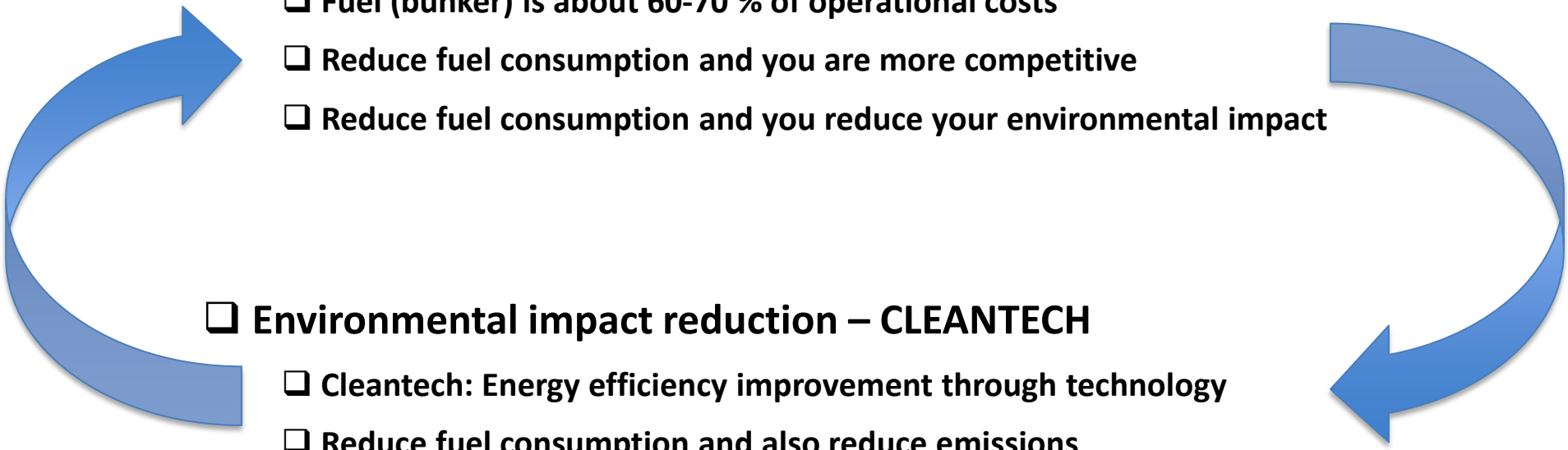
Energy Efficiency improvements in shipping

13.10.2015 WE Tech Solutions Oy / Mårten Storbacka

Drivers for improving energy efficiency in shipping – why is this interesting?

- **Operational cost reduction – IMPROVE COMPETITIVENESS**
  - **Fuel (bunker) is about 60-70 % of operational costs**
  - **Reduce fuel consumption and you are more competitive**
  - **Reduce fuel consumption and you reduce your environmental impact**



- **Environmental impact reduction – CLEANTECH**
  - **Cleantech: Energy efficiency improvement through technology**
  - **Reduce fuel consumption and also reduce emissions**
  - **Implement Cleantech in your business and become more competitive**

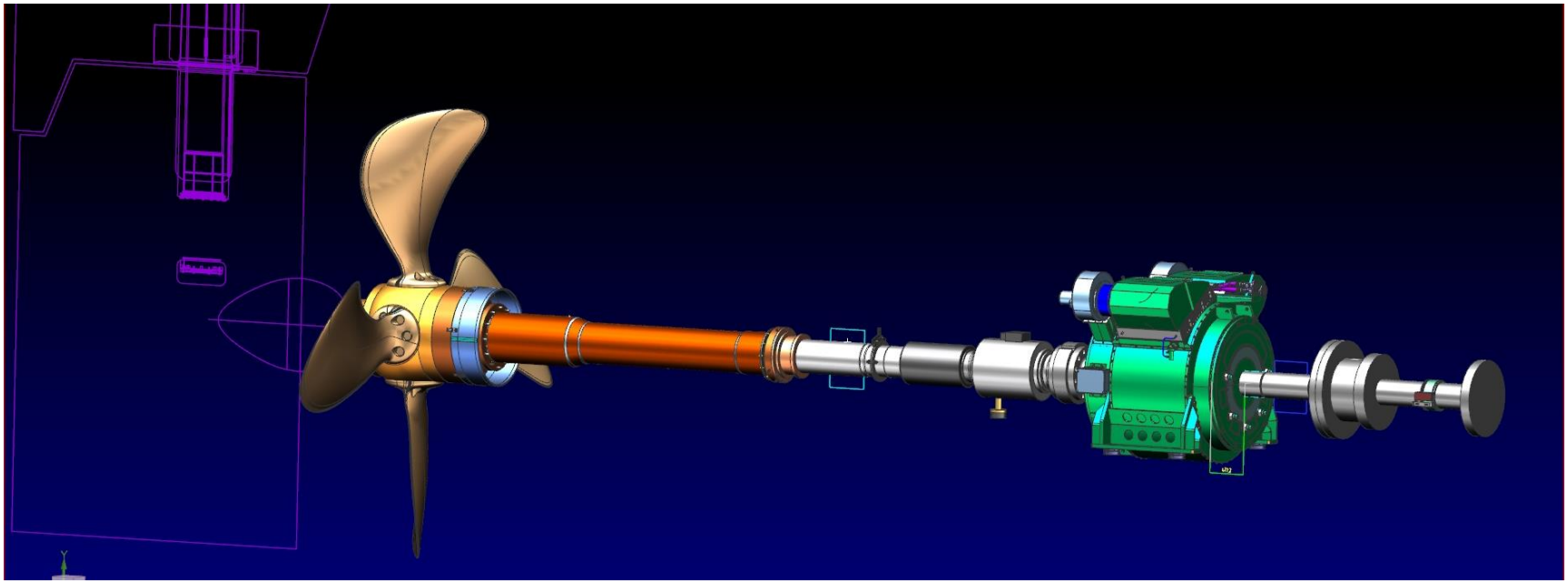
Cleantech for shipping – todays presentation:

- Short introduction of hybrid propulsion systems
  - Variable speed Shaft Generator
  - Shaft Generator as booster motor and Take Me Home device
  - DC-link distribution systems
  - Variable speed Auxiliary Generators and battery systems
  - LNG as fuel – additional flexibility with shaft generator
  - Cargo handling operations with variable speed shaft generator

CLEANTECH FINLAND

About WE Tech Solutions Oy

- WE deliver energy efficiency solutions to shipping industry
- WE create savings in operational cost for ship owners and operators
- WE are a strong player with global presence
- WE deliver proven technologies
- WE BRING THE NEXT LEVEL IN ENERGY EFFICIENT SHIPPING – 30 / 2030



Our Services

- Turnkey deliveries of energy efficiency upgrading solutions for existing fleets
- Engineering and delivery of energy efficiency solutions for new build series
- Energy efficiency analysis of propulsion machinery and electrical systems
- Project management services
- Installation services
- Commissioning services
- After sales services

Our Technology

- Active Front End frequency drive technology – WE Drive™
- Permanent magnet generator/motor technology
- Controls: Dedicated power management systems - DPMS

Omron NJ series controller

WE Tech NXA series WE Drive™

The Switch PMM 1000

WE Tech Network of companies in Vaasa, Finland

WE Tech
CREATING SAVINGS

Permanent Magnet Generator / Motor manufacturing and testing.
> 200 Employees globally.

THE SWITCH
A YASKAWA COMPANY

Switchboard / WE Drive™ manufacturing and testing.
> 360 Employees globally.

VEO

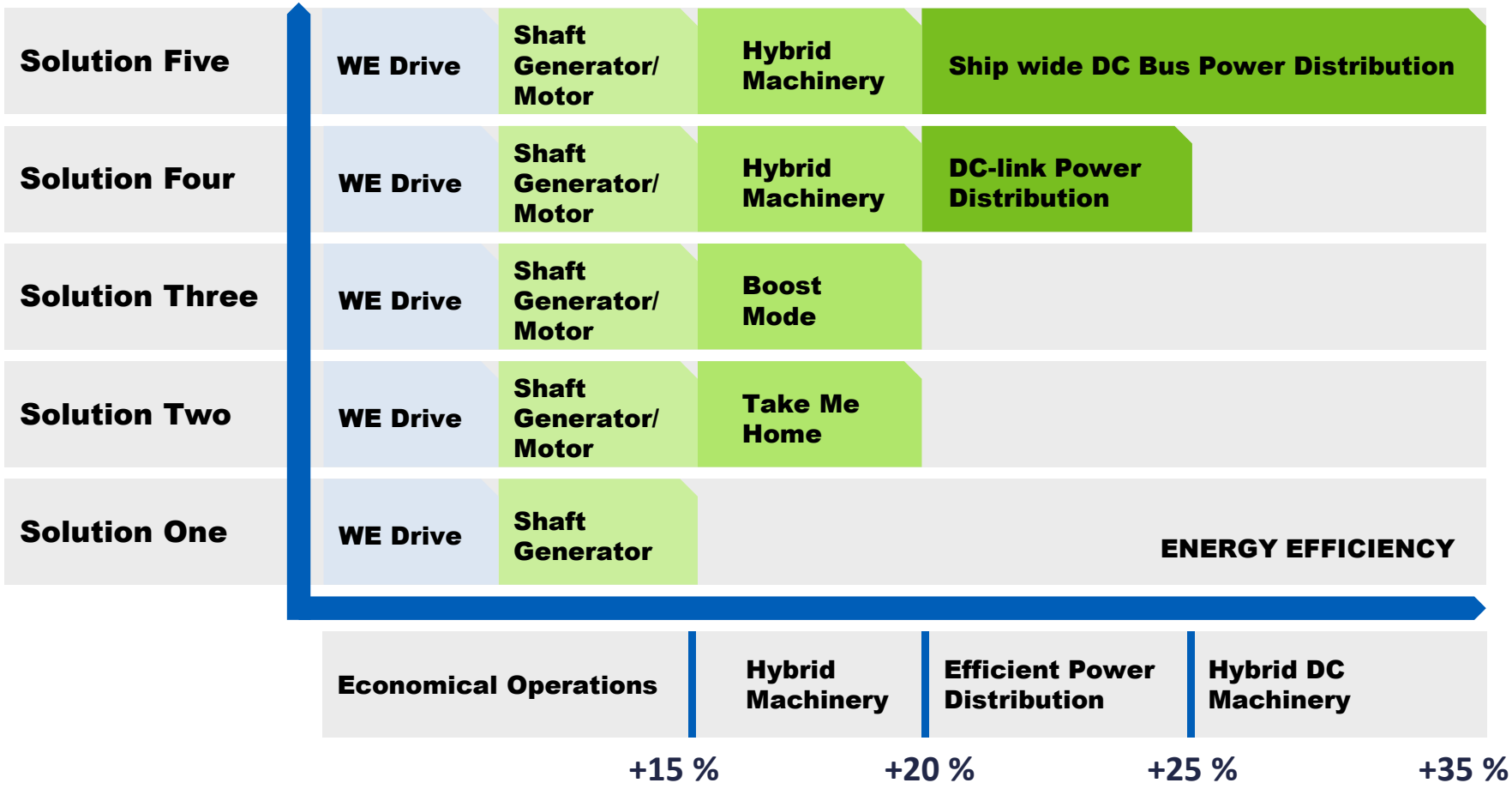
Frequency Drive manufacturing and testing.
> 1600 Employees globally.

VACON®
DRIVEN BY DRIVES

Source: Vaasa Airport Park

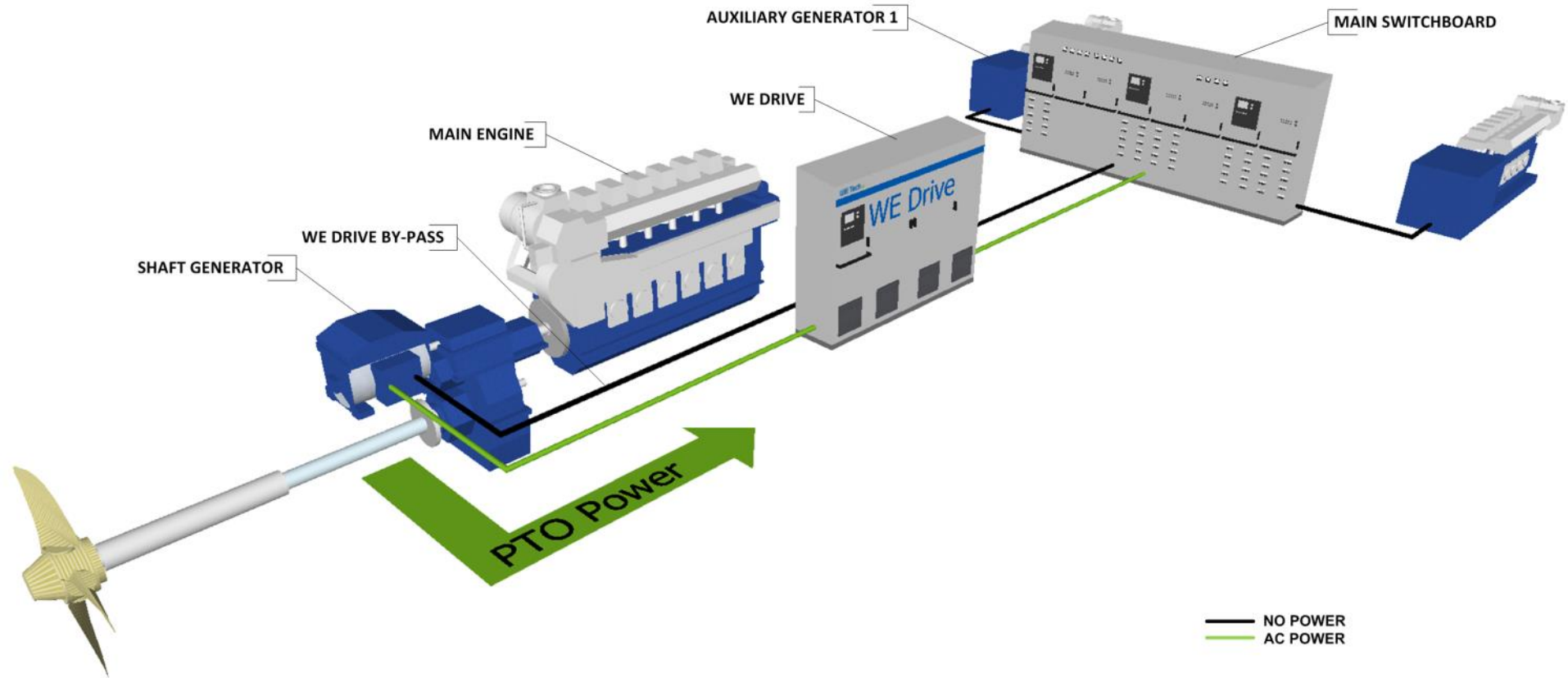
WE Tech Solutions:

Improved Energy Efficiency in machinery - compared with pre-2008 designs



Variable speed Shaft Generator

Benefit: Economical operations

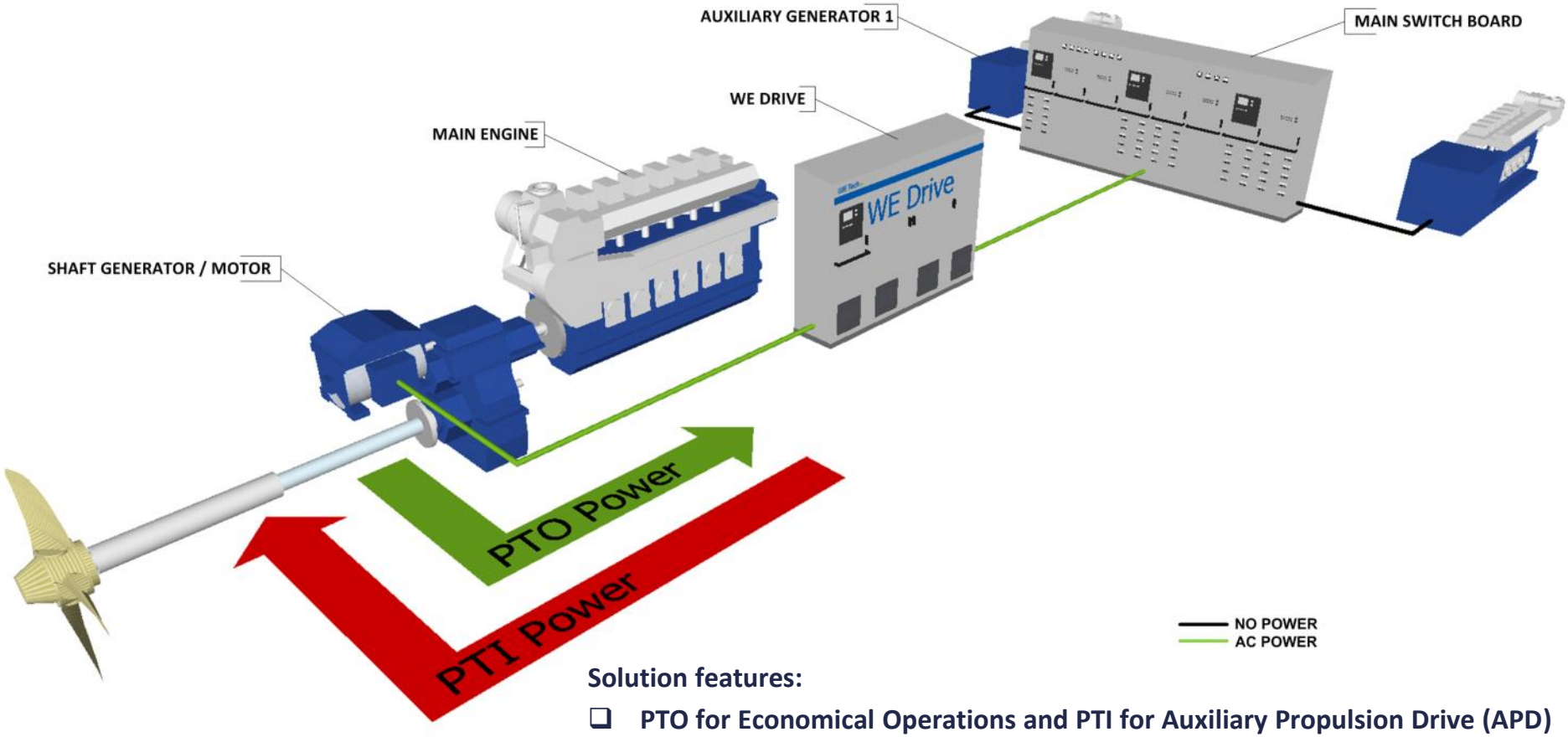


Solution features:

- ❑ **Economical operations utilizing energy efficient Main Engine for electrical power generation**
- ❑ **Stopped Aux. Generators during sailing –> Electrical power generated with 40-50 g/kWh less fuel consumed**
- ❑ **WE Drive™ allowing variable speed of the propulsion machinery –> optimal operation of propeller**

Shaft Generator as booster motor and Take Me Home device

Benefits: Economical operations and flexibility & safety with Hybrid propulsion

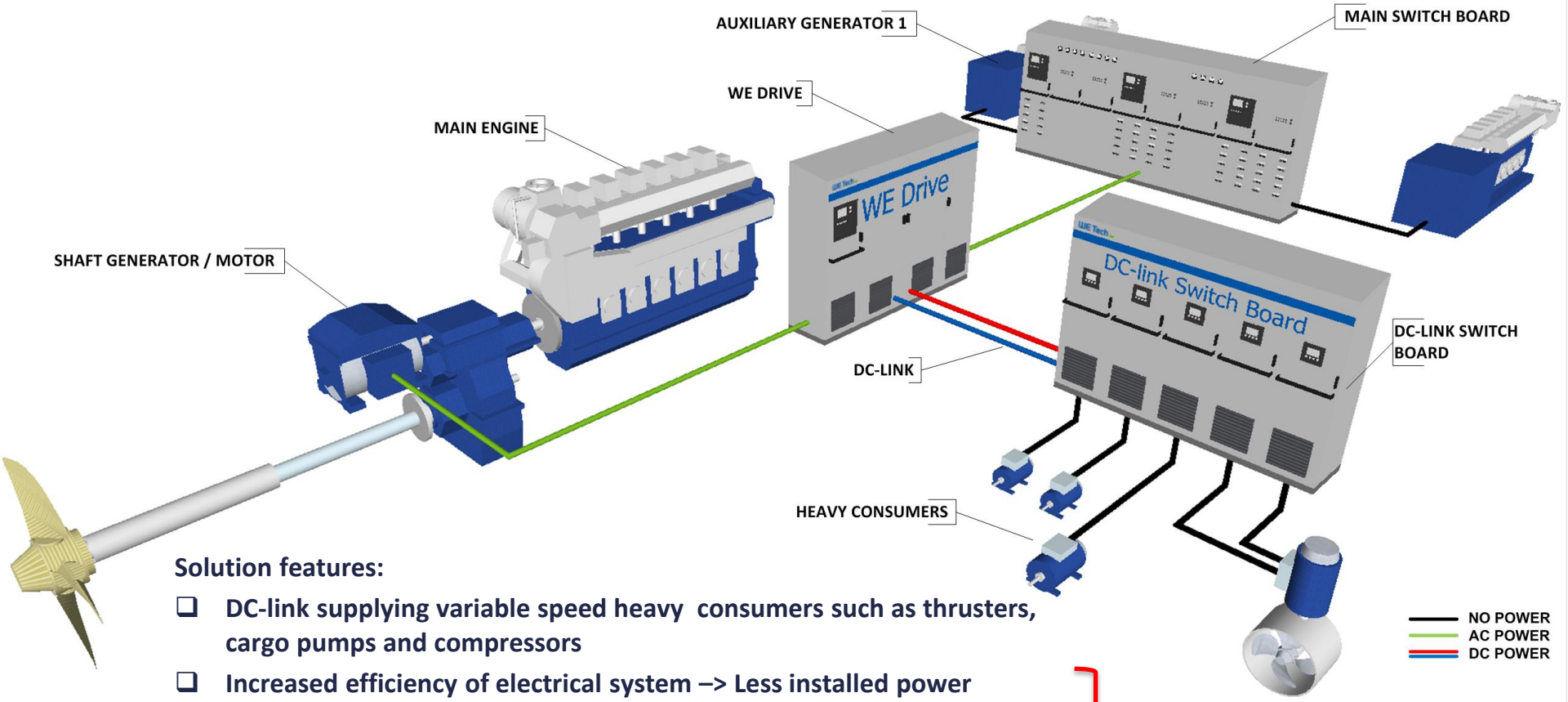


Solution features:

- ❑ **PTO for Economical Operations and PTI for Auxiliary Propulsion Drive (APD)**
- ❑ **Boost mode – Low load optimisation of the Main Engine**
- ❑ **Ice-Boost mode when ice-classed vessel**

DC-link distribution systems

Benefits: Economical operations , Hybrid propulsion and efficient power distribution



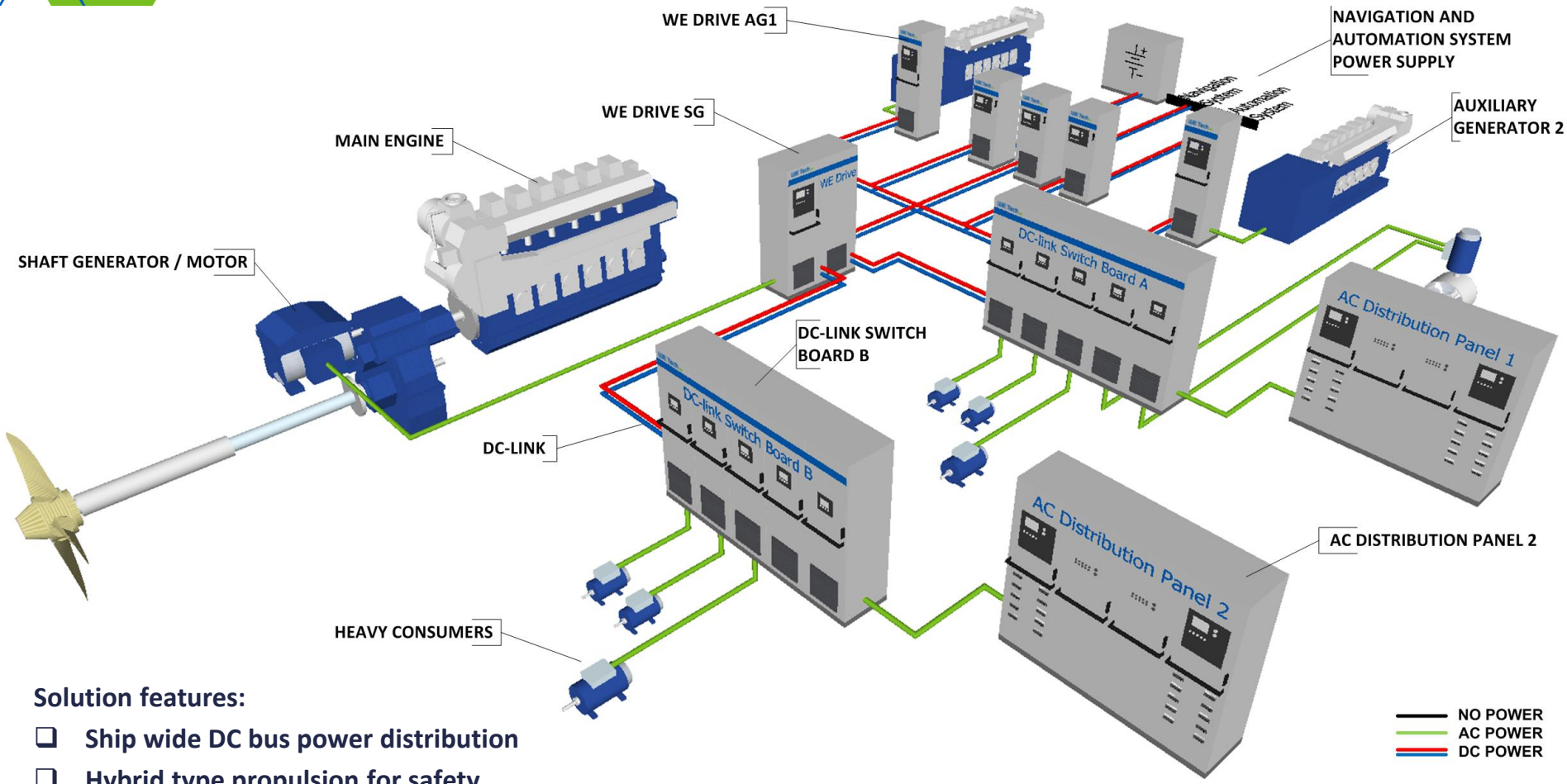
Solution features:

- DC-link supplying variable speed heavy consumers such as thrusters, cargo pumps and compressors
- Increased efficiency of electrical system –> Less installed power
- Fault currents limited by WE Drive –> Smaller footprint of Main Switch Board and less copper –> lower weight of electrical system
- Lower THD (Total Harmonic Distortion) and improved Power factor
- Battery package ready –> Energy storage & transfer via the DC-link

Lower CAPEX!

Variable speed Auxiliary Generators and battery systems

Benefits: Safety, flexibility and economy

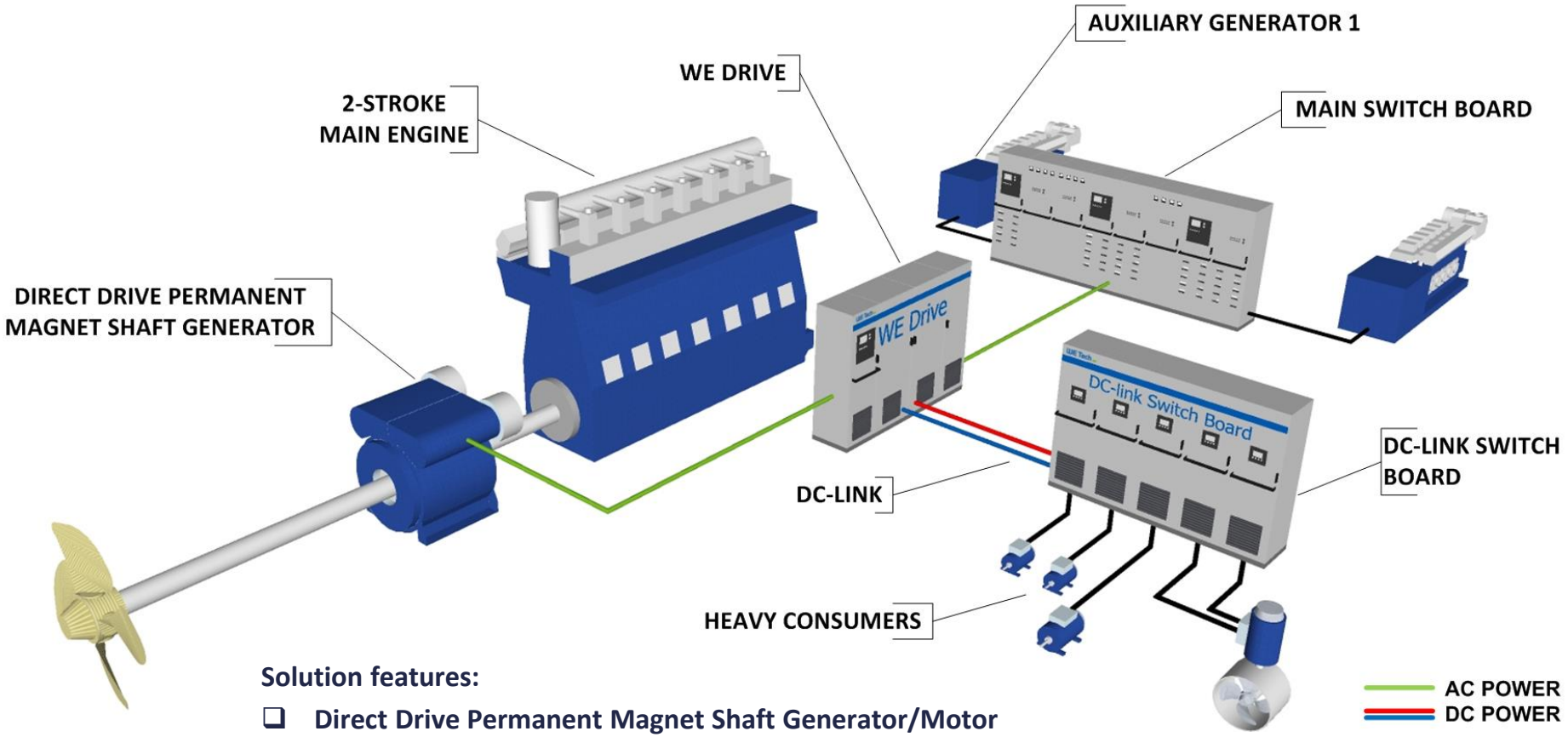


Solution features:

- ❑ **Ship wide DC bus power distribution**
- ❑ **Hybrid type propulsion for safety, flexibility and economy**

Hybrid propulsion solution for 2-Stroke Main Engine

Benefits: As previous e.g. Economical operations , Hybrid propulsion and efficient power distribution



Solution features:

- ❑ Direct Drive Permanent Magnet Shaft Generator/Motor
- ❑ Take Me Home Device (add. PSC) and Booster motor
- ❑ Electrical power generation with > 50 g/kWh comp. to AG

2-Stroke Main Engine Solution One:
Direct Drive Permanent Magnet Shaft Generator

- **Electrical power generation from Direct Drive Shaft Generator – example:**
  1400 TEU Container vessel

- **Conventional: Electrical power generated by Auxiliary Generating-sets:**
- **SFOC: Abt. 220 g/kWh ***

- **Energy efficient: Electrical power generated by fuel efficient 2-stroke Main Engine:**
- **SFOC: Abt. 160 g/kWh ***

Difference:

- **Sailing 5200 hours / annually (60 %)**
- **With a typical electrical load of 1500 kW**
- **Aux. Gen-sets consumes 1716 ton/annually**
- **DD Shaft Generator consumes (via ME) 1248 ton/annually**

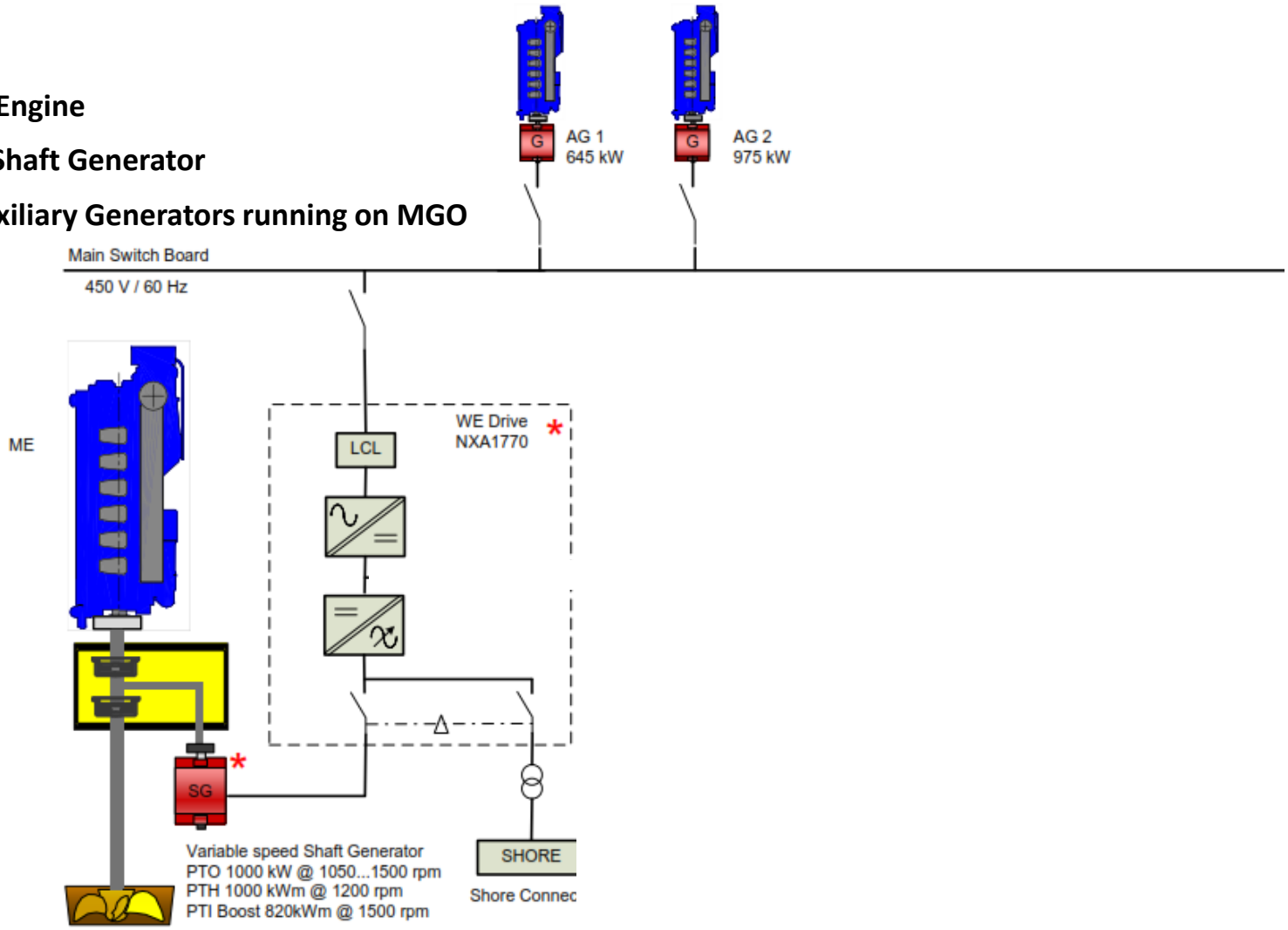
468 tons of bunker annually

= 27 % savings with Shaft Generator

*) HFO figure, typical

LNG as fuel – additional flexibility with shaft generator

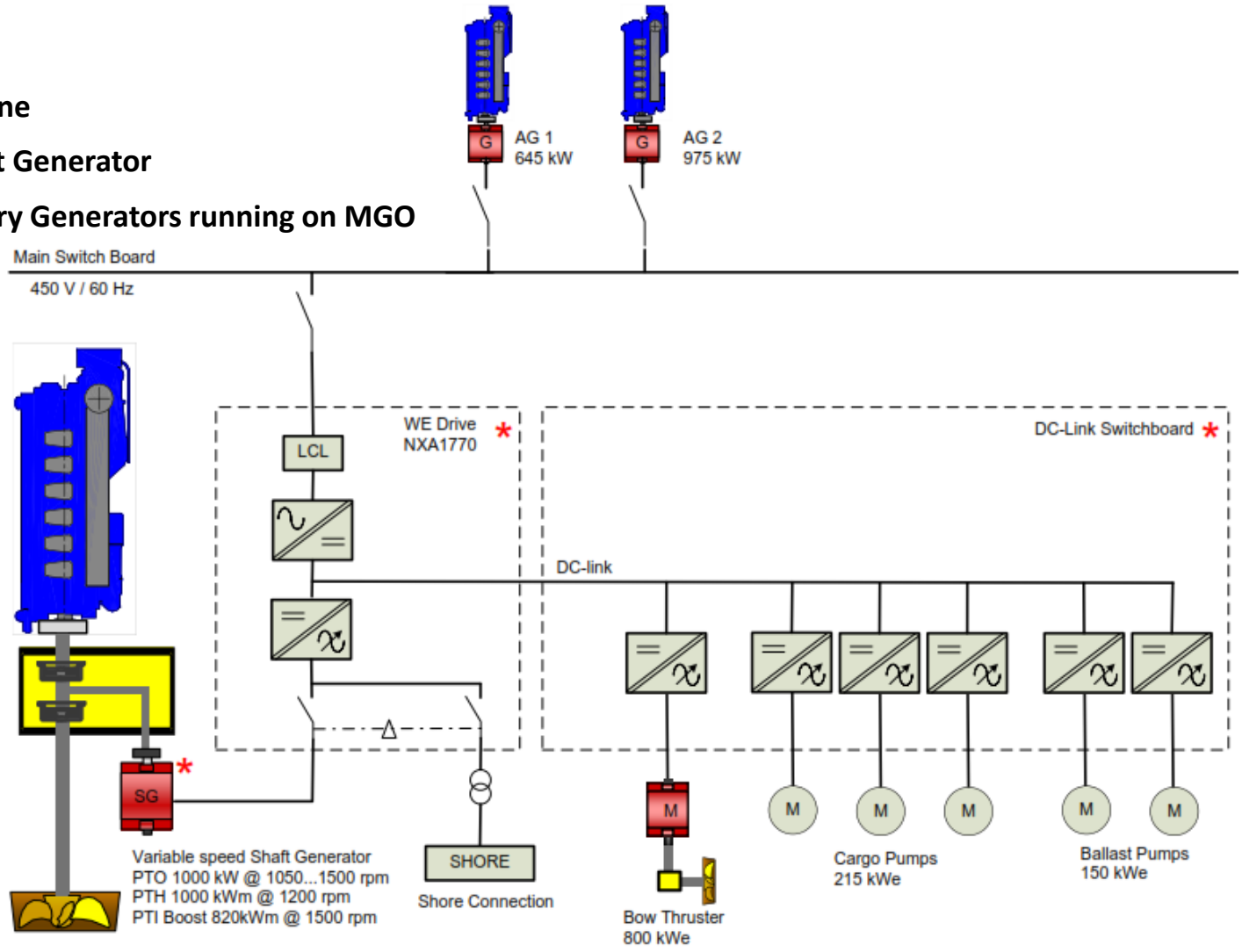
- Dual Fuel Main Engine
- Variable speed Shaft Generator
- Optimal size Auxiliary Generators running on MGO



Cargo handling operations with variable speed shaft generator

- Dual Fuel Main Engine
- Variable speed Shaft Generator
- Optimal size Auxiliary Generators running on MGO

- DC-link distribuiton
- Cargo pumps on DC-link
- Cargo handling with DF ME Main Engine – running on optimal speed
- Shore connecton ready
- Aux. Generators only as backup in cargo handling



References

m/v Miranda
Type: Ro-Ro vessel
Owner: Godby Shipping Ab
Solution: Economical Operations upgrade (PTO, Solution One)
Delivery: Q4 2010

m/v Mistral
Type: Ro-Ro vessel
Owner: Godby Shipping Ab
Solution: Economical Operations upgrade (PTO, Solution One)
Delivery: Q1 2011

m/v Bore Sea
Type: Ro-Ro vessel
Owner: Bore Ltd
Solution: Economical Operations upgrade (PTO, Solution One)
Delivery: Q2 2012

m/v Seagard
Type: Ro-Ro vessel
Owner: Bore Ltd
Solution: Economical Operations upgrade (PTO, Solution One)
Delivery: Q2 2013

m/v Kallio
Type: General cargo vessel
Owner: ESL Shipping Ltd
Solution: Economical Operations upgrade (PTO, Solution One)
Delivery: Q3 2014

m/v Bore Song
Type: Ro-Ro vessel
Owner: Bore Ltd
Solution: Economical Operations upgrade (PTO, Solution One)
Delivery: Q1 2015

References (cont.)

Zelenodolsk NB 111
Type: Coastguard Vessel
Owner: Russian Coastguard
Solution: Economical operations & Loitering mode (PTO/PTI, Solution Two)
Delivery: First vessel Q2 2013

A series of 4 newbuild vessels order by Tianjin Xingang Shipbuilding Heavy Industry
Type: Post-Panamax sized Pure-Car-Truck-Carrier (PCTC) vessels
Owner: Wallenius Marine
Solution: Direct Drive Permanent Magnet Shaft Generator (PTO/PTI Boost mode)
Delivery: First vessel Q2 2015

A series of 4 newbuilding vessels ordered by AVIC Dingheng Shipbuilding Co., Ltd.
Type: 15000 DWT Product Tanker
Owner: Terntank Rederi A/S
Solution: Direct Drive Permanent Magnet Shaft Generator (PTO/PTI Take Me Home mode)
Delivery: First vessel Q2 2015

A series of 2 newbuilding vessels ordered by Besiktas Gemi Insa A.S.
Type: 15100 DWT Asphalt Carrier/Product Tanker
Owner: Transport Desgagnés Inc.
Solution: Direct Drive Permanent Magnet Shaft Generator (PTO/PTI Take Me Home mode)
Delivery: First vessel Q4 2015

A series of 2 newbuilding vessels ordered by Jiangsu Hantong Ship Heavy Industry
Type: 68000 DWT SUL Bulk Carrier
Owner: Vulica Shipping
Solution: Direct Drive Permanent Magnet Shaft Generator (PTO mode)
Delivery: First vessel Q2 2016

A series of 2 newbuilding vessels ordered by Turkish RMK Marine
Type: 9400 DWT Asphalt/Bitumen Tanker
Owner: Tarbit Shipping AB
Solution: Permanent Magnet Shaft Generator and DC Power Distribution
Delivery: First vessel Q2 2016

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