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INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET


JOHAN HJORT
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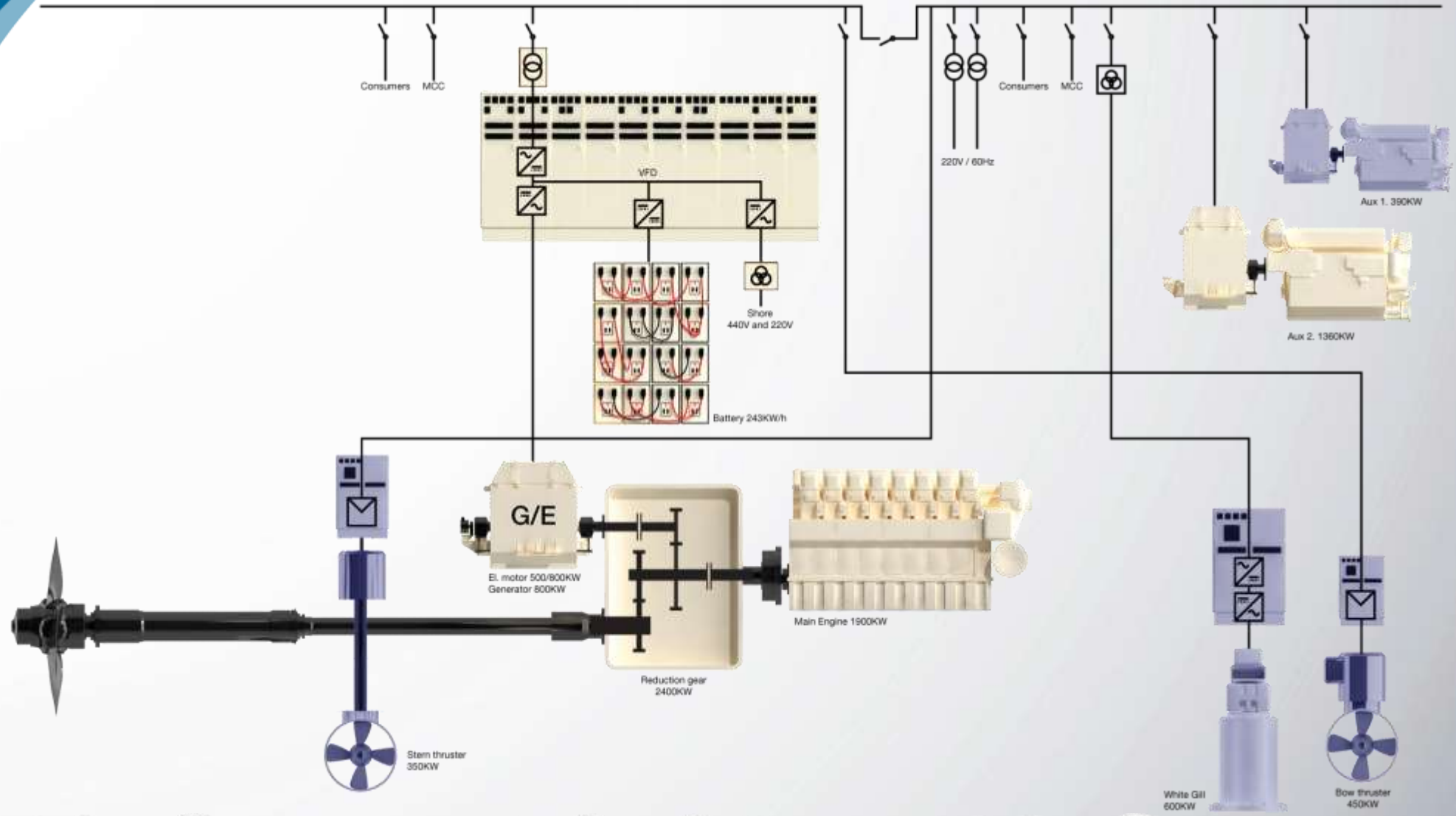
Johan Hjort conversion project:

Targets:

- Increase operational safety.
- Reduce fuel consumption.
- Reduce emissions.
- More flexible shore power capabilities.
- Reduced on-board noise.
- Reduced marine life contamination.
- Reduced underwater radiated noise.

System overview: propulsion & power distribution.



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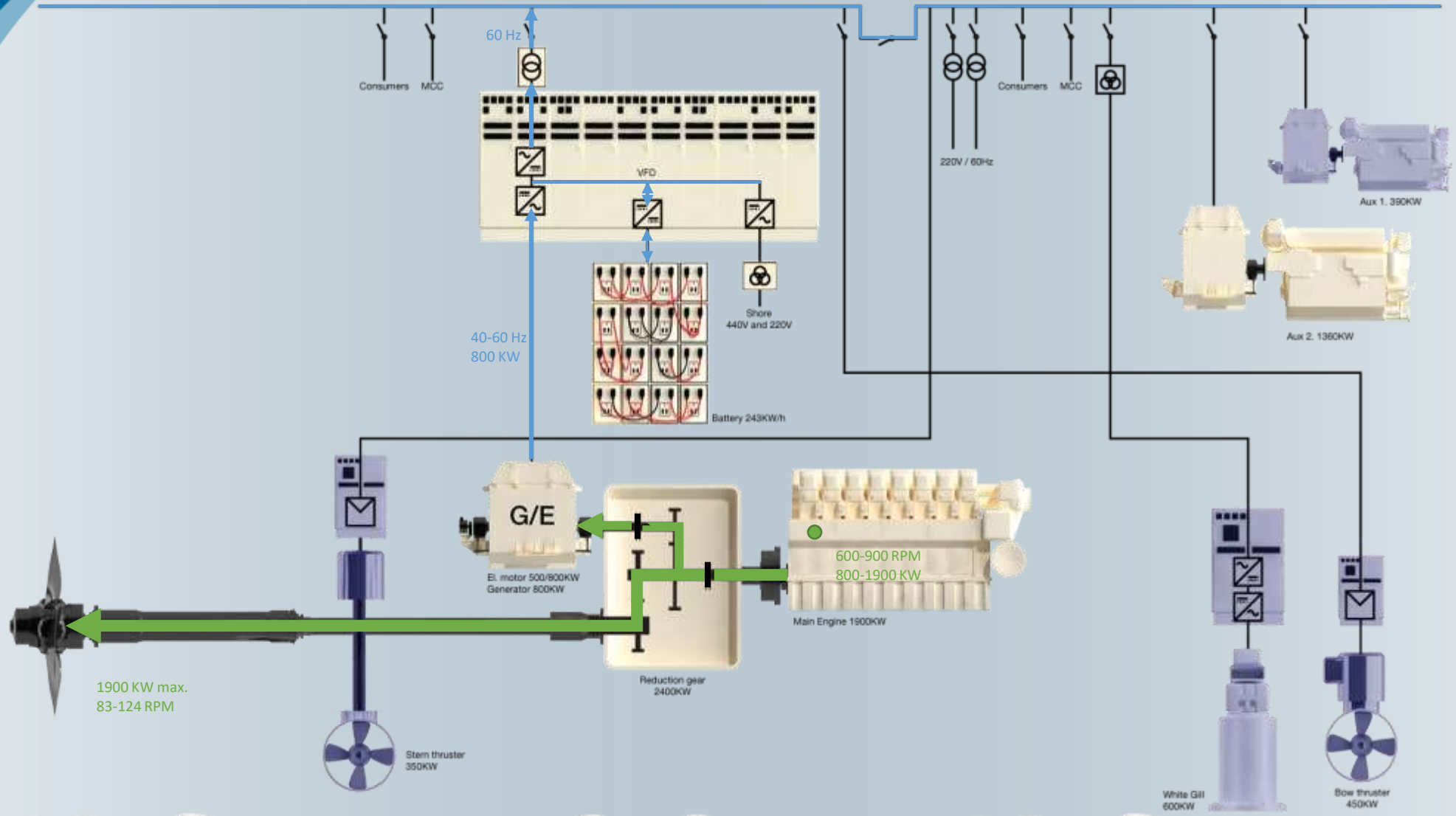
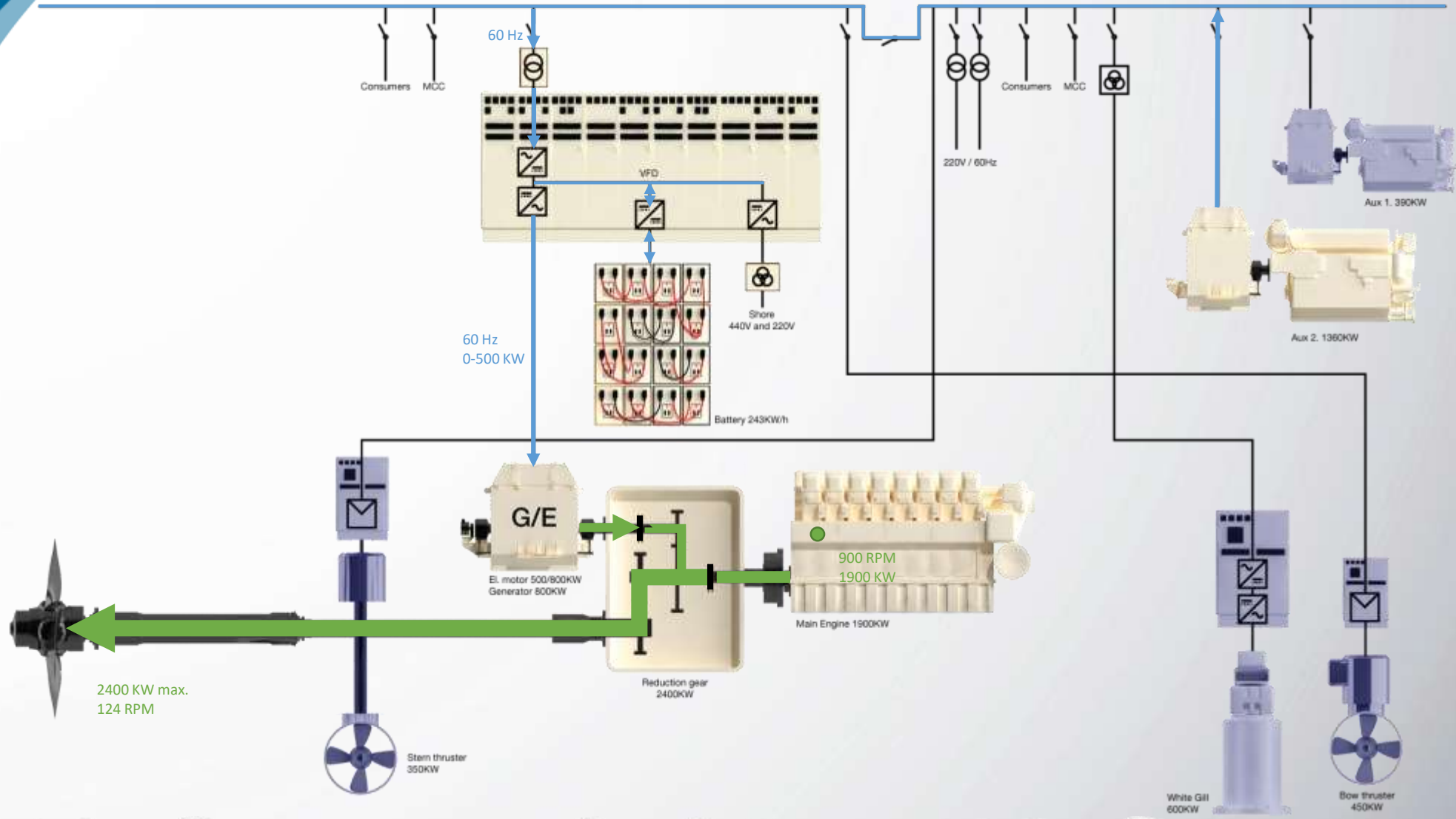
Propulsion: Diesel mechanical mode W/PTO available.



Propulsion: Diesel mechanical mode W/Boost.



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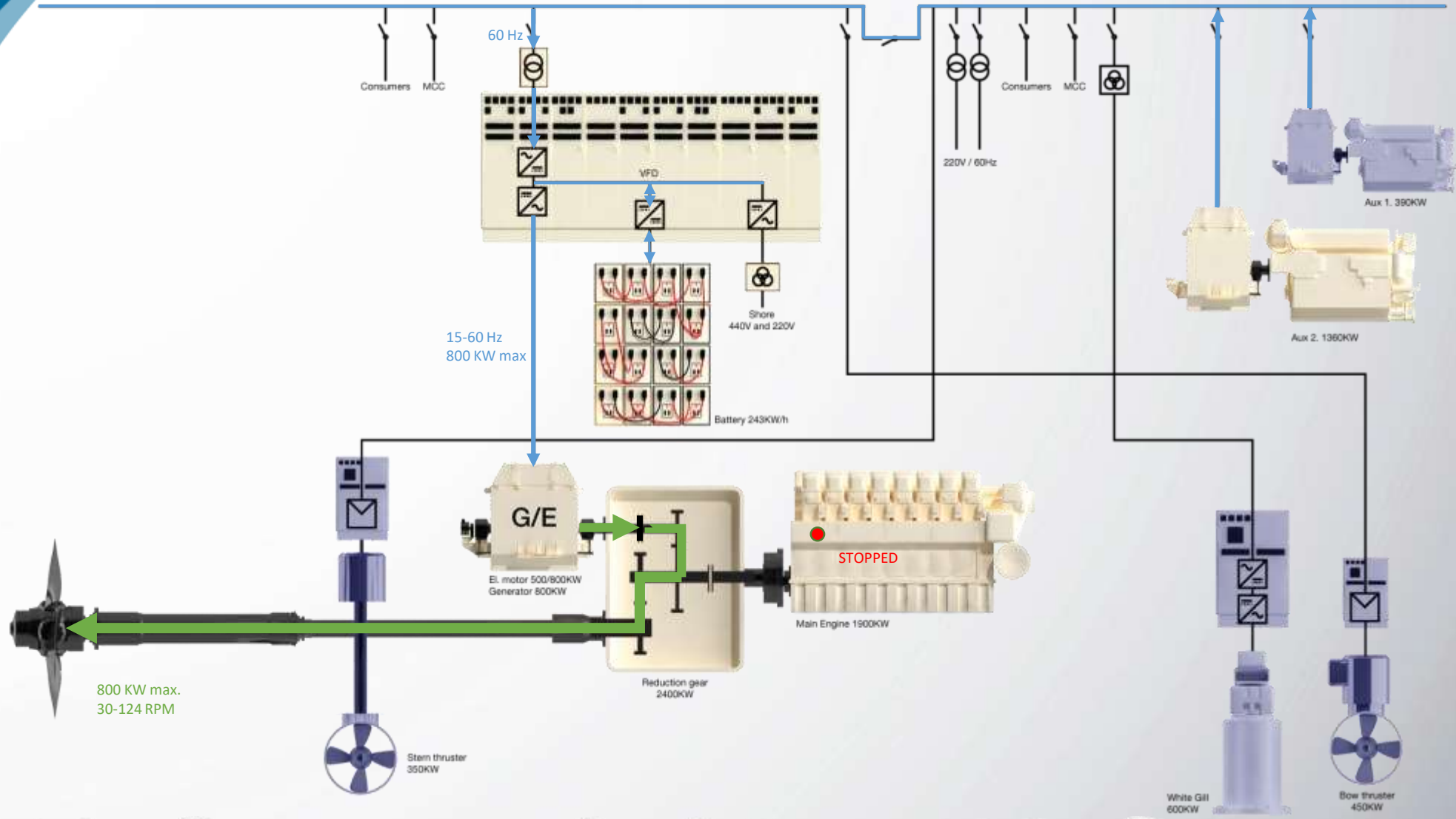
Propulsion: Diesel electric mode.



- Possible with one or two Aux. Running.

<u>Only new Cat 3512 running.</u>

- Silent mode. Double isolated mounting and >35dB exhaust noise reduction.
- IMO Tier III compliant. SCR and Urea plant.

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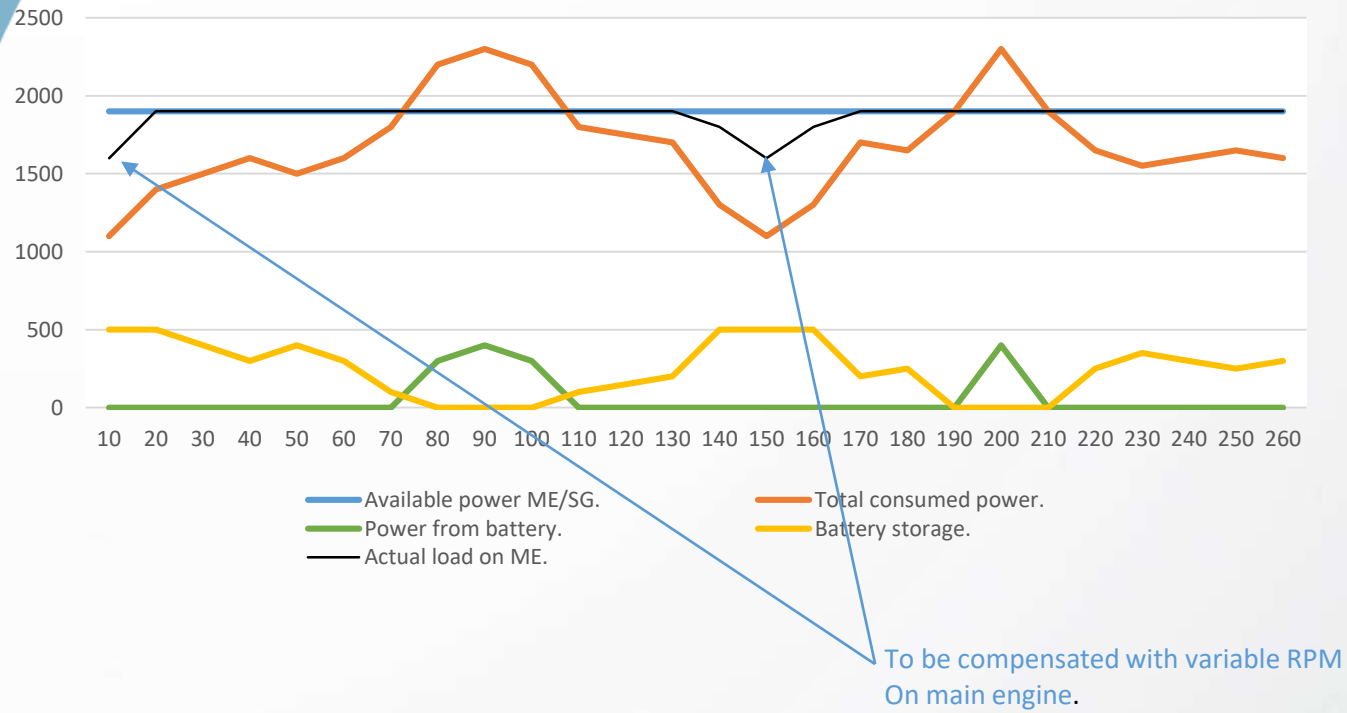
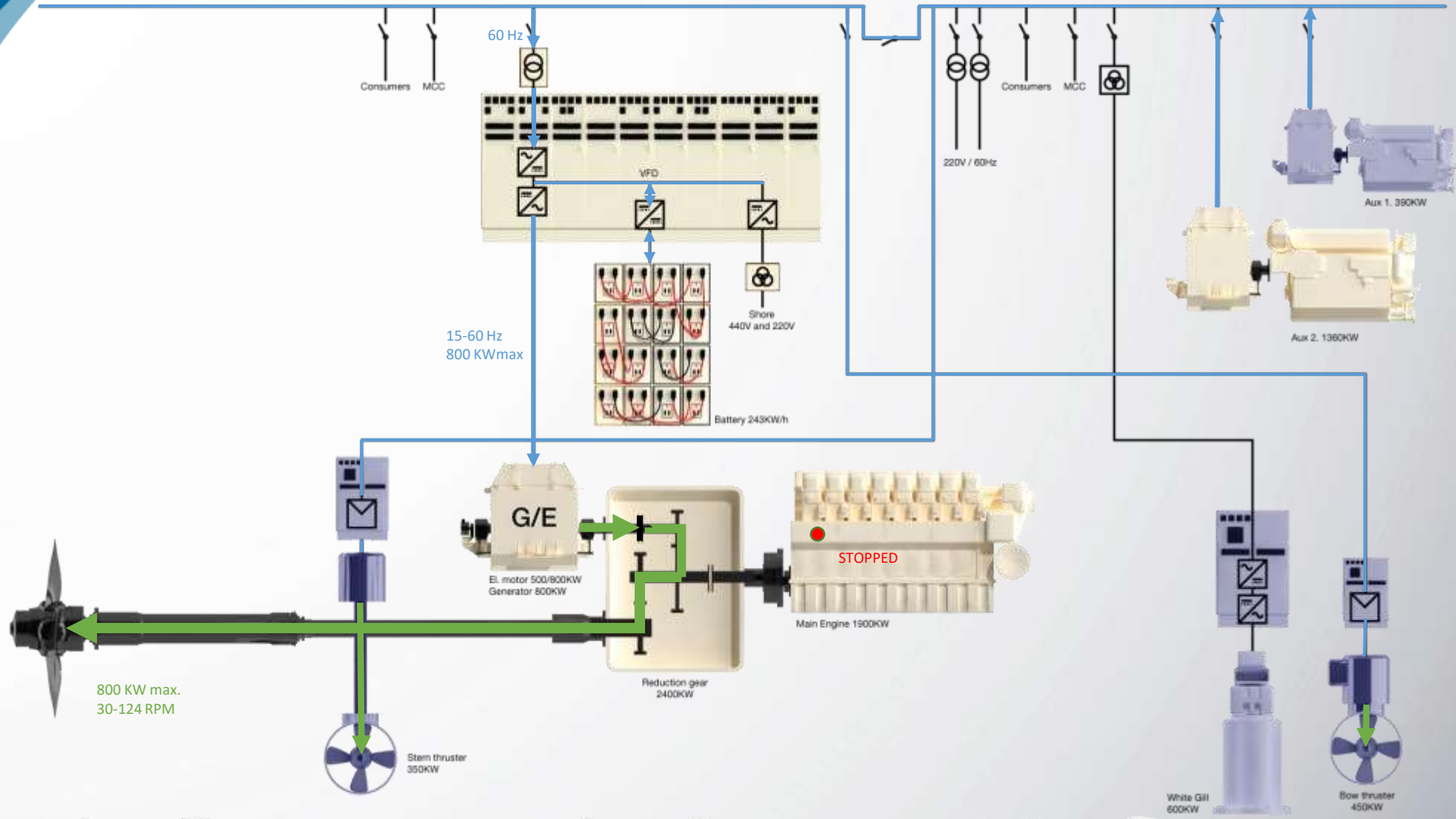
Battery functionality:

Peak shaving:



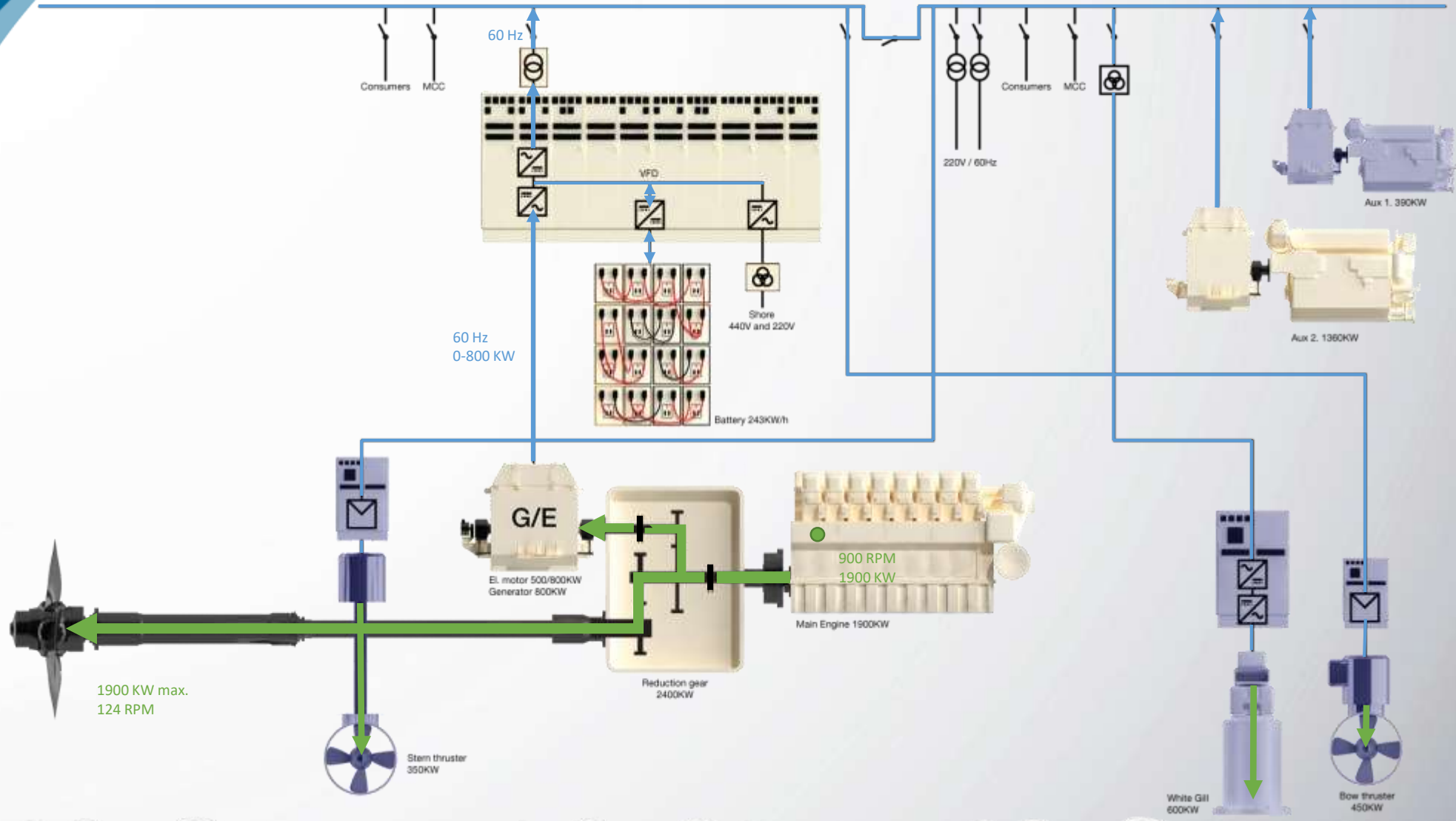
- Peak shaving- No need to start additional aux. power to compensate for short overload conditions.
- Battery charging in low power condition to maintain ideal load on ME→ Best specific fuel consumption and lower maintenance on ME.
- Combination with variable RPM on ME → further fuel reduction & ME load stability.

Operational modes: Low-power DP.



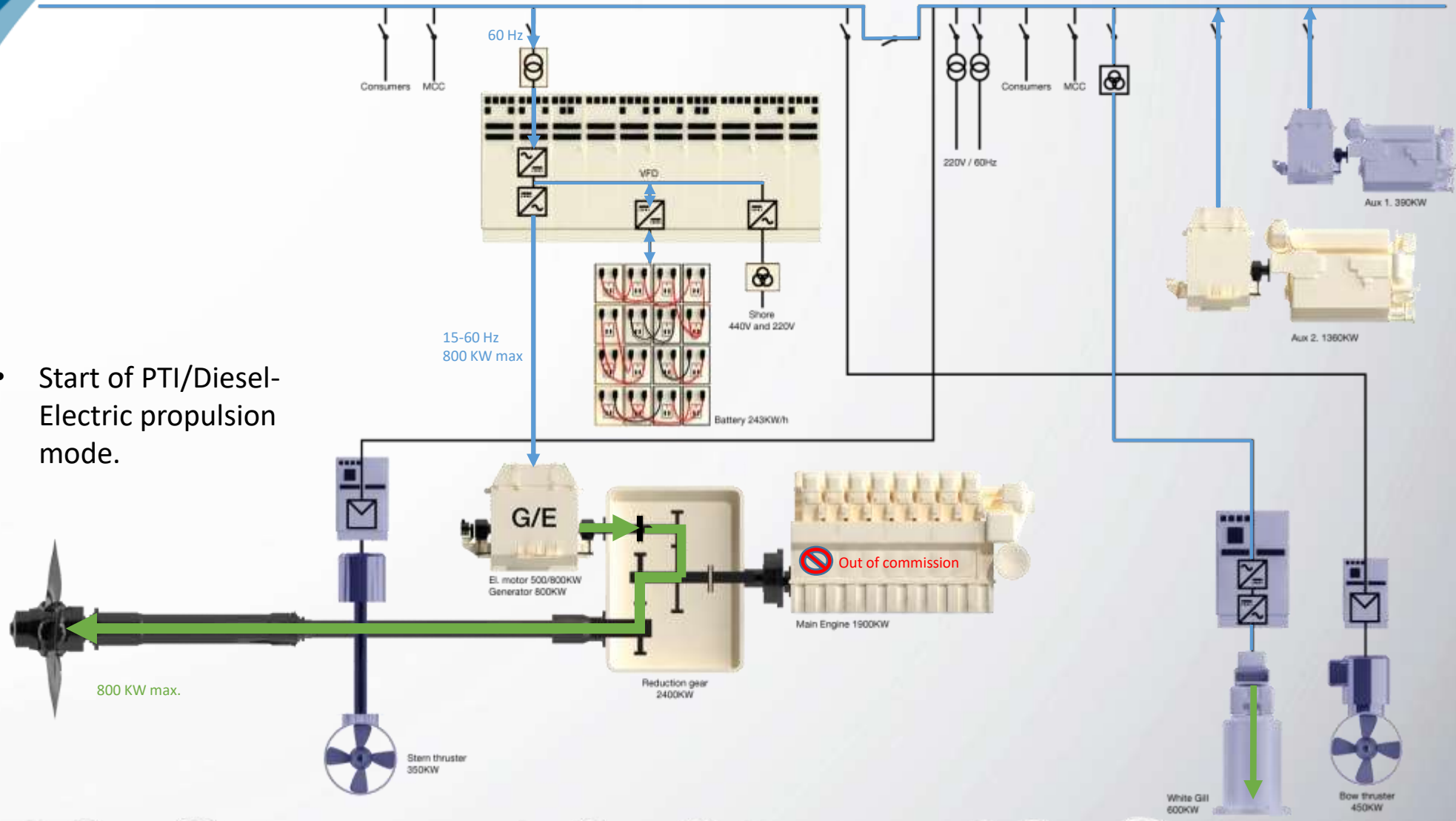
- Possible with one or two Aux. Running. PMS will start/stop additional Aux based on power demand.

Operational modes: High-power DP.



- Possible with one or two Aux. Running in parallel with SG. PMS will start/stop additional Aux based on power demand.

Operational modes: Emergency 'Take home' 1.

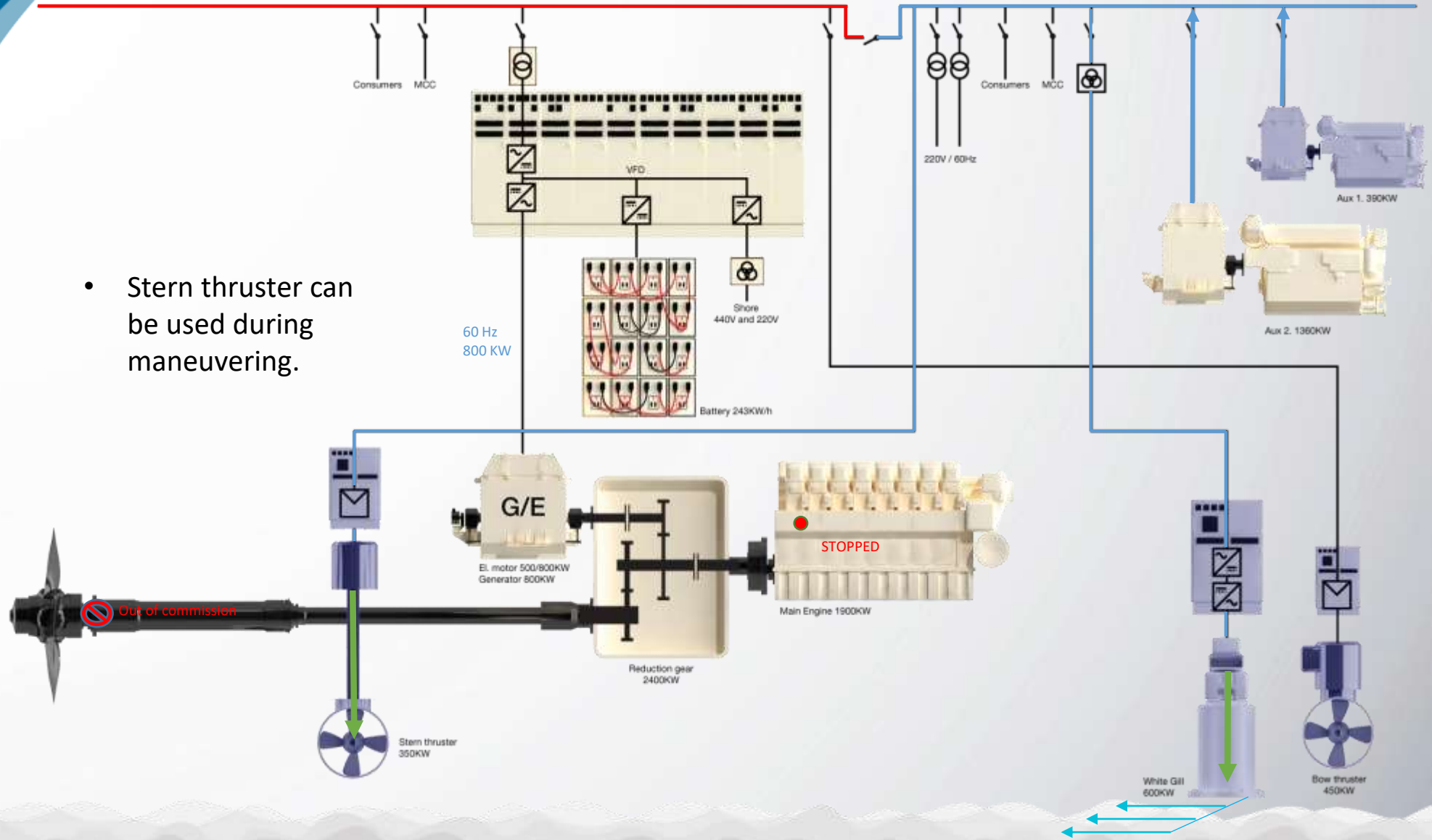


- Start of PTI/Diesel-Electric propulsion mode.

- Possible with one or two Aux. Running. PMS will start/stop additional Aux based on power demand.
- White Gill or Bow thruster can be used during maneuvering.

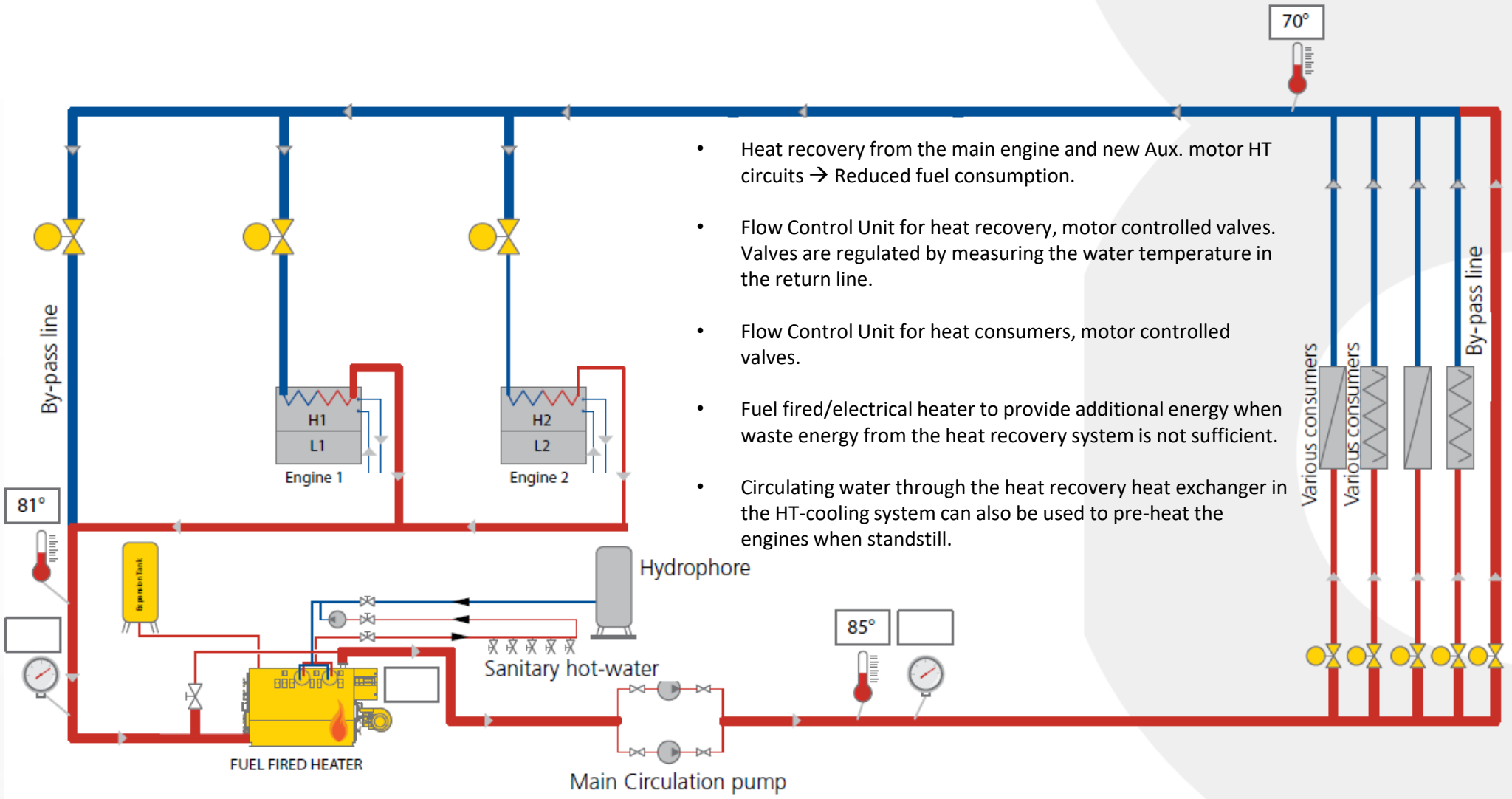
Operational modes: Emergency 'Take Home' 2.

- Stern thruster can be used during maneuvering.



- White Gill to be used for propulsion.

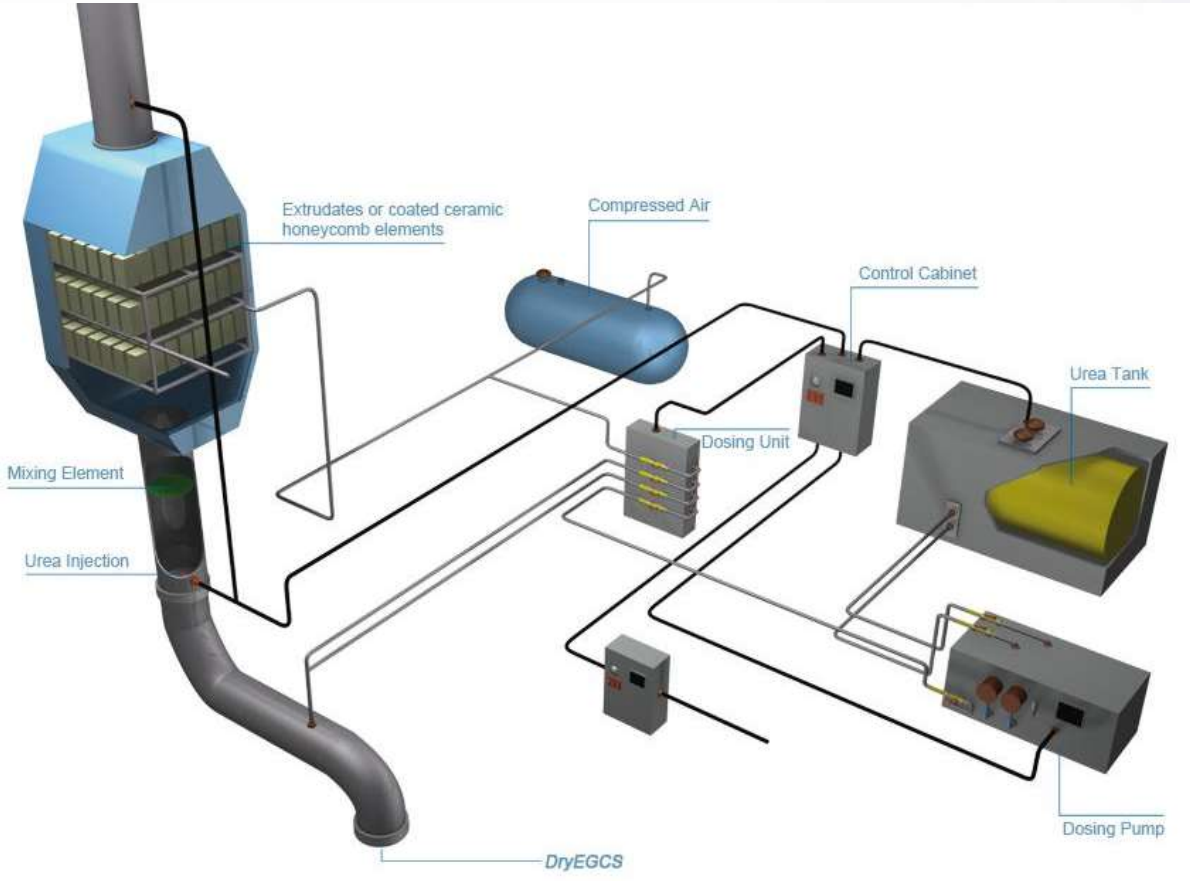
System overview: Heat Recovery.



- Heat recovery from the main engine and new Aux. motor HT circuits → Reduced fuel consumption.
- Flow Control Unit for heat recovery, motor controlled valves. Valves are regulated by measuring the water temperature in the return line.
- Flow Control Unit for heat consumers, motor controlled valves.
- Fuel fired/electrical heater to provide additional energy when waste energy from the heat recovery system is not sufficient.
- Circulating water through the heat recovery heat exchanger in the HT-cooling system can also be used to pre-heat the engines when standstill.

System overview: SCR (Selective Catalytic Reduction).

The SCR unit for the Johan Hjort project will be installed in connection with the new auxiliary diesel generator, enabling the vessel to operate within the IMO Tier III regulations when in diesel electric mode / PTI. This will be the main operational mode for the vessel.



The SCR system normally give reduction as follows:

- NOx 85-99 % reduction
- HC 70-90 % reduction
- Soot reduction 20 - 30 %
- Noise: SCR 15 dBA + Muffler 25dBA reduction

Operation:

- Temperature range 285 – 500 °C
- Fuel MGO / MDO

Specific Costs:

- Investment 30 – 50 € / kWh
- Operation 4 – 6 € / MWh

NOx reduction with 40 % urea:

- 15 l/h urea / MW engine power for 90 % NOx reduction
- 0.6815 kg NOx reduction per 1 liter urea injected

System overview: Ballast Water Management System

- Approved according to the IMO and DNV standards. Vessel to receive notation DNVGL-*BWM.
- Filter: minimum flow 24 m3/h, maximum flow 100 m3/h
- UV: one chamber, minimum flow 10 m3/h, maximum flow 150 m3/h
- Power consumption UV: minimum 7,2 KW, maximum 13,5 KW
- Skid or separate components.

Conclusion: -Increased operational safety

The operational safety of the vessel and the safety of the crew is increased dramatically by the introduction of several alternative propulsion modes. The configuration of the main distribution enables alternative propulsion even with total loss of a single propulsion line.

Conclusion: -Reduced fuel consumption

Several factors will contribute to reduced fuel consumption.

- Variable RPM on the main engine (& propeller) when in PTO mode will significantly reduce propeller off-pitch losses in low propulsion power transit conditions.
- Diesel electric mode (PTI) in DP conditions will enable further reduction in main propeller off-pitch losses.
- Battery peak shaving will reduce the need for start of additional auxiliary power during short time load peaks.
- Heat recovery of the main engine and new auxiliary engine HT circuits will reduce the demand for electric and/or fuel fired heating on board and subsequently reduce fuel consumption.

Conclusion: -Reduced emissions

The reduction in fuel consumption will consequently lead to equally reduced emissions. In addition the vessel is fitted with an IMO Tier III compliant SCR plant in it's main operational mode.

Conclusion: - Flexible shore power capabilities

The flexible shore power connection in conjunction with the battery peak shaving capabilities enables the vessel to connect to a variety of different available shore power supplies. Even if the available shore power has a slightly lower capacity than the peak demand of the vessel the battery will act as a buffer supply.

In turn the increased shore power capabilities will also lead to reduced fuel consumption.

Conclusion: - Reduced on-board noise

- Double resilient mounting on new auxiliary motor will reduce the on board structural noise when operating with only this auxiliary running.
- >35dB silencing on both auxiliary motor exhausts will reduce air borne noise on deck.
- Reduced propeller RPM will further reduce structural borne noise, especially in DP conditions and low propulsion power transit conditions (PTI mode & Variable RPM diesel mechanical mode).

Conclusion: - Reduced marine life contamination

IMO compliant ballast water treatment will ensure that the vessel dos not transfer and contaminate marine life.

In addition the reduced propeller noise due to variable RPM will reduce waterborne noise.

Conclusion: - Reduced underwater radiated noise.

- Double resilient mounting on new auxiliary motor minimize the transmission of vibration to hull structure.
- Specially designed low-noise propeller 30-124 RPM will minimize propeller cavitation.
- Noise reduced vessel will improve the performance with respect to fish avoidance behavior and detection range for seabed mapping/penetration.

Thanks

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