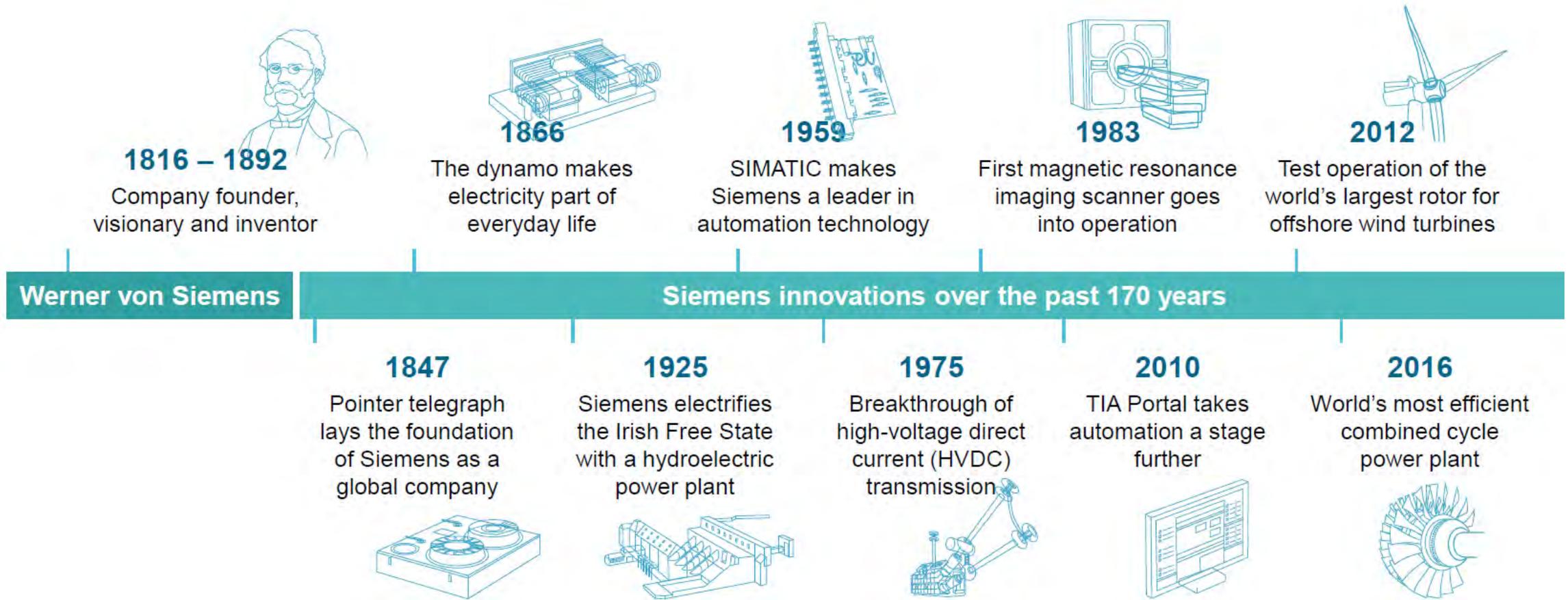


SIEMENS
Ingenuity for life



*Integrated Power and Energy System for
Research Vessels*

Milestones of a 170 Year History



Siemens' Excellence in the Global Marine Market

Leader in technology with 165 years of engineering, innovation, quality, and reliability

Proven History

- 1879 - World's first company to electrify a ship
- 1886 - Built world's first ship with electric propulsion
- 1900s - Specialized in marine design, manufacture and commissioning of automation, electrical and propulsion solutions worldwide

Siemens Today

- Leader in advanced diesel-electric propulsion systems
 - Over 260 vessels in operation worldwide



Elektra – 1886 The Vessel Without a Chimney



Naval & Commercial Ships – Siemens Marine Portfolio

Systems	Components	Global Service
Propulsion	Generators	Preventative Maintenance
Drive Systems	Motors	Overhauls
Power Distribution	Converters	Lifecycle Upgrades
Energy Storage	Transformers	Project Management
Automation and Control (bridge, propulsion and machinery, machinery condition monitoring and alarms, remote monitoring, damage control)	Switchboards	Engineering Studies (Short circuit calculation, Selectivity & discrimination calculation, Harmonic distortion calculation & measurements)
Waste Heat Recovery		Propulsion System Dynamic Analysis
		FMEA and DVTP
		ABS Certification & USCG drawings and approval
		Commissioning and trials support

Evolving Maritime Environment

Current Challenges

- Environmental concerns
- Cost savings
- Safety
- Increased complexity of shipboard systems

Owners are demanding higher rates of return on investment, and both operators and passengers require safe vessels with low noise and vibration

Industry Response that Meet the Challenges

Innovative propulsion systems:

- **Variable-speed Diesel-electric**
- **Hybrid**
- All-electric vessels

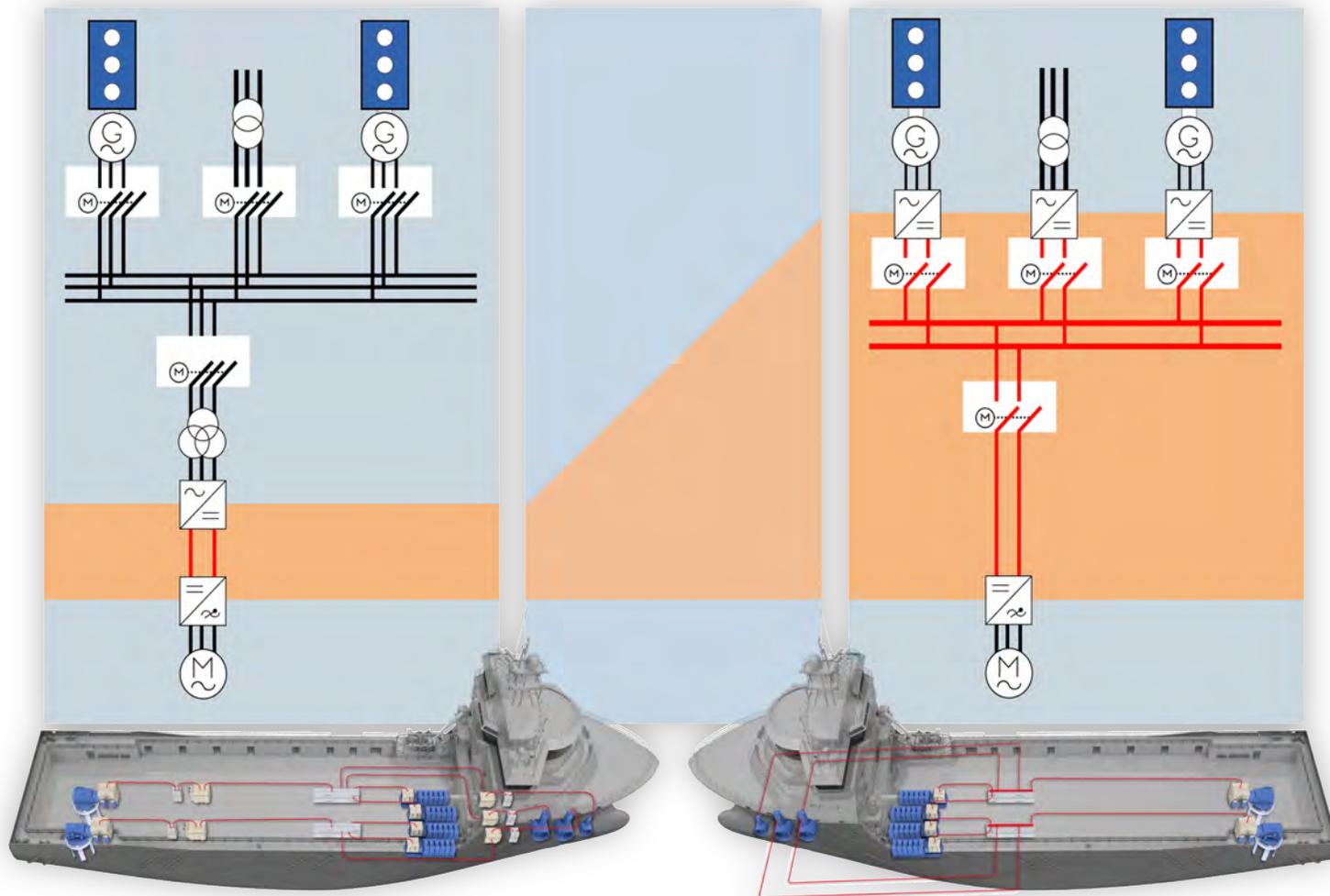
Condition Monitoring Systems

Product Lifecycle Management (PLM) Software

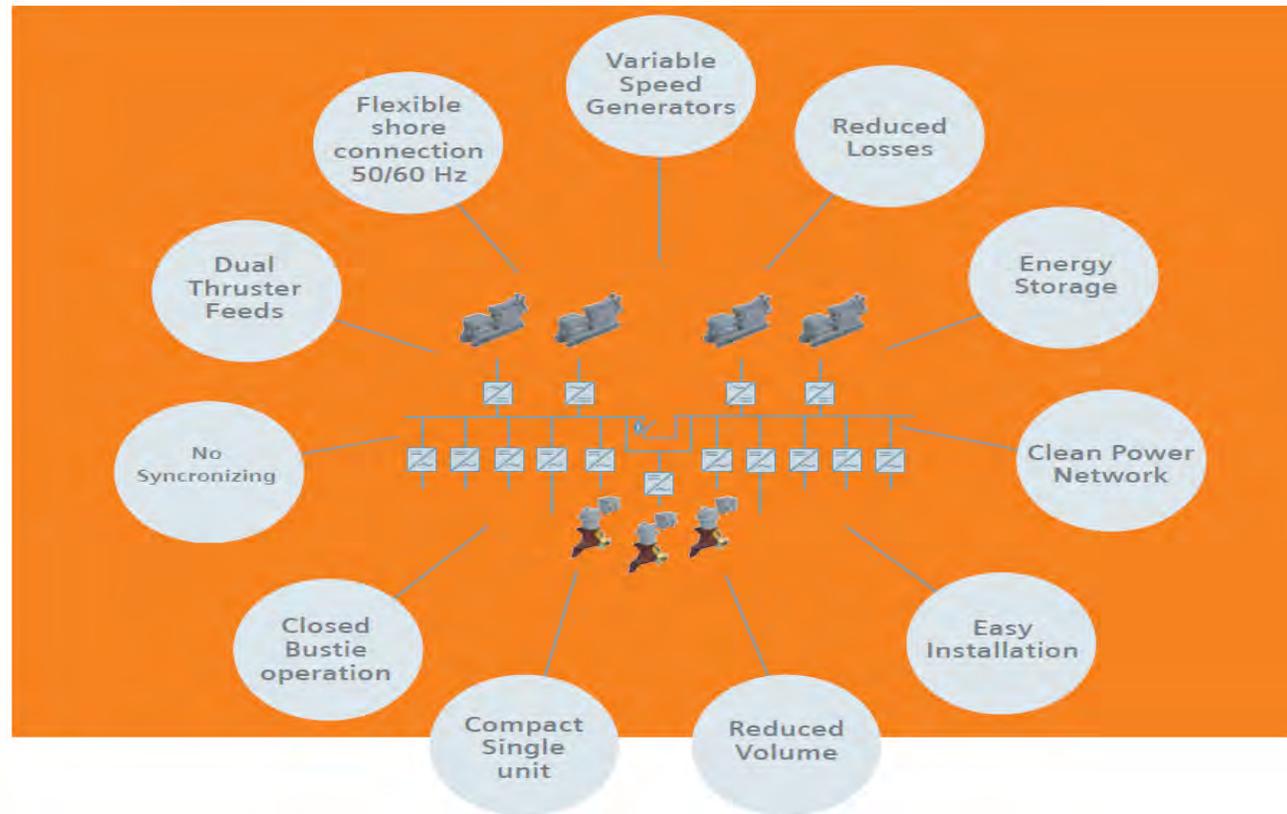
Applying Existing Technology to Maritime Industry



Siemens Integrated Diesel Electric Systems

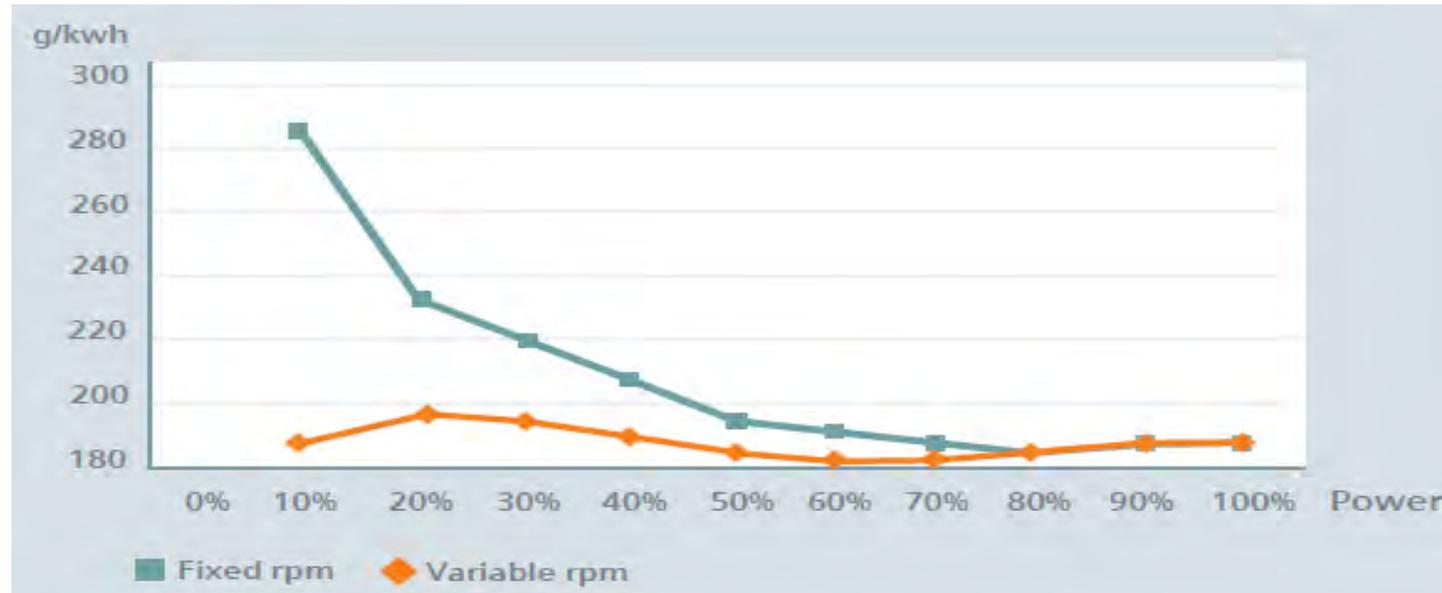


Benefits of Variable Speed System



Noise and vibration are cut significantly by reducing speed at any load below rated power

Variable Speed System Fuel Savings



Fuel consumption is dramatically reduced at low loads for variable-speed gensets compared to fixed-speed gensets

This is a large benefit while the vessel is performing scientific operations

Integration of Energy Storage System (ESS)

DC system increases efficiency for battery operation

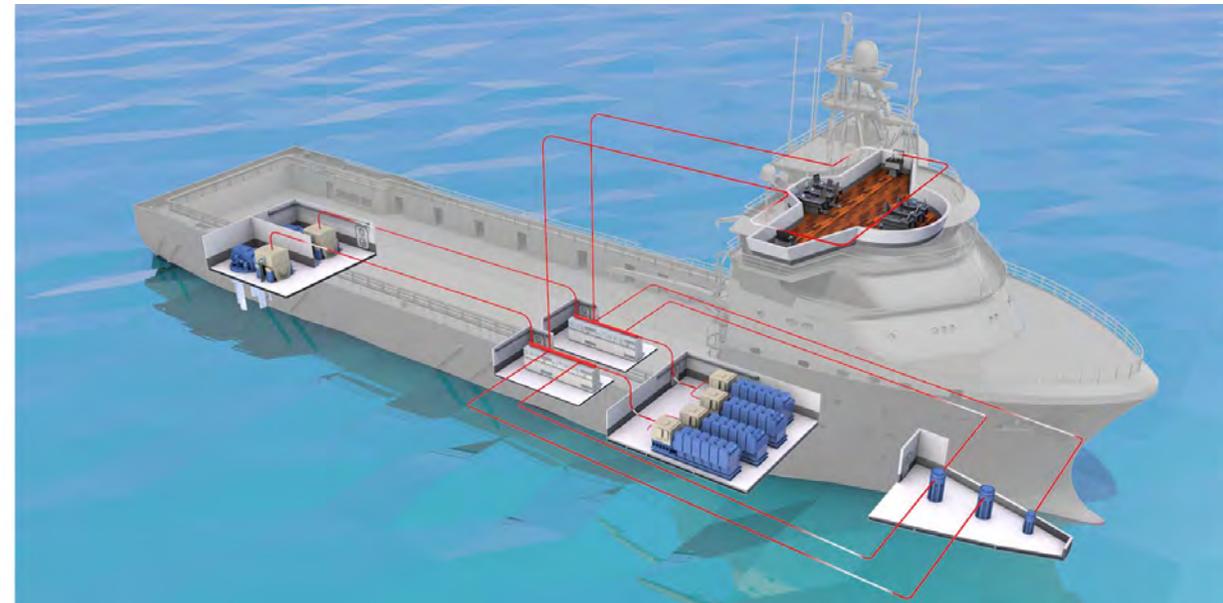
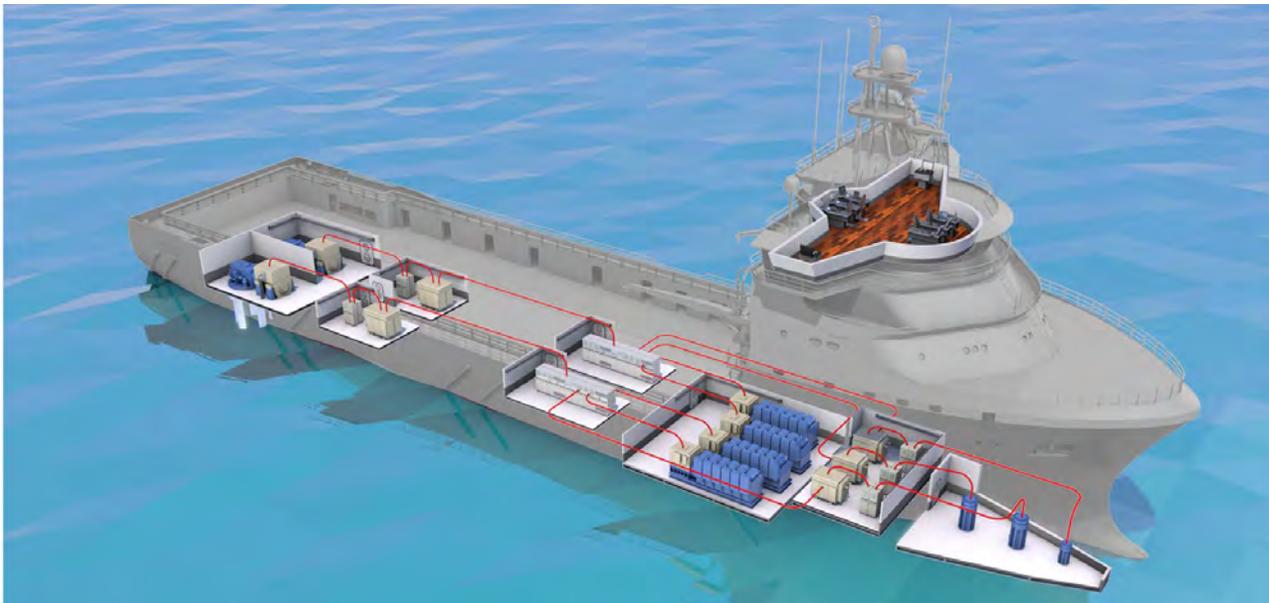
- Higher efficiency compared to AC system
- Addition of ESS/Batteries can significantly alter and improve vessel operations
 - All electric propulsion for noise sensitive and emission-free operations
 - Peak shaving- less speed variation, ability to reduce size of engines
 - Spinning reserve - generator bridging and no idle back up generator running
 - Safety power back-up - Power to maintain position and operation until power is restored, or safely terminate operation in case of power loss



Reduced Footprint

DC systems provide streamlined operations with smaller mechanical footprint

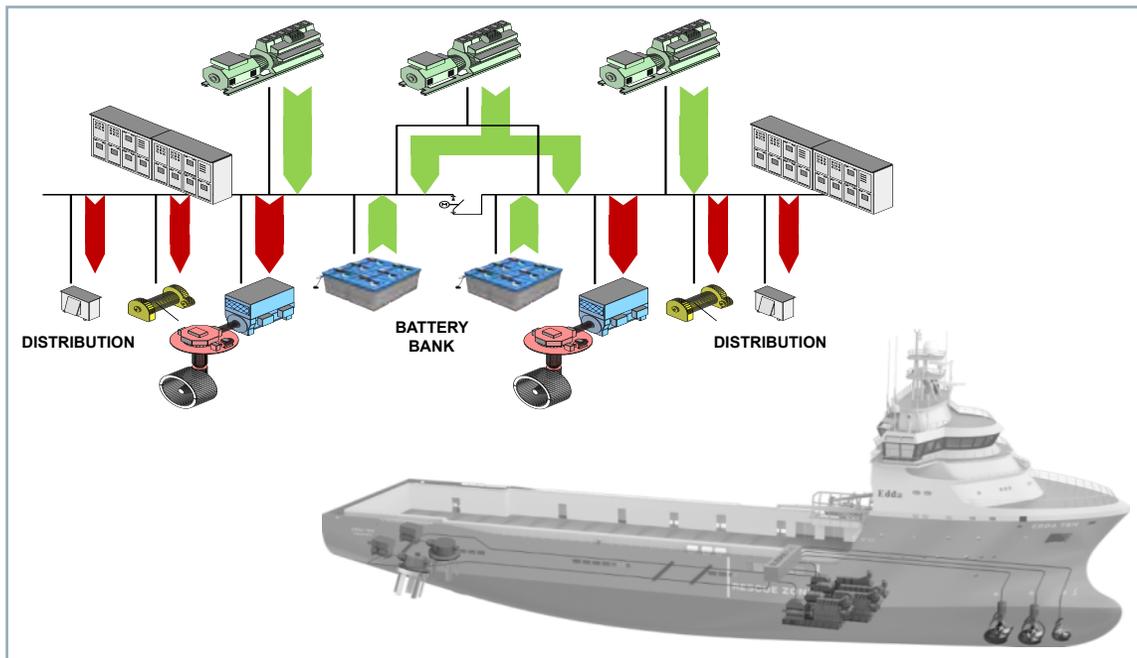
- Eliminate transformers
- Drives are centrally located instead of all over the vessel
- Approximate space savings of 30%



Siemens BlueDrive PlusC



Variable Speed System (BlueDrive PlusC) Snapshot



Key feature

- DC power network
- Variable speed of generators
- Easy integration of alternative energy sources
- Completely integrated electrical system

Scope of supply

- BlueDrive PlusC frequency converter
- Power management/power plant protection
- Batteries
- LV propulsion motors/generators

Customer benefit

- Improved overall efficiency
- Improved flexibility for alternative energy sources
- Highest redundancy
- Extended maintenance intervals for main engines
- Reduce engine run time
- Reduce fuel consumption
- Reduce maintenance costs
- Reduce operational costs
- Increase profitability
- Improve safety
- Reduce or eliminate noise and vibration

Environmental value

- Reduction of fuel consumption in all operating conditions
- Reduction of CO₂
- Zero emission operation

Questions?

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