

# FESSMI – Future Energy Storage Solutions for Marine Installations

## Vaasa Energy Week Energia- & ympäristöseminaari

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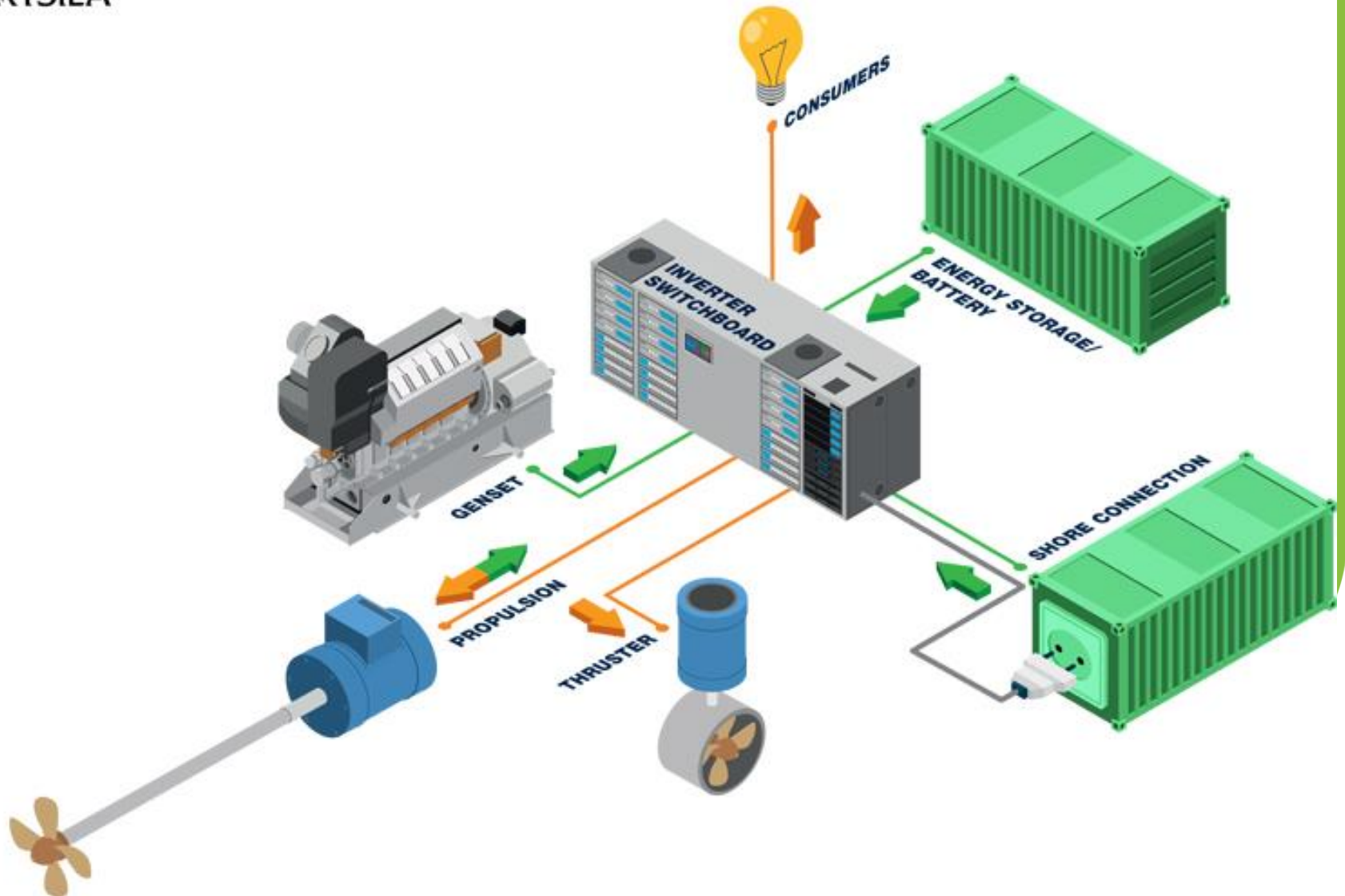
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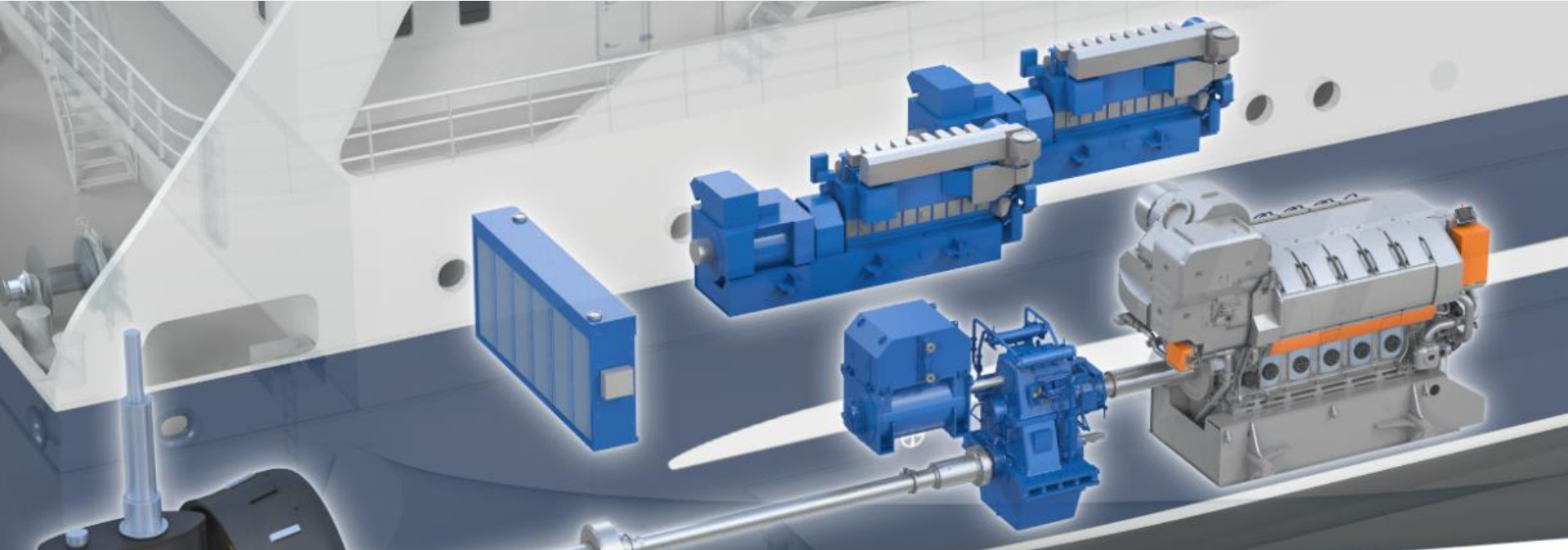
Programme for Sustainable Growth and Jobs

Leverage from  
the EU  
2014–2020



European Union  
European Regional  
Development Fund





### COST EFFICIENCY

Lower operating and maintenance costs



### FLEXIBILITY

Energy flexibility  
– now and tomorrow



### ENVIRONMENTAL REGULATIONS

Reduced emissions  
– future environmental compliance



# Background and Objectives for the research

- Battery technology, performance and cost is **developing fast** and its application within main markets in marine business is **growing fast**
- The marine and power generation industry is facing **ever more stringent environmental regulations**
- **Hybrid solutions enables more increased energy efficiency.**
- Little research has been done of the utilization of harbour based renewable power production and it's interface to hybridized vessel. **Demand for new knowledge is evident.**
- Competitive hybrid solutions will require **significant advances in energy management & control systems (smart energy)**
- **Ship Owners** are considering **lowering OPEX for existing fleet** with hybrid solutions



# FESSMI Partners and Scope



- WP 1 – Life cycle analysis for hybrid marine technology (LUT, UVA)
- WP 3 – Hybrid vessel electric system modelling and analysis (LUT)
- WP 5 – Demonstration system development and testing (LUT)
- WP 2 – Hybrid vessel harbour support system modelling and analysis (UVA)
- WP 4 – Remote vessel data management (UVA)



# Wärtsilä's interest, contribution and main outcome from the research

## Wärtsilä Interest

- Where are the sweet spots of hybridization?
- How to deliver added value to the customers through hybridization?
- How our R&D and Business Development should approach hybridization?

## Wärtsilä Contribution

- Detailed operational data from the real ships provided for universities to analyse
- Continuous dialogue with the researchers during the execution with input data and reviewing the results

## Outcome to Wärtsilä

- OPEX & CAPEX analysis for the system lifetime for real cases
- Validated simulation results to prove benefits of the selected configurations
- New knowledge obtained and collaboration increased with universities



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# CLS-Engineering interest, contribution and main outcome from the research

## CLS Interest

- Different protocols used in Marine environment ?
- Data sharing and communication ways out from the ship.
- Cosmos platform usage in storage system?

## CLS Contribution

- Cosmos cloud platform provided for researchers.
- Cosmos X10 data collector shared the researchers.
- Platform hands on checking together with researchers.

## Outcome to CLS

- Data point of view Cosmos platform (Hardware+Cloud) is usable for the data collection and storage
- New knowledge about battery systems.



# Hybrid vessel harbour support system modelling and analysis

## WP 2:

### Tasks:

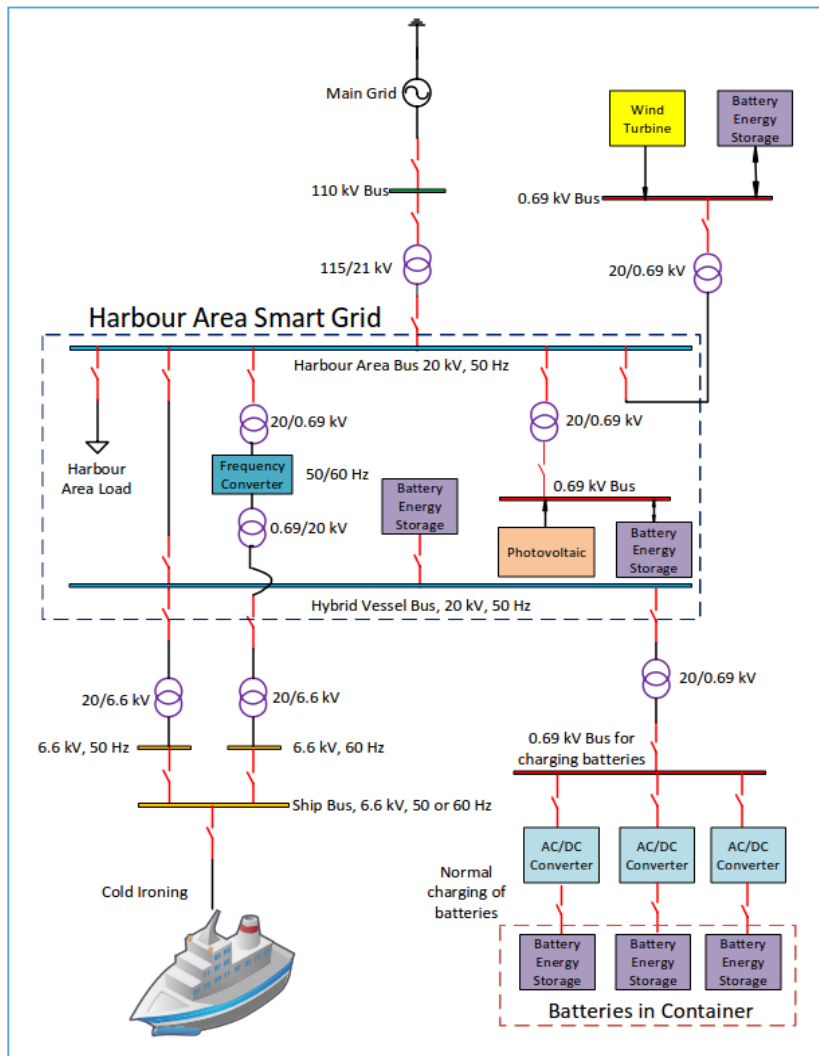
- Design principles of the harbour support system
  - Vessel interface
  - Land based storage
  - Renewable generation
  - Grid connection
- Different operational scenarios
- Protection and safety issues
- Power quality
- Tolerances to external faults





# Hybrid vessel harbour support system modelling and analysis

## WP 2:

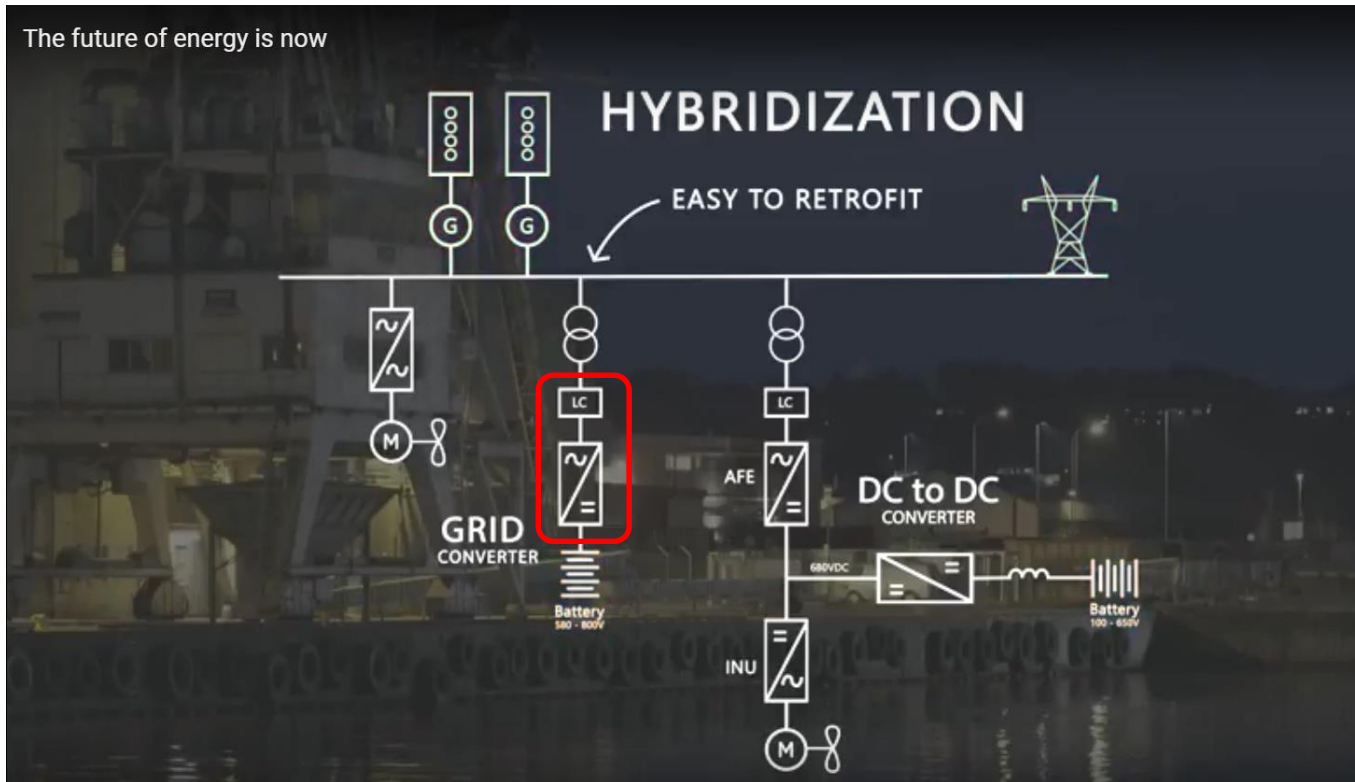


### Deliverables:

- ✓ Modular solutions for different operation scenarios
  - ✓ Fast and Slow charging
  - ✓ Suitable regardless technical requirements
  - ✓ New business models for ship owners and port administrators
  
- ✓ Utilizes local renewable based power generation
  - ✓ Wind turbines, Photovoltaic
  - ✓ Pollution free environment
  - ✓ Benefits for hybrid vessel and seaport owners
  
- ✓ Performance validated by simulating different case studies
  - ✓ Steady and transient state operations
  - ✓ Protection studies
  - ✓ Grid connected and islanded mode

# Danfoss Drives

## AFE – Grid Converter as battery interface



# Danfoss Drives

## AFE – Grid Converter as a battery interface

- The Marine industry is on top when utilizing the latest Lithium-ion battery technology for hybridization to achieve better efficiency and sustainability onboard all kinds of vessels. Danfoss Drives has been involved for the last ten years, delivering drive systems.
- Battery-hybridization still brings up demands for new functionalities for AC-drive technology; this is due to wide variations in Lithium-ion battery types, how to use them properly and how to control them in the best possible way.
- Products from Danfoss Drives are power electronics ‘components’ up to multi megawatts, creating system functionality for hybridization in many forms.
- Research partners can provide a safe environment to create new and tested ideas. Collaboration with proper research partners is mandatory to learn specific demands for components for hybridization in the future.
- FESSMI provided a reliable laboratory environment to verify the ‘Active Front End Interface for the Battery’ as the part of vessel-wide system simulations