inland waterways and short distance freight service are able to serve the purpose, a commercial large scale roll-out has a different set of challenges than those facing the automotive sector including
 - Lower production volumes and many more individual types of vessels.
 - Both the installation and operational conditions of MB systems are very different from that required by the standard battery packs on a new electrical car.
 - High technology and large investment are required to establish both onshore and offshore charging infrastructure for vessels.

Key facts

- Primary objective: increase the operational benefits of marine batteries (MBs) on vessels by 5 to 10%:
 - Three secondary objectives:
 - ✓ Development of new, optimal, integrated MB operational models through the integration of three new MB modules:
 - Operational data analysis and learning using large amounts of operational data.
 - Degradation diagnosis and testing.
 - Benefits from onshore/offshore charging facilities.
 - ✓ Testing new MB operational models on commercially operating vessels for two and half years.
 - ✓ Roadmap for more MB installations on vessels.

- Project partners:
 - Havila (ship owner): Administrator
 - Equinor (project developer): Project manager
 - Corvus (MB supplier)
 - SINTEF Energy (SINTEF)
 - Institute for Energy Technology (IFE)

- Project period: three years: 1st April 2021- 30th March 2024
- Total budget: 12 million NOK with 50% approved funding from RCN



OMB6 consortium: three industrial partners and two research institutes

- ❖ Advisory board:
 - Prof. David Howey (University of Oxford, UK)
 - Prof. Egbert Figgemeier (RWTH, DE)
 - Prof. Jeff Grossman (MIT, USA)

Project summary

This project aims at increasing the benefits to ship owners of operating marine batteries (MBs) on vessels by 5-10 %.

- A new integrated MB operational model will improve the current operational models by integrating three new MB operational modules.
 - MB operational data analysis and learning module will use a large amount (6 years) of operational data
 - MB degradation diagnosis and laboratory testing of new operational strategies
 - MB benefits from both onshore and offshore charging
- Testing new optimized MB operational strategies has been planned on two commercially operating offshore supply vessels (PSVs) for two and half years.
- Roadmaps will enhance investor's confidence in installing more MBs on vessels. It will provide the cost benefit analysis of installing more MBs on vessels and explore synergies of cross sector collaboration.
- ❖ The amount of data and close cooperation between theoretical aspects and practical testing and implementation in this project are unprecedented. This project will have high impact on future R&D of MB applications.

Outcomes and impacts

The three major project outcomes are:

- A new integrated MB operational model will substantially improve the current operational models by integrating three new MB operational modules (operational data analysis and learning, degradation diagnosis and testing, benefits from onshore/offshore charging facilities).
 - A comprehensive testing the optimized MB operational strategies on two PSVs for two and half years. The testing results will verify the new integrated MB operational models and identify the workable MB operational strategies on vessels.
 - Roadmaps to enhance investor's confidence in installing more MBs on vessels based on the cost benefit analysis and the synergies of cross sector collaboration.
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- ❖ The project impacts include i) the new integrated MB operational model improving MB operations by 5-10%, and ii) a new best practice for MBs which promotes future R&D and increases investor confidence for continued electrification of vessels to reduce costs and emissions.

OMB6 - Optimizing marine battery operations using 6 years' operational data from two commercially operating vessels

Background:

There are gaps between the various initiatives accelerating marine battery applications and the ship owners' actual operational results. Moreover, most Norwegian ship owners are facing financial pressures and they must pursue significant benefits from continuing their green transition.

Objectives:

Optimizing marine battery (MB) operations to maximize the benefits for ship owners by using six years MB operational data on commercially operating vessels. Firstly, the novel MB optimal operational models will be developed. Secondly, the new MB optimal models will be comprehensively tested by two commercial vessels for two and half years. Thirdly, OMB6 will provide novel roadmaps to enhance investor's confidence in installing more MBs on vessels based on the cost benefit analysis and the synergies of cross sector collaboration.



OMB6 consortium: three industrial partners and two research institutes

Responsible organization: Havila Shipping AS (project administrator), Equinor Energy AS (Project manager), Contact: Wei He (weih@equinor.com)

Partner: Havila Shipping AS, Equinor Energy AS, Corvus Energy, SINTEF Energy and Institute for Energy Technology

Project period: April 2021 - March 2024

Type: Innovation Project for the Industrial Sector (IPN)

RCN funding: NOK 6 millioner

Website: <https://www.sintef.no/OMB6>

Project number: 321559

OMB6 – Optimalisert drift av maritime batterisystemer basert på 6 års operasjonelle data fra to kommersielle batterihybride fartøy

Bakgrunn:

Det er et gap mellom insentiver og målsetninger for akselerert bruk av batterier i maritime sektor og de faktiske forbedringer som operatører og redere erfarer. Samtidig opplever flere norske skipsredere og operatører et økende økonomisk press for å gi betydelige bidrag til det grønne skiftet, blant annet gjennom innstallering av batterier

Mål:

Hovedmålet er å fremskaffe og teste metodikk for å optimalisere driften av batterier på batterihybride fartøyer for å maksimere nytteverdien av installerte batterier. Dette vil gjøres med utgangspunkt i allerede målte data på to kommersielle fartøyer samt målinger som vil bli gjort underveis i prosjektet. Optimaliseringen skal hensynta hvordan utslipp, drivstofforbruk, batteri degenerering og slitasje på dieselmotororer påvirkes av valgt driftsstrategi. Strategier vil bli testet ut på to kommersielle fartøyer i løpet av prosjektperioden. Prosjektet har videre som mål publisere resultater for derigjennom å bidra til å øke investorers tiltro til at installasjon av batterier vil være fordelaktig.



OMB6 partnere: Tre industrielle aktører og to forskningsinstitutter

Ansvarlig organisasjon: Havila Shipping AS (Prosjekteier), Equinor Energy AS (Prosjekt leder). Kontakt: Wei He (weihe@equinor.com)

Partnere: Havila Shipping AS, Equinor Energy AS, Corvus Energy, SINTEF Energi AS and Institutt for Energiteknikk (IFE)

Prosjektperiode: April 2021 - March 2024

Type: Innovasjonsprosjekt for næringslivet

Offentlig finansiering: 6 mill. kroner

Nettside: <https://www.sintef.no/OMB6>

Prosjektnummer: 321559

Project summary

To remain at the forefront of international efforts towards the electrification of waterborne transport, this project aims at increasing the benefits to ship owners of operating marine batteries (MBs) on vessels by 5-10 %. The project consortium has brought Havila, Equinor, Corvus, SINTEF and IFE together. Three major innovations have been planned to unlock MB operational benefits in order to accelerate electrification of waterborne transport.

Firstly, a new integrated MB operational model will improve the current operational models by integrating three new MB operational modules. The first new MB operational data analysis and learning module will use a large amount (6 years) of operational data to highlight MB performances where most improvements could be gained. The second new module: MB degradation diagnosis and laboratory testing of new operational strategies aims to understand and minimize MB degradation under operational conditions on vessels. The third new module will explore MB operations with the existing onshore and future offshore charging facilities. This extends the current MB operations supporting diesel generators by keeping the generator at optimal efficiency.

Secondly, testing new optimized MB operational strategies has been planned on two commercially operating offshore supply vessels (PSVs) for two and half years. A comprehensive testing program will ensure sufficient iterations to improve new MB operation models and to achieve the optimized MB operational strategies to be tested on two PSVs.

Thirdly, roadmaps will enhance investor's confidence in installing more MBs on vessels. It will provide the cost benefit analysis of installing more MBs on vessels and explore synergies of cross sector collaboration.

The amount of data and close cooperation between theoretical aspects and practical testing and implementation in this project are unprecedented. This project will have high impact on future R&D of MB applications.

Outcomes and impacts

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Calling for student projects for OMB6

- Responses from University of Oxford, UK:
 - Prof. David Howey (University of Oxford) has placed a fourth-year project student (masters level – running from October 2021 to ~April 2022).
- Responses from Delft University of Technology, the Netherlands:
 - Professor Zian Qin at DCE&S (DC System, Energy Conversion and Storage Group) at Electrical Engineering has placed a MSc thesis for WP1: WP1: Marine battery (MB) operational data analysis and learning.
- Calling for student projects at University of Oslo for OMB6:
 - A high impact research and industrial collaborative project with RCN funding
 - ✓ Working with leading Norwegian researcher partners: IFE, SINTEF & industrial partners: Havila, Equinor, Corvus.
 - ✓ International communications.
 - Addressing state-of-the-art marine battery optimal operations:
 - ✓ Very few R&D efforts have been dedicated towards optimal operation of MBs.
 - ✓ Optimal marine battery operational models by integrating three new MB operational modules.
 - ✓ Verifying the new models by two and half years testing.