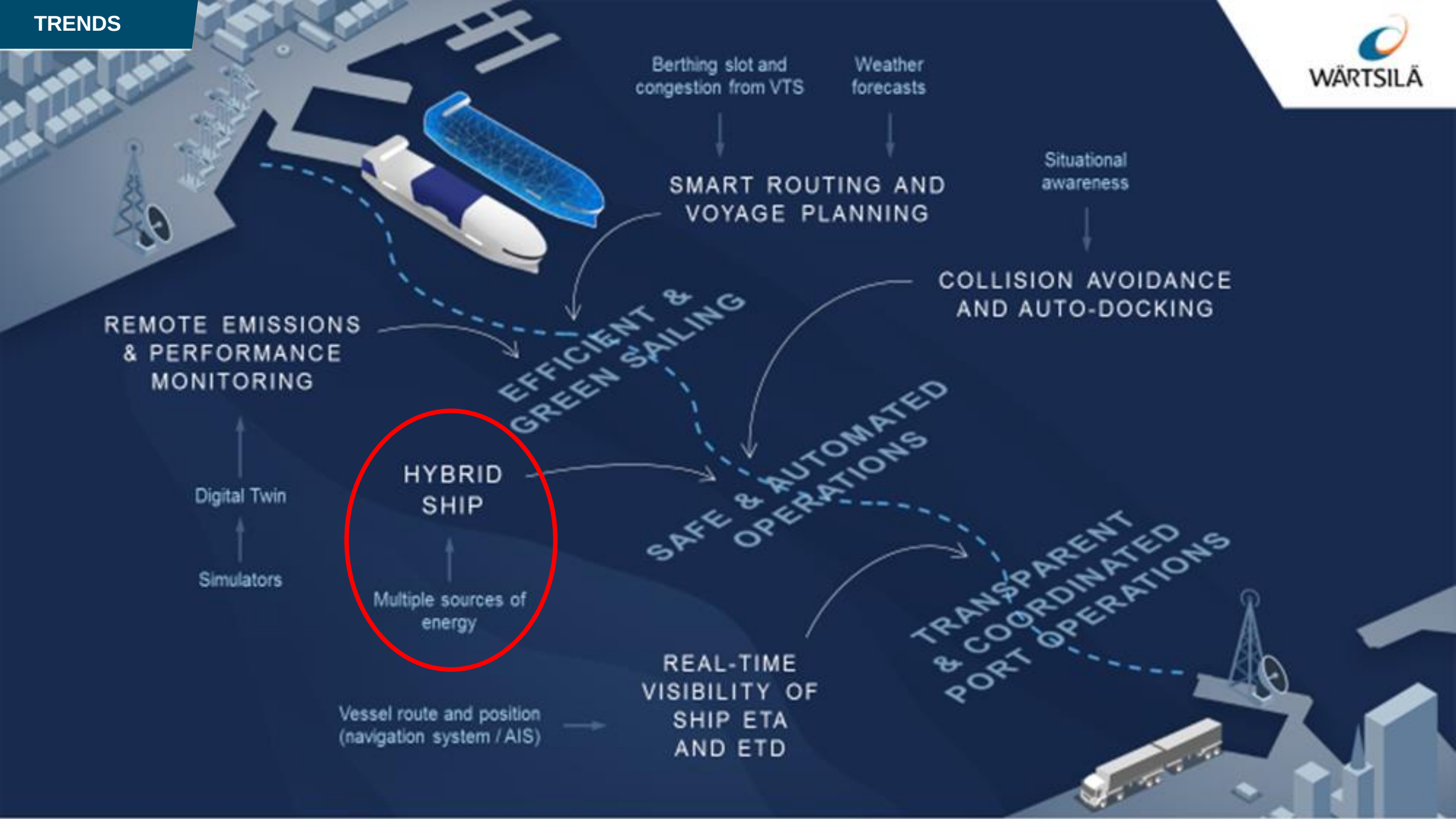
Wärtsilä Hybrid Solutions

Michael Uecker-Weigel
General Manager Area Sales

WÄRTSILÄ


Berthing slot and congestion from VTS
Weather forecasts
SMART ROUTING AND VOYAGE PLANNING
Situational awareness
COLLISION AVOIDANCE AND AUTO-DOCKING
REMOTE EMISSIONS & PERFORMANCE MONITORING
EFFICIENT & GREEN SAILING
SAFE & AUTOMATED OPERATIONS
TRANSPARENT & COORDINATED PORT OPERATIONS
HYBRID SHIP
Digital Twin
Simulators
Multiple sources of energy
Vessel route and position (navigation system / AIS)
REAL-TIME VISIBILITY OF SHIP ETA AND ETD

HYBRID ENERGY SYSTEM

Hybrid Energy System =

Combination of several different energy sources or power conversions and the means to store energy in a storage medium.

Energy

Controlled by the **Energy Management System (EMS)**:

- Maximize the electric and mechanical energy generated from the minimum amount of fossil fuel.
- Maximize the useful work obtained from the minimum amount of generated energy.

混合动力系统

混合动力系统 =
结合不同的能源或动力，并将能量集中存储。

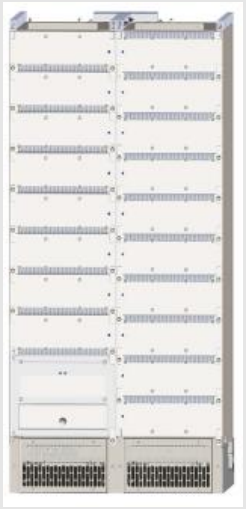
Energy

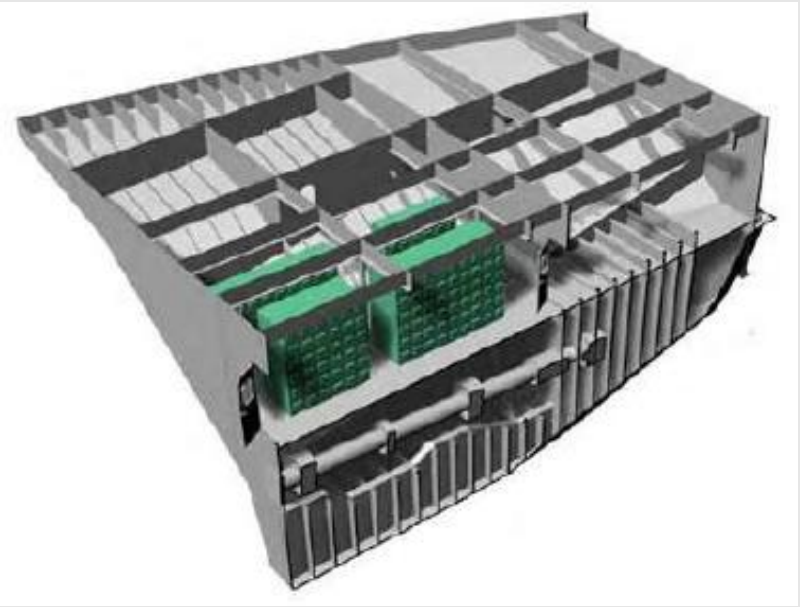
由**能量管理系统(EMS)**控制:

- 以最少的燃料，产生最大化的电能和动能。
- 以最少的能量，产出最大化的有用功。

BENEFITS of ENERGY STORAGE

- **Optimized engine operation**
  - Energy storage support operation of engines at optimal specific fuel consumption
- **Reduced engine transients**
  - Energy storage will be used to reduce transient loads in engines. Transients will increase fuel consumption and emissions.
  - Maintenance cost will be reduced
- **Increased redundancy and efficient operations**
  - Power redundancy requirements requires engines to run at low loads. With energy storage as redundant power the engine will operate more efficient on higher loading and secure back-up in case of trip of engine.
  - Engine operation time will be reduced.

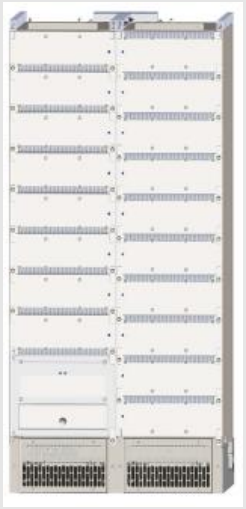


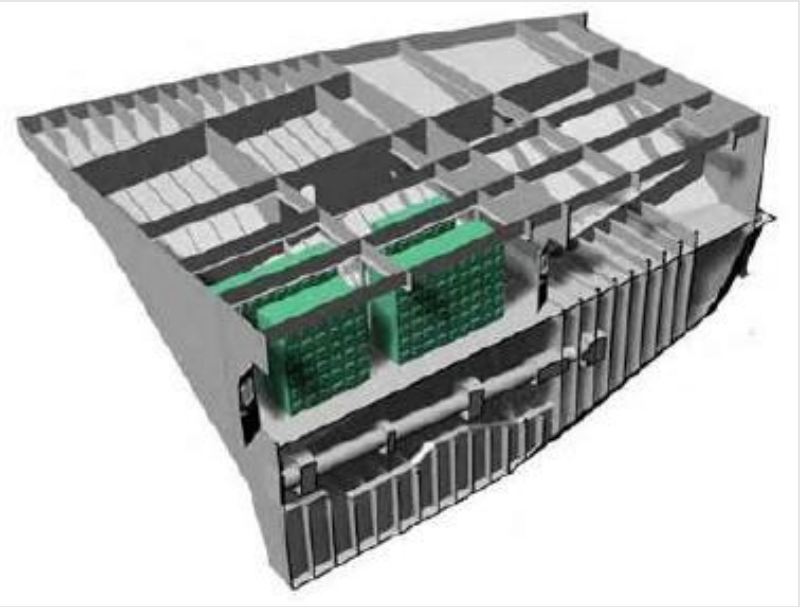


WÄRTSILÄ

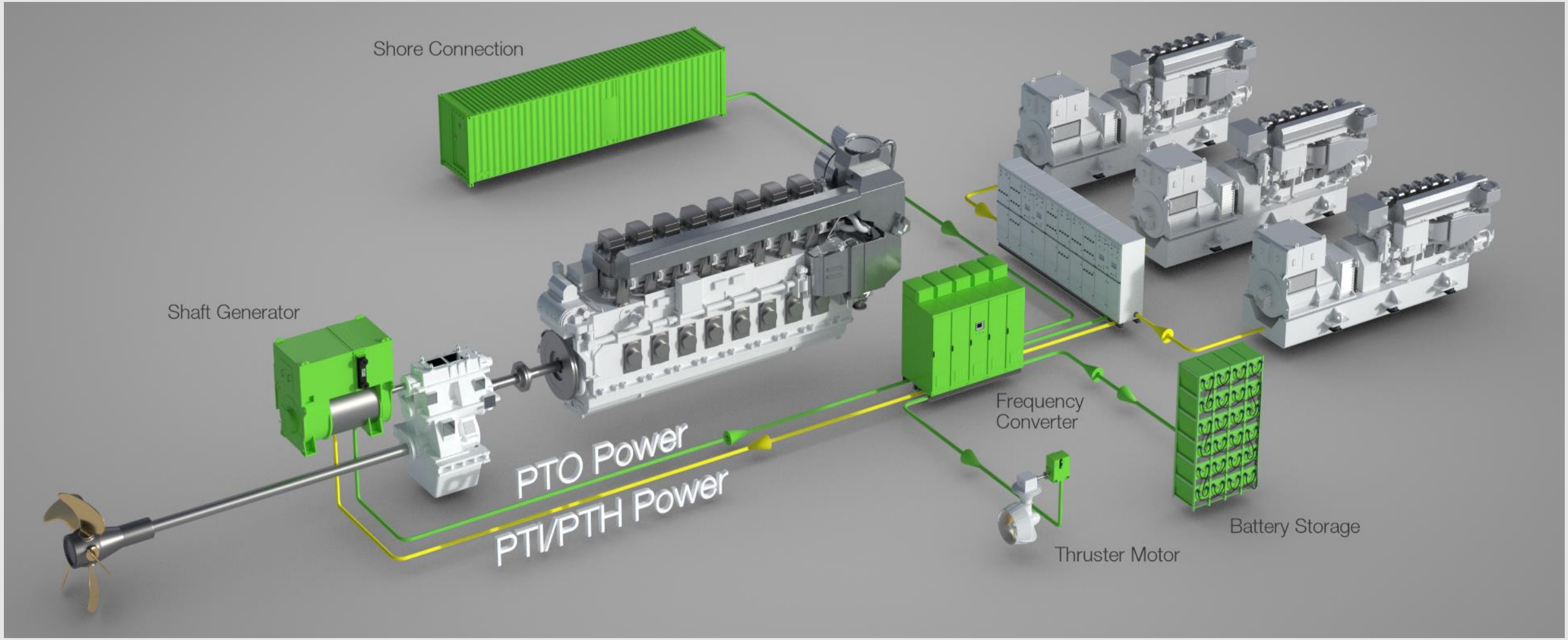
能量存储的优势

- **优化的发动机操作**
  - 能量存储支持发动机在最优的燃油工况下运行。
- **Reduced engine transients减少发动机瞬变**
  - 能量存储减少发动机的瞬态负载，进而减少油耗和排放。
  - 降低维护成本
- **增加冗余和高效运营**
  - 电源冗余需要发动机在低负载下运行。以能量存储作为冗余动力，发动机可以在更高的负载下运行，同时效率更高，并且确保在发动机跳闸时，立刻供电。
  - 缩短发动机运行时间

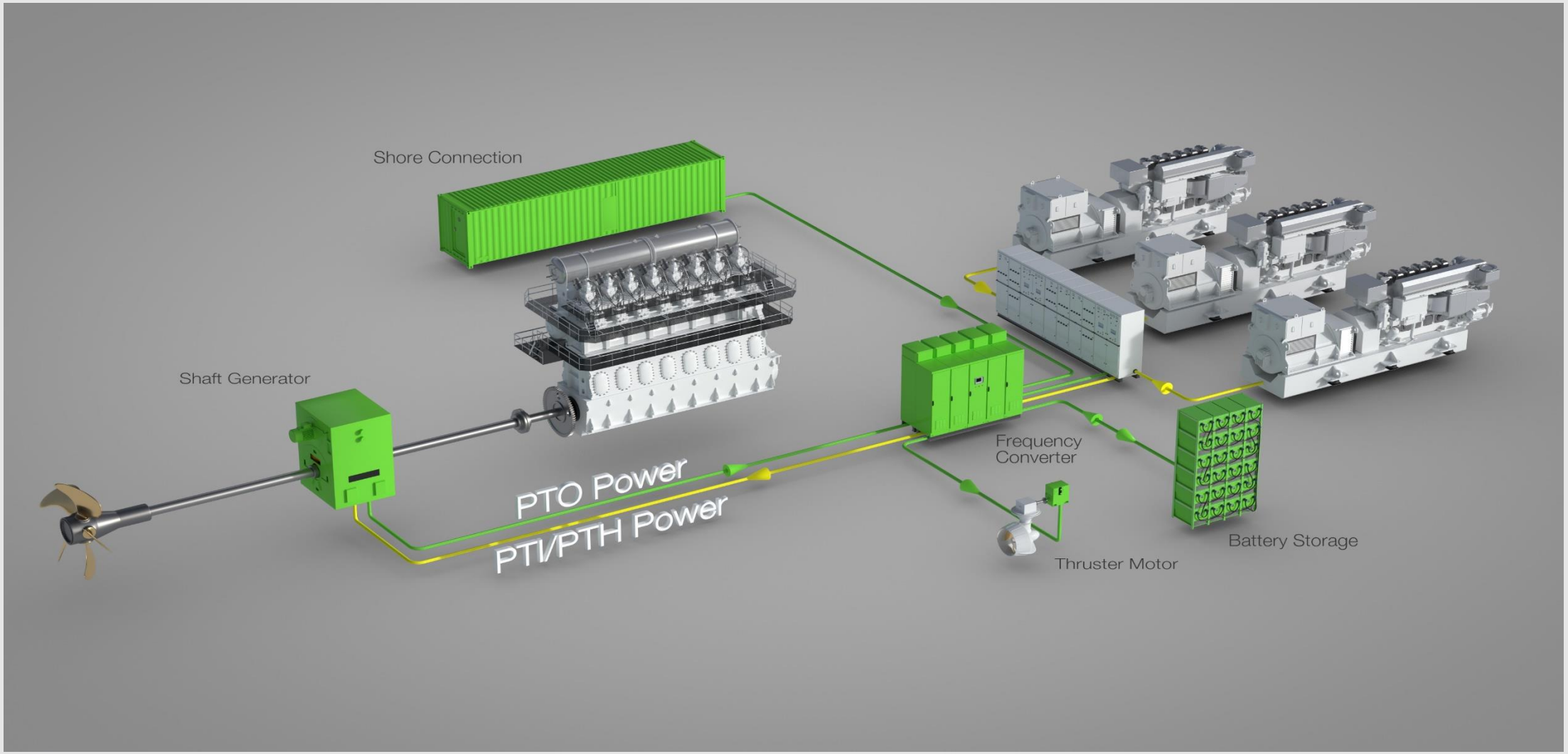




Operation Principles Hybrid System with Shaft Generator / Motor System PTO/PTI (gearbox type)



Operation Principles Hybrid System with Shaft Generator / Motor System PTO/PTI (in-line type)



Shipyard: Yantai CIMC Raffles Offshore Ltd.
Hull Nos: YCRO H479 / Cargo Vessel
End Customer: Aker BioMarine Antarctic Services
– under construction -

Scope of Supply

- Battery Solution
- Energy Management System (EMS)
- Hybrid Drive Switchboard
- PTI/PTO electric motor/generator
- 690V Main Switchboard
- Tunnel Thrusters Frequency Drives
- Tunnel Thrusters E-Motor

Technical Features

- Wärtsilä hybrid propulsion solution supported by batteries
  → results in very low emission levels
- Engine's load fluctuations and vessel load variations
  → will be absorbed through batteries
- The engines can be operated close to its optimum design point,
  → will provide the highest level of efficiency
  = minimised exhaust emissions
- The vessel can operate on battery in harbour
  → minimizing noise and local pollution.

船厂: Yantai CIMC Raffles Offshore Ltd.
船号船型: YCRO H479 / Cargo Vessel
船东: Aker BioMarine Antarctic Services
– 建造中-

供货范围

- 电池解决方案
- 能量管理系统(EMS)
- 混合驱动变频器
- PTI/PTO 轴带发电机
- 690V 主配电板
- 侧推变频器
- 侧推马达

技术特征

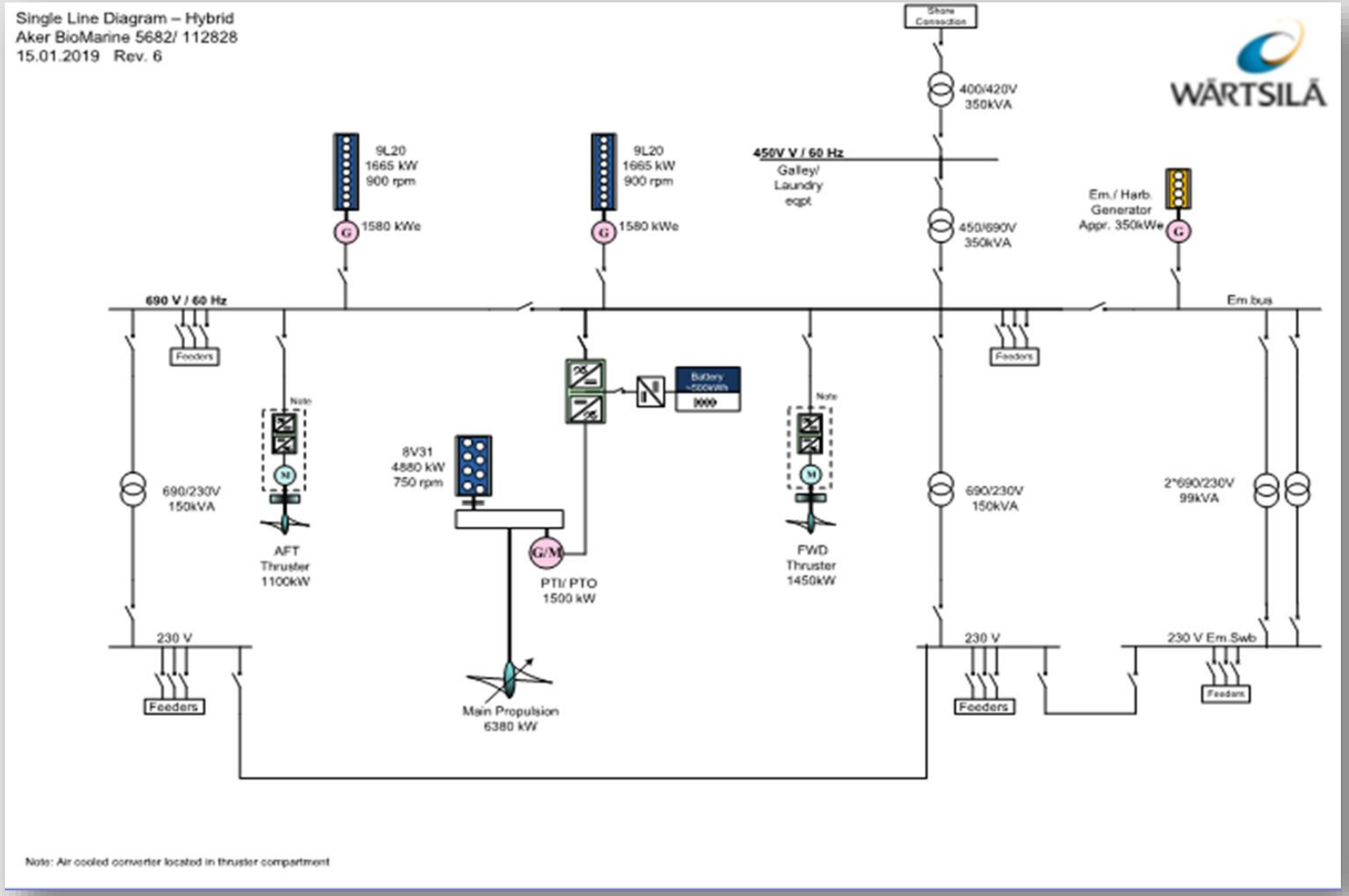
瓦锡兰电池混合推进解决方案
→ 达到了极低的排放水平

发动机负载波动和船舶负载变化
→ 通过电池吸收

发动机可以接近其最佳设计点操作
→ 提供最高效率，同时减少排放

该船可以在港口使用电池操作
→ 尽可能减少噪音和局部污染

YCRO H479 / Cargo Vessel



Customers: Jinling Shipyard / Finnlines
Vessel Type: 3x “Green Ro-Ro Vessel”
238m long, 5,800 lane meters
– under construction -

Scope of Supply

- 2x Shaft Generator / Motor System; Power Take-Off (PTO) 2000kW, Power Take-In (PTI) 2000kW Slow-speed, in-line type
- 2x Hybrid Power Converter, AFE-PWM-type, incl. modules for Bow Thruster Motor (1800kW) and for battery
- 4x Battery System each 1250kWh
- Energy Management System (EMS)

Technical Features

- Wärtsilä hybrid propulsion solution supported by batteries
  → results in very low emission levels
- Engine’s load fluctuations and vessel load variations
  → will be absorbed through batteries
- The engines can be operated close to its optimum design point,
  → will provide the highest level of efficiency = minimised exhaust emissions
- The vessel will operate on battery in harbour
  → guaranteeing “**zero emissions in port**”.

客户: Jinling Shipyard / Finnlines
船型: 3x “Green Ro-Ro Vessel”
238m long, 5,800 lane meters
– 建造中 -

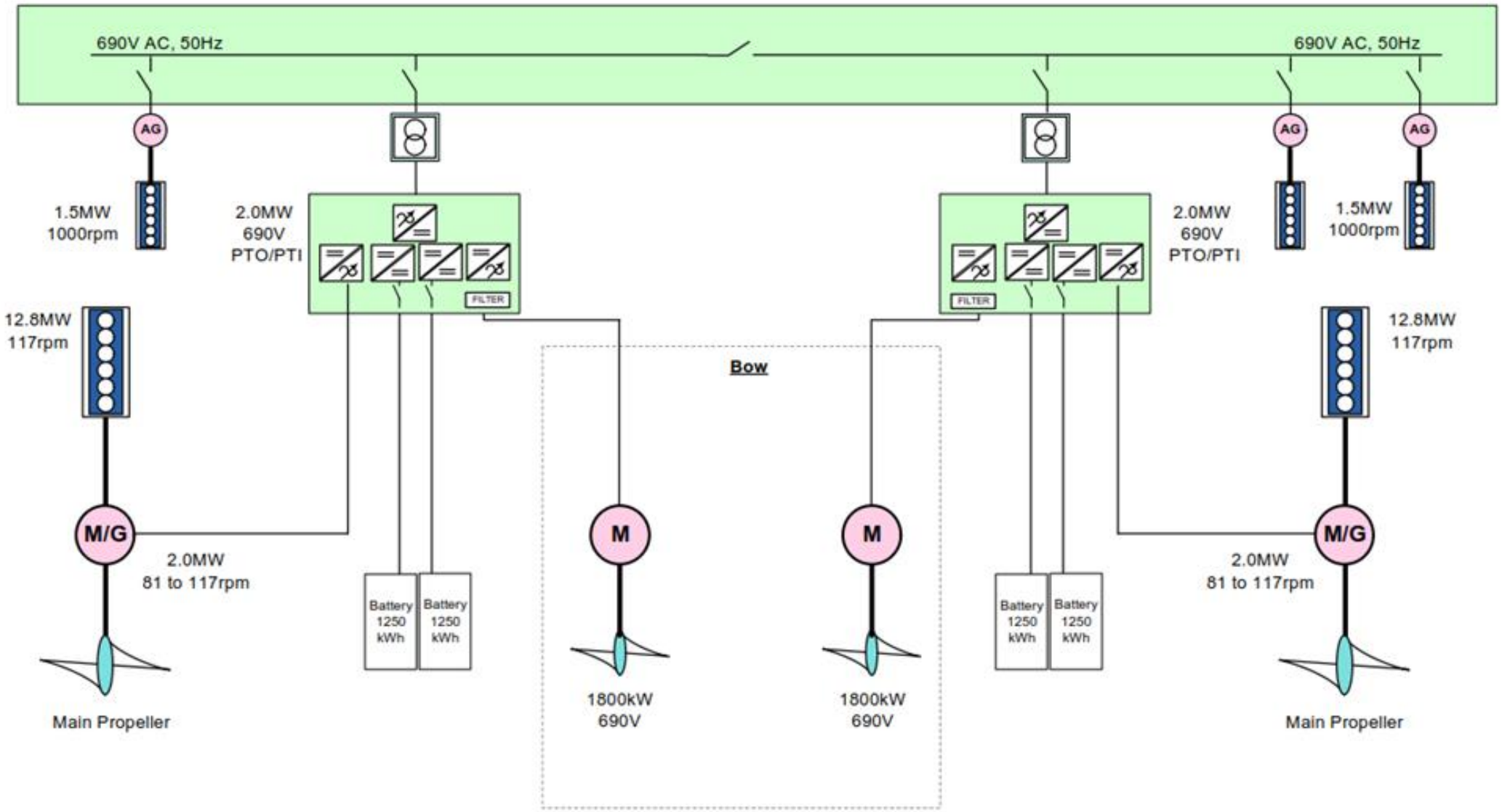
供货范围

- 2x 轴带发电机系统;
  Power Take-Off (PTO) 2000kW,
  Power Take-In (PTI) 2000kW
  低速抱轴式
- 2x 混合动力变频器,
  AFE-PWM-型, 包括艏侧推马达 (1800kW) 和电池
- 4x 电池系统，1250kWh/每组
- 能量管理系统(EMS)

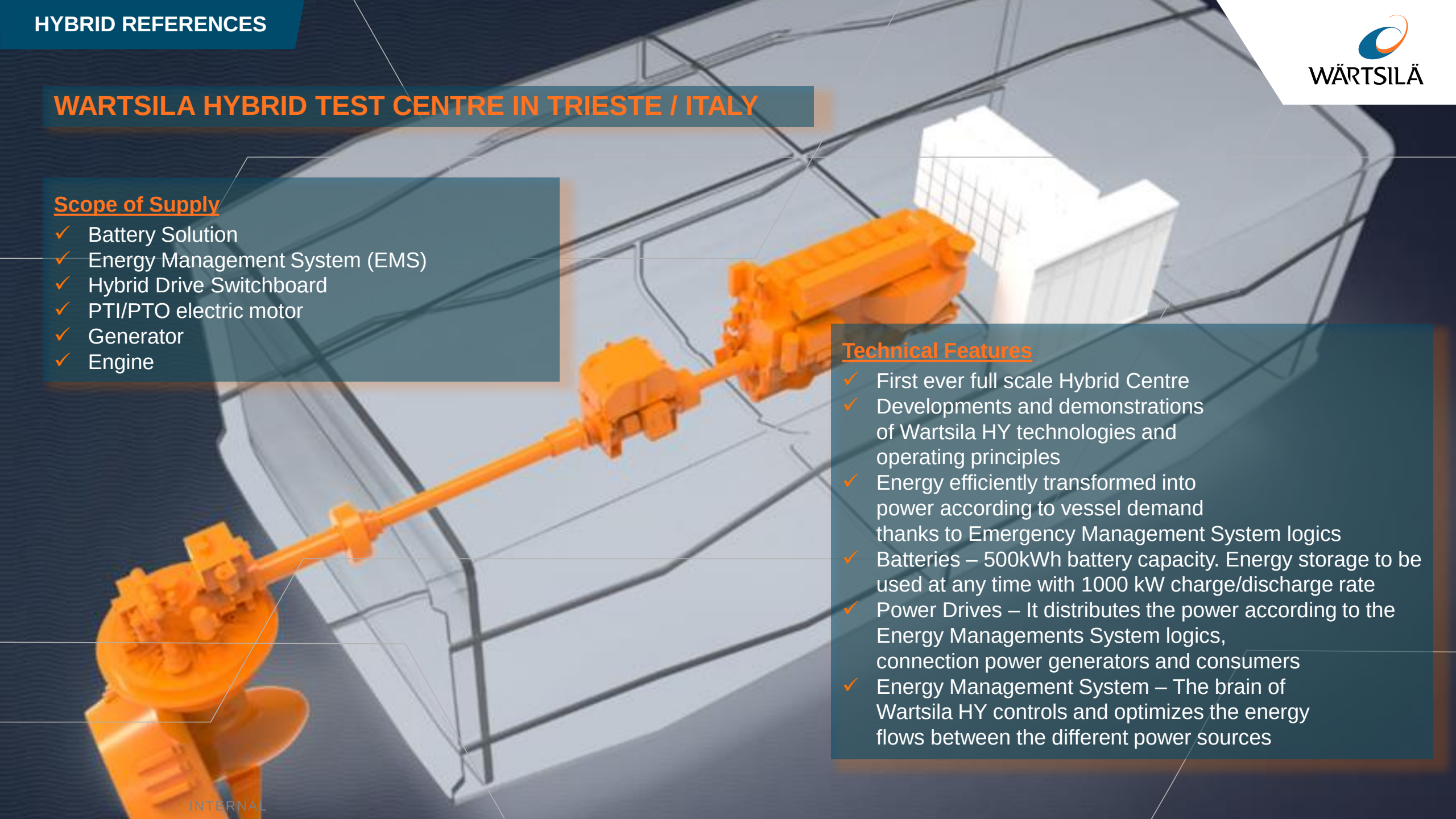
技术特征

- 瓦锡兰电池混合推进解决方案
  → 达到了极低的排放水平
- 发动机负载波动和船舶负载变化
  → 通过电池吸收
- 发动机可以接近其最佳设计点操作
  → 提供最高效率，同时减少排放
- 该船可以在港口使用电池操作
  → 保证"港口零排放"

REFERENCE HYBRID SYSTEM – CHINA -



WARTSILA HYBRID TEST CENTRE IN TRIESTE / ITALY



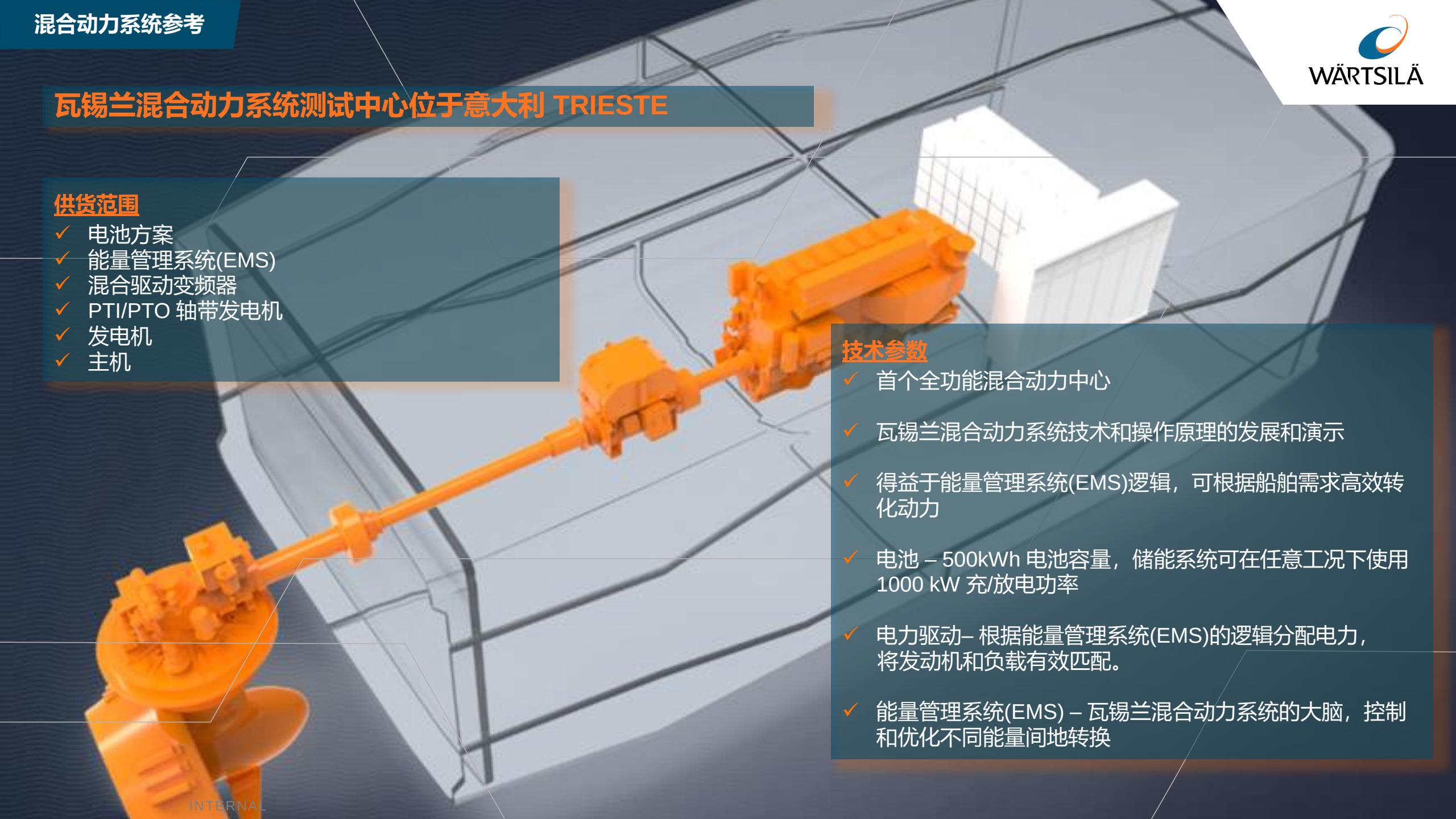
Scope of Supply

- ✓ Battery Solution
- ✓ Energy Management System (EMS)
- ✓ Hybrid Drive Switchboard
- ✓ PTI/PTO electric motor
- ✓ Generator
- ✓ Engine

Technical Features

- ✓ First ever full scale Hybrid Centre
- ✓ Developments and demonstrations of Wartsila HY technologies and operating principles
- ✓ Energy efficiently transformed into power according to vessel demand thanks to Emergency Management System logics
- ✓ Batteries – 500kWh battery capacity. Energy storage to be used at any time with 1000 kW charge/discharge rate
- ✓ Power Drives – It distributes the power according to the Energy Managements System logics, connection power generators and consumers
- ✓ Energy Management System – The brain of Wartsila HY controls and optimizes the energy flows between the different power sources

瓦锡兰混合动力系统测试中心位于意大利 TRIESTE



供货范围

- ✓ 电池方案
- ✓ 能量管理系统(EMS)
- ✓ 混合驱动变频器
- ✓ PTI/PTO 轴带发电机
- ✓ 发电机
- ✓ 主机

技术参数

- ✓ 首个全功能混合动力中心
- ✓ 瓦锡兰混合动力系统技术和操作原理的发展和演示
- ✓ 得益于能量管理系统(EMS)逻辑，可根据船舶需求高效转化动力
- ✓ 电池 – 500kWh 电池容量，储能系统可在任意工况下使用 1000 kW 充/放电功率
- ✓ 电力驱动– 根据能量管理系统(EMS)的逻辑分配电力，将发动机和负载有效匹配。
- ✓ 能量管理系统(EMS) – 瓦锡兰混合动力系统的大脑，控制和优化不同能量间地转换

WÄRTSILÄ

VIKING LADY
OWNER: EIDESVIK OFFSHORE AS

Technical Features

Platform Supply Vessel with Fuel cell and Battery

- ✓ Battery and Fuel cell Class Notations developed by DNV throughout this project period.
- ✓ 15% reduced fuel consumption
- ✓ 25% reduced NOx emission
- ✓ 30% reduced CH4 emission
- ✓ First documented consistent hybrid operation

Scope of Supply

- ✓ Energy Management System (EMS)
- ✓ Hybrid Power Electronic
- ✓ Battery Solution
- ✓ Container for HY equipment
- ✓ DNV- GL class notation “Battery (Power)”

WÄRTSILÄ

VIKING PRINCESS
OWNER: EIDESVIK OFFSHORE AS

Technical Features

- ✓ Hybrid conversion according to DNVGL Battery Power notation
- ✓ Dual Fuel-Electric with Wärtsilä LLC System
- ✓ Refit complete battery hybrid system complying with DNV-GL class notation “Battery (power)”
- ✓ Replacing one generator set
- ➢ Fuel reduction DP (one eng + batt): - 30%
- ➢ Total fuel reduction - 15-17%
- ➢ Reduced engine running hours - 33-38%

Scope of Supply

- ✓ Energy Management System (EMS)
- ✓ Hybrid Power Electronic
- ✓ Battery Solution
- ✓ Container for HY equipment
- ✓ DNV- GL class notation “Battery (Power)”

WÄRTSILÄ

6 x E-SHUTTLE CLASS
OWNER: TEEKAY

Technical Features

- ✓ It will be the most efficient shuttle tanker in operation
- ✓ Highly redundant DP2 based on LLC power distribution system
- ✓ Wartsila 34DF Engines
- ✓ Fully diesel electric propulsion combined with battery support
- ✓ Optimization of engines, gas turbine, batteries and the different fuels by the Energy Management System

ANNUAL REDUCTIONS

- ✓ Emission
  CO2 → - 42%
  NOx → - 84%
  Particles → - 96%
- ✓ Fuel Consumption → - 22%
- ✓ Bunkering → - 50%
- ✓ Running Hours Machineries → - 25%

Scope of Supply

- ✓ Integrated Control and Monitoring System
- ✓ Power Management System (PMS)
- ✓ LLC Transformer
- ✓ Generators
- ✓ Electrical motors for Main Propulsion and Thrusters
- ✓ Uninterruptible Power Supply
- ✓ 690V Low voltage MSWBD
- ✓ Propulsion drives, Multidrive & Hybrid Drive
- ✓ Battery packages

Thank you for your attention!