



ABB – a strong business partner

Integrated marine solutions for more productivity

Wind farm Development Seminar – Tapei 27.05.2016

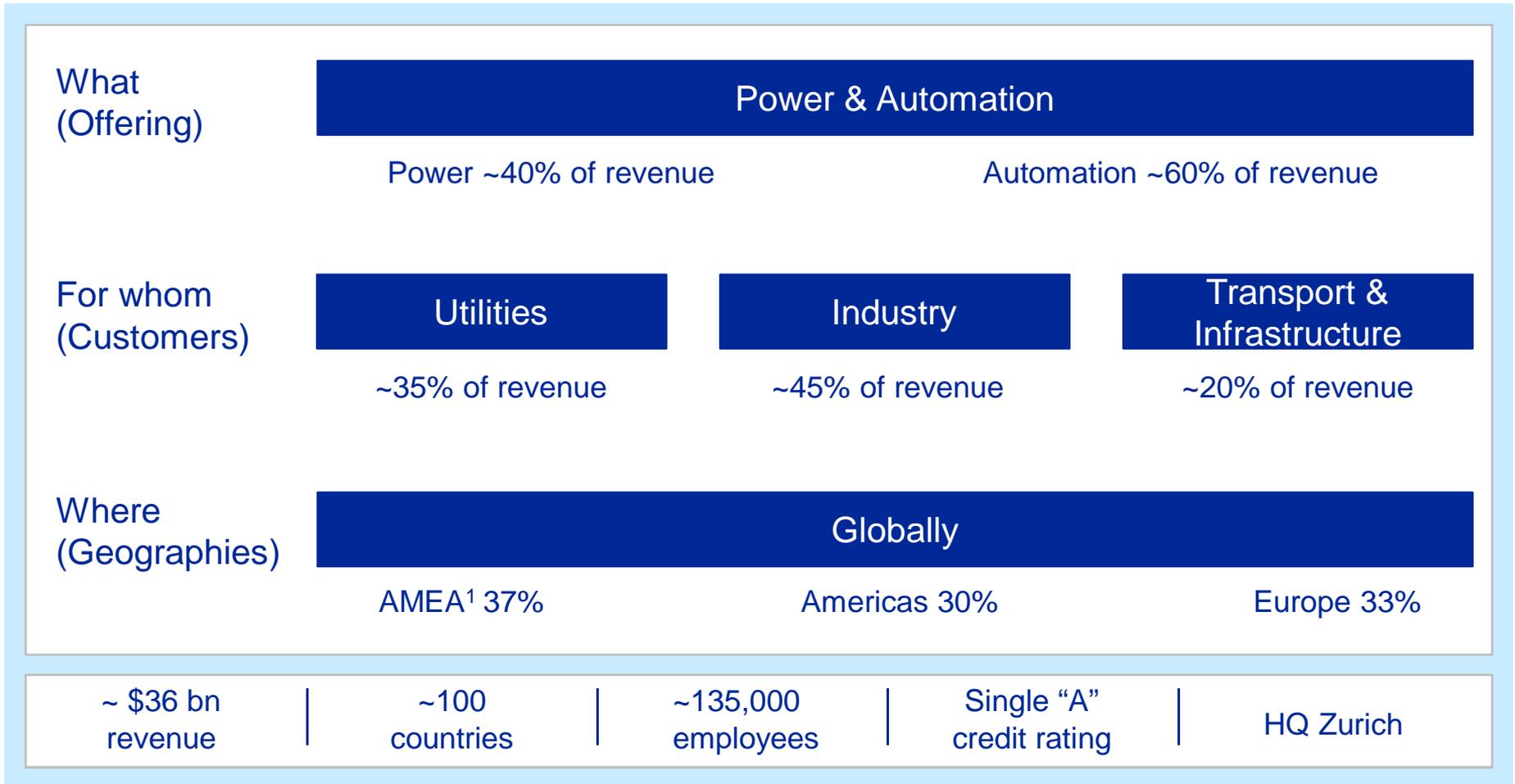
Joar Gjerde – Vice President, ABB Marine Global Sales

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1. Introduction of ABB
2. ABB Marine – Systems & Scope of Supply
3. Case Study; «Pacific Orca»
4. New Technology & Possibilities
5. Operation & Service
6. End

ABB today

A global leader in power and automation technologies



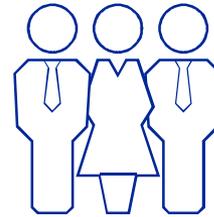
Shaping the world through innovation

Consistent R&D investment



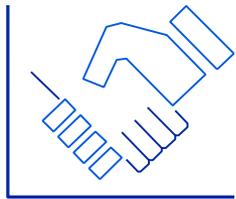
+\$1.5 bn

Investment annually



~ 8,500 k

Technologists



~ 70

University collaborations



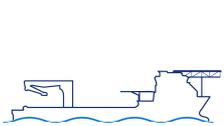
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Corporate research centers linked by a global research center

Innovation is ingrained in the DNA of ABB

Marine and Ports

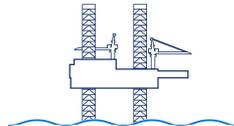
More than a Century in the business



OSV



Drillship



Jack-up



LNG



Tanker



Ice going



Cruise vessel



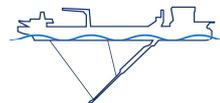
Ferry



Container vessel



Tug



Dredger



Ice breaker

Marine and Ports

- 1,700 employees in 22 countries
- 3 Hubs
 - China
 - Finland
 - Norway
- 23 Service Centers
- 5 Center of Excellence
 - Oil and Gas
 - Passenger and Cargo
 - Propulsion Products
 - Ports
 - Automation and Advisory

Complete provider

From design to operational optimization



Design

- Conceptual study
- Lifecycle cost analysis
- System design



Build

- Project management
- System engineering
- Installation



Operate

- Core services
- Projects and consulting
- Management services

Integrated solutions for the marine market

Our offerings

Electric propulsion
Azipod® propulsion
and Thruster units



Power Generation and
Distribution, including
Onboard DC Grid



Integrated marine
automation and
advisory systems



Marine Service and
Integrated Operations



Total system supplier

Average of 90% own products

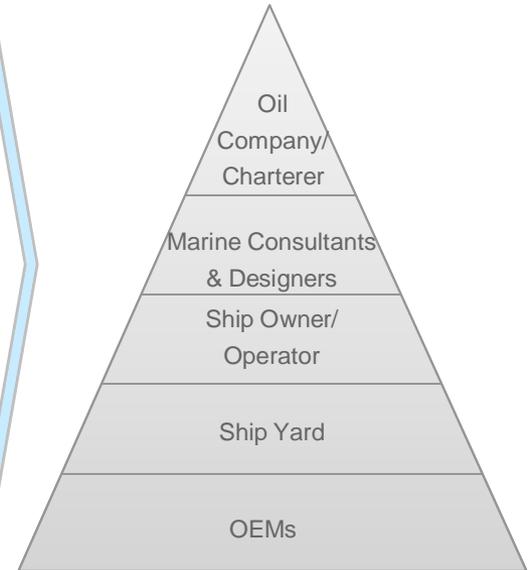
ABB products



Integrated systems



Our customers



Total supplier

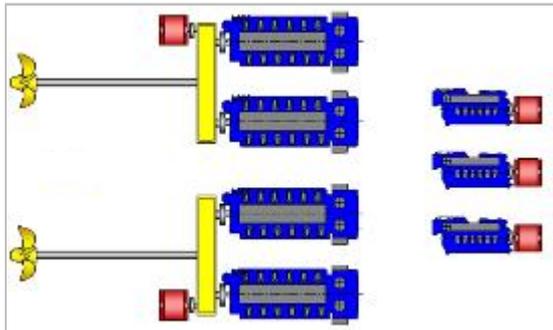
Business based on electric propulsion

Conventional mechanical propulsion

Diesel engines, gearboxes and controllable pitch propellers for propulsion.

Separate auxiliary engines for electricity generation for ship use.

Still main propulsion concept in cargo vessels.

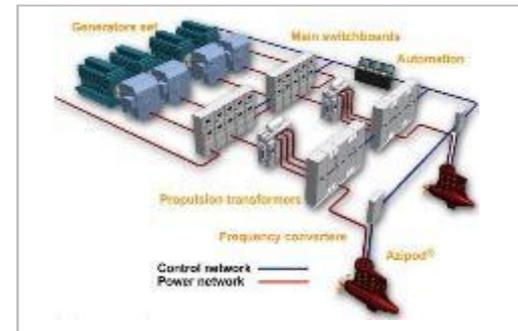


Electric propulsion

Diesel-Generator sets to produce electricity to common grid for propulsion and ship use.

Variable speed drives to rotate fixed pitch propellers.

Commonly used in cruise vessels, LNG tankers, offshore vessels and icebreaking vessels due to reduced fuel oil consumption, lower emissions and increased pay-load.



Electrically powered by ABB

ABB Systems for Windmill Installation Vessels

Typical scope of supply

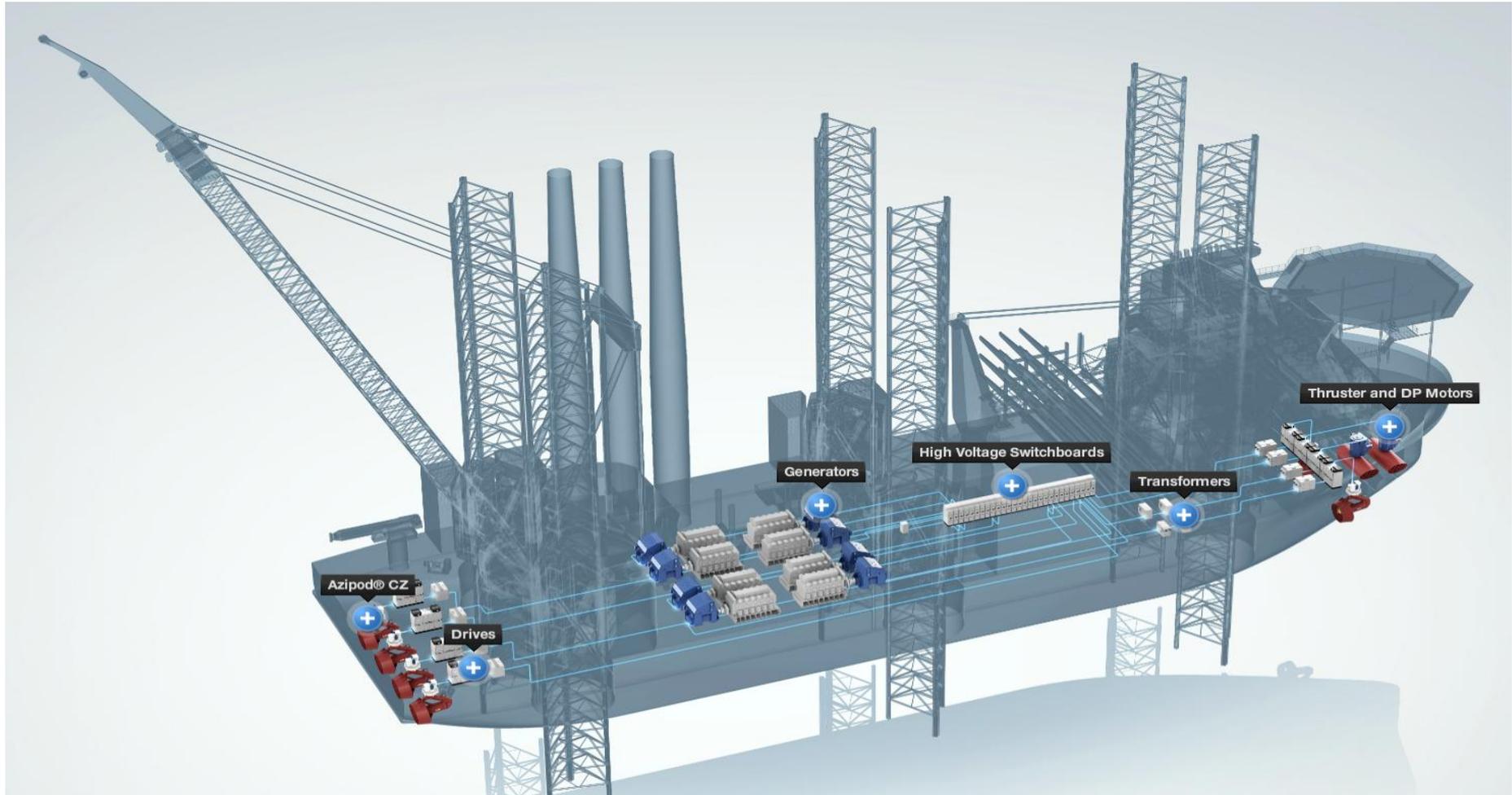


ABB References

Windmill Installation Vessels

Reliable and efficient Systems and Solutions

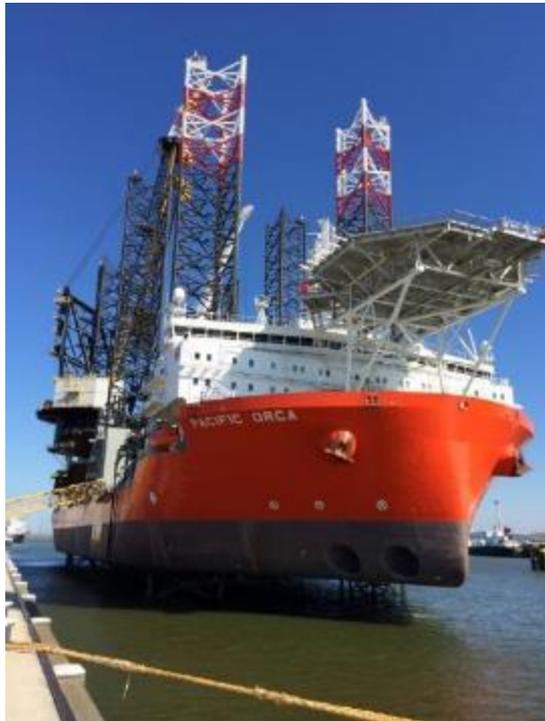


ABB System and Propulsion Delivery

Windmill Installation Vessels – "Pacific Orca" & "Pacific Osprey"



Vessel information

- Vessel name: "Pacific Osprey" & "Pacific Orca"
- Vessel Type: Windmill Installation Vessel
- Design: Knud E Hansen
- Yard: Samsung Heavy Industries
- Year of delivery: 2012/13
- Class/Notation: GL DP2
- Owner: Swire Pacific Offshore

ABB Power & Propulsion Solution

- Generators: 8 x 3780kVA, 720rpm
- MV Main Switchboard: 11kV, 4 splitt
- Deck.equip.transformers: 4x5400kVA
- Azipod CO1250: 4 x 3.4MW
- Tunnel thr. drive system: 4 x 2200kW
- Automation: PMS
- Advisory: Octopus

Other Information

Pacific Orca/Osprey is a purpose-built heavy-lift jack-up vessel, self elevating and self propelled built for use in the offshore wind farm market.

Each vessel have a installation carrying and capability of up to 12 wind turbine generators, each rated 3.6MW. They are the biggest WIV in the world.

"Pacific Orca" & "Pacific Osprey"

ABB Solution

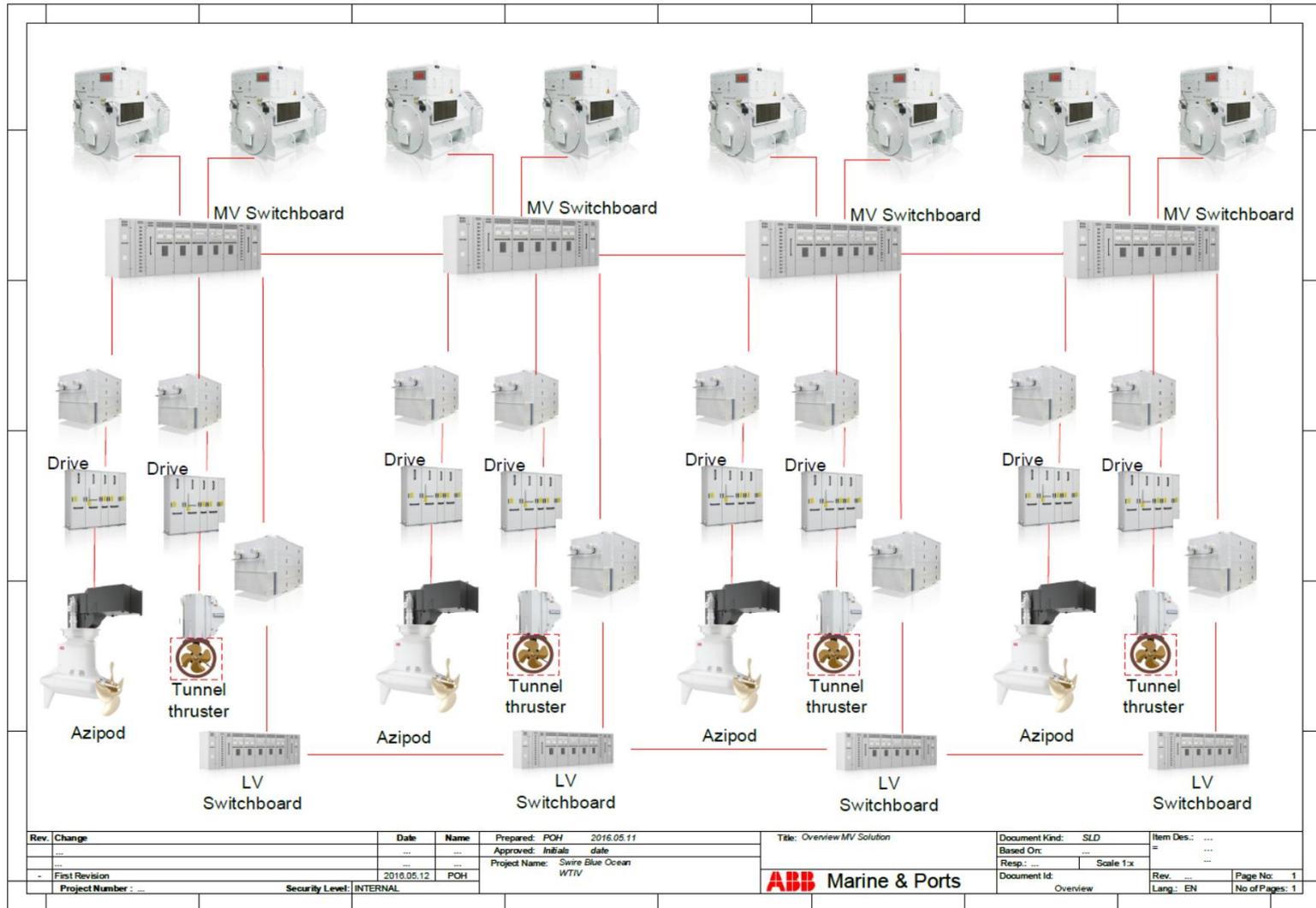


ABB Azipod – "Pacific Orca" & "Pacific Osprey" CO1250



Azipod[®] propulsion

In figures

12 million

hours of operation
experience

Up to 20%

fuel savings achievable
compared to conventional
systems

More than 20

ship types are
equipped with
Azipod propulsion

4,500 MW

of total ordered
propulsion power

25 years

of successful
operation

> 99.8%

vessel availability
on average

Solution of choice for several ship types

Benefits of gearless thruster

Gearless means simplicity and improved efficiency

Efficiency

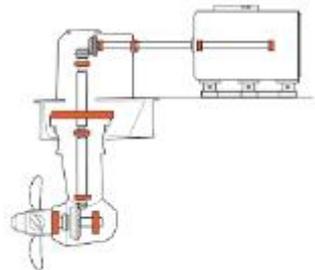
- Gearless power train improves the efficiency 2–5% compared to a mechanical thruster

Reliability

- Minimum number of bearings and seals
- Simple auxiliary systems

Maintenance

- Simplicity reduces maintenance needs

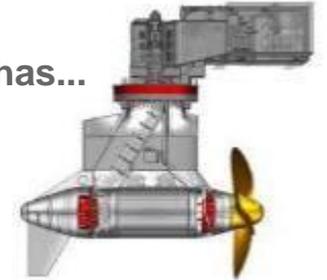


Regular mechanical thruster drive train has...

1–2 Gears
Typically over 10 Bearings

Azipod drive train has...

0 Gears
3 Bearings



Our broad offering

Azipod[®] propulsion units and thrusters



- Unit power from 1.5 MW up to more than 22 MW
- The ducted versions for high thrust applications
- Ice-strengthened versions for heavy arctic or icebreaking operations
- Compact solutions for merchant, offshore and special vessels
- Gearless thruster with simple auxiliary systems and small space requirements
- High efficiency and good maintainability
- Permanent magnet and induction motor technologies

Onboard DC Grid

What is it?

Our offering

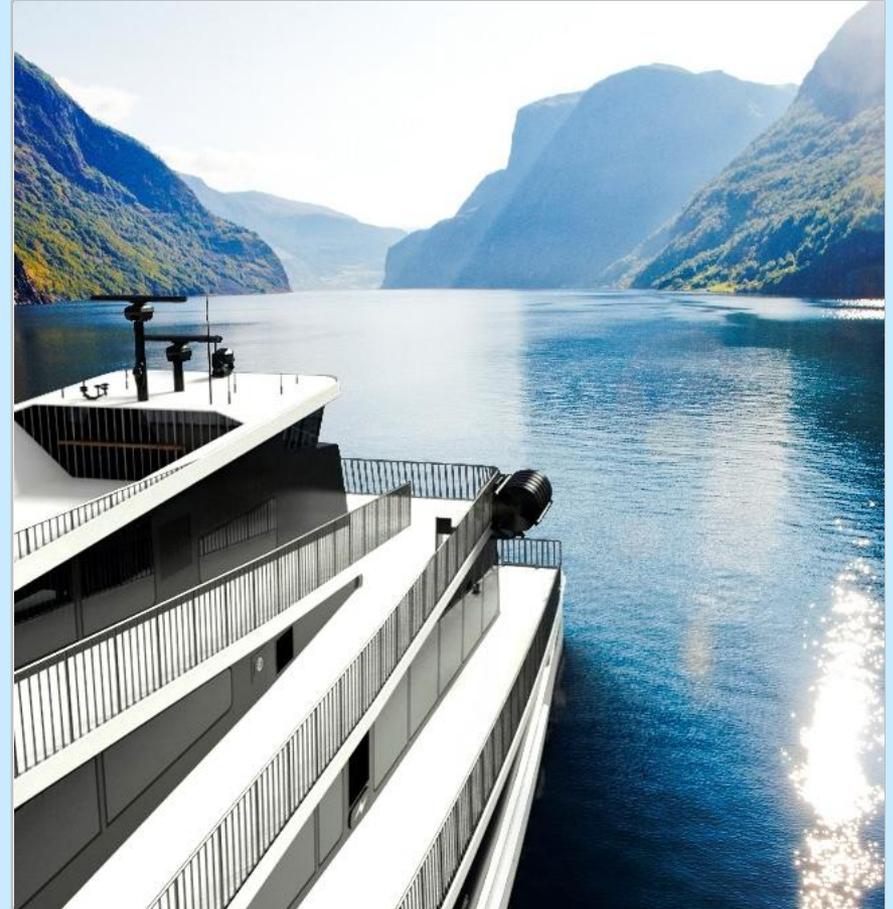
Onboard DC Grid is a modular, state-of-the-art LVDC based power system tailored to the needs of next generation power systems. It comprises:

- Power Generation, Distribution & Consumers
- Power and Energy Management System

Advantages include reduced operational costs, improved safety and lower emissions through:

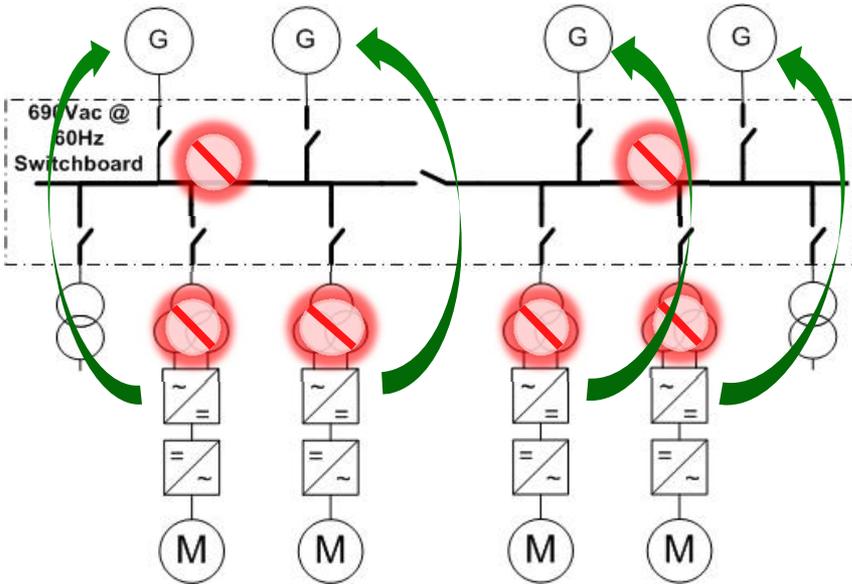
- Variable speed generators
- Highly functional integration of Energy Storage
- DC is simpler and therefore safer

Next Generation Power Systems

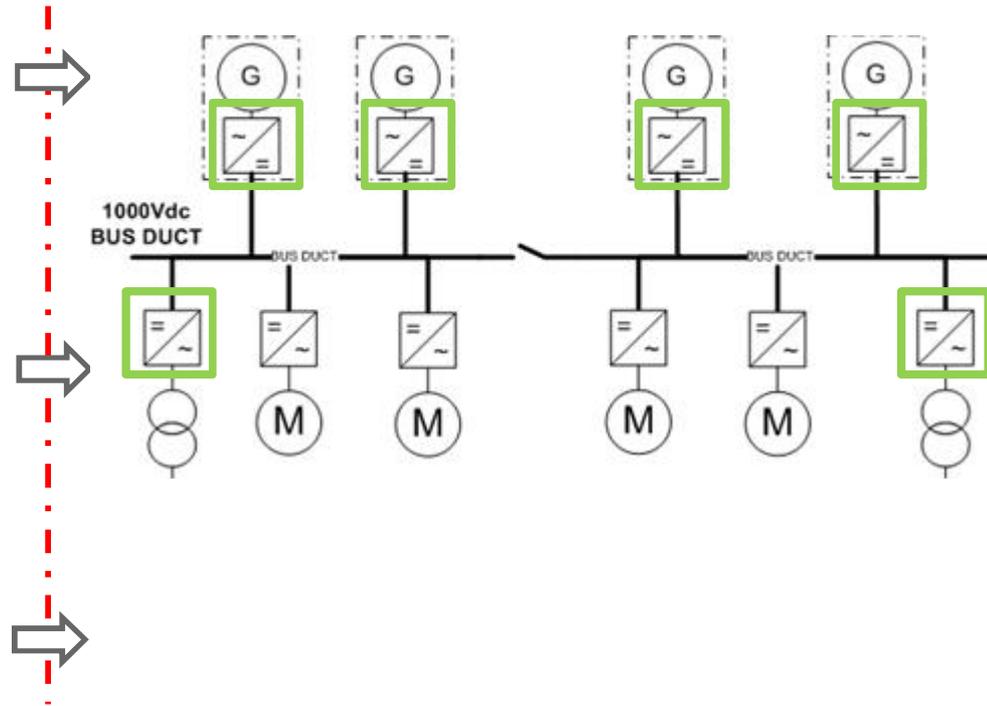


Onboard DC Grid Basic Principle

- Traditional AC System



- Onboard DC Grid



 Removed components

 Developed components

Energy Storage Solutions

What is it?

Our offering

ABB offers state-of-the-art Energy Storage Solutions for both:

- Zero emissions
- Hybrid applications

Integrating ESS into a Power System will:

- Improve safety
- Reduce operating costs
- Cut emissions

ABB provides ESS solutions for both AC and DC power systems.

Next Generation Power Systems

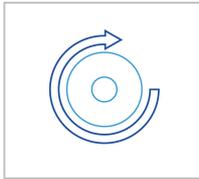


Energy Storage Solutions

What can it do?

Expect more from your power system

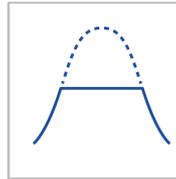
Spinning Reserve



Backup power to running generators.

- Benefits include
- Improved safety
 - Reduced fuel consumption and engine maintenance

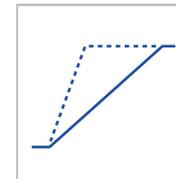
Peak Shaving



Level power seen by engines and offset need to start new engines.

- Benefits include
- Reduced fuel consumption and engine maintenance

Enhanced Dynamic Perf.



Instant power in support of running engines.

- Benefits include
- Reduced fuel consumption
 - Enabler for “slower” sources like LNG and fuel cells

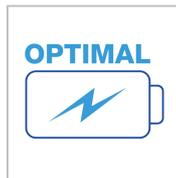
Enhanced Ride Through



Short time backup power to running generators.

- Benefits include
- Improved safety
 - Reduced fuel consumption and engine maintenance

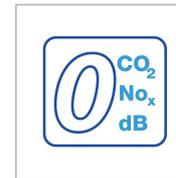
Strategic Loading



ESS used to charge or discharge with the aim of optimizing engine operating point.

- Benefits include
- Reduced fuel consumption

Zero Emissions Operations



Power system is fully powered by ESS.

- Benefits include
- Quiet engine room
 - Zero emission operation

Total integrated solutions for OCV

With Onboard DC Grid and Energy Storage solutions

Complete power conversion through Onboard DC Grid and Energy Storage

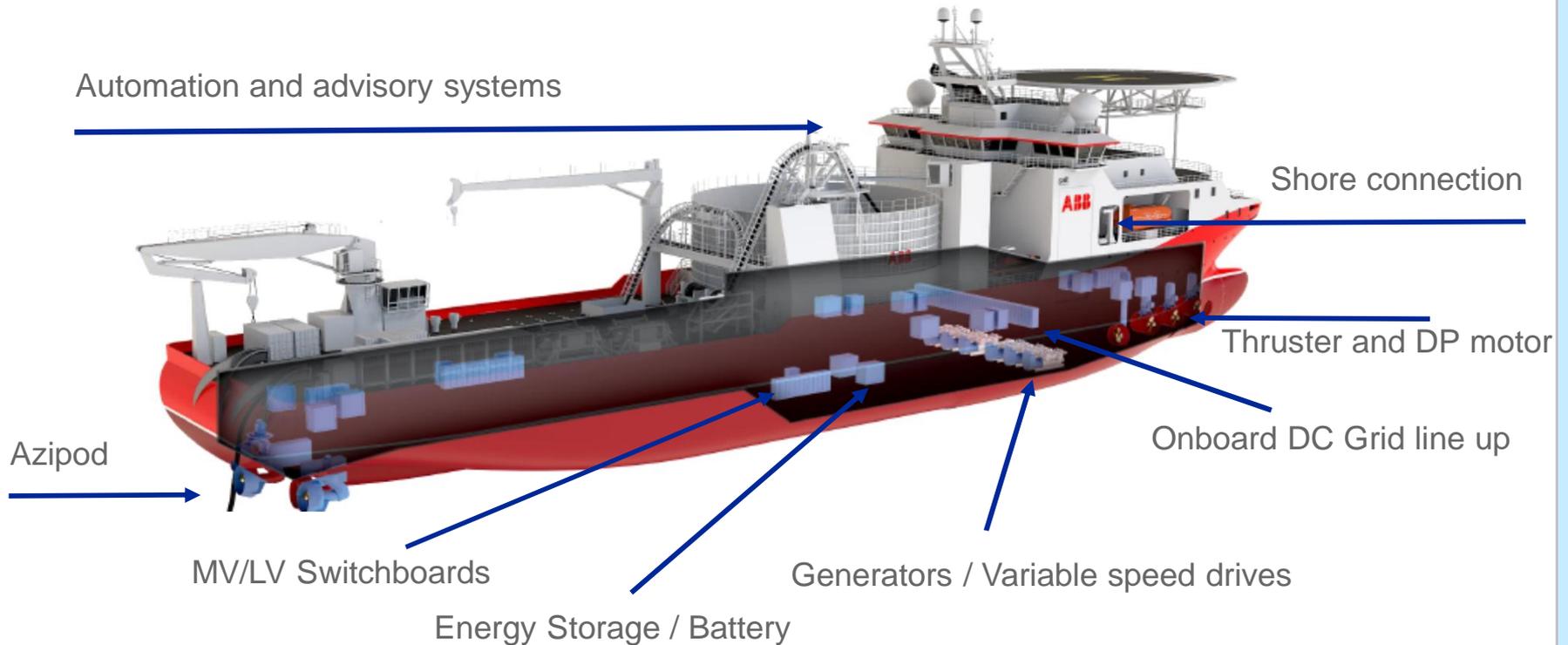
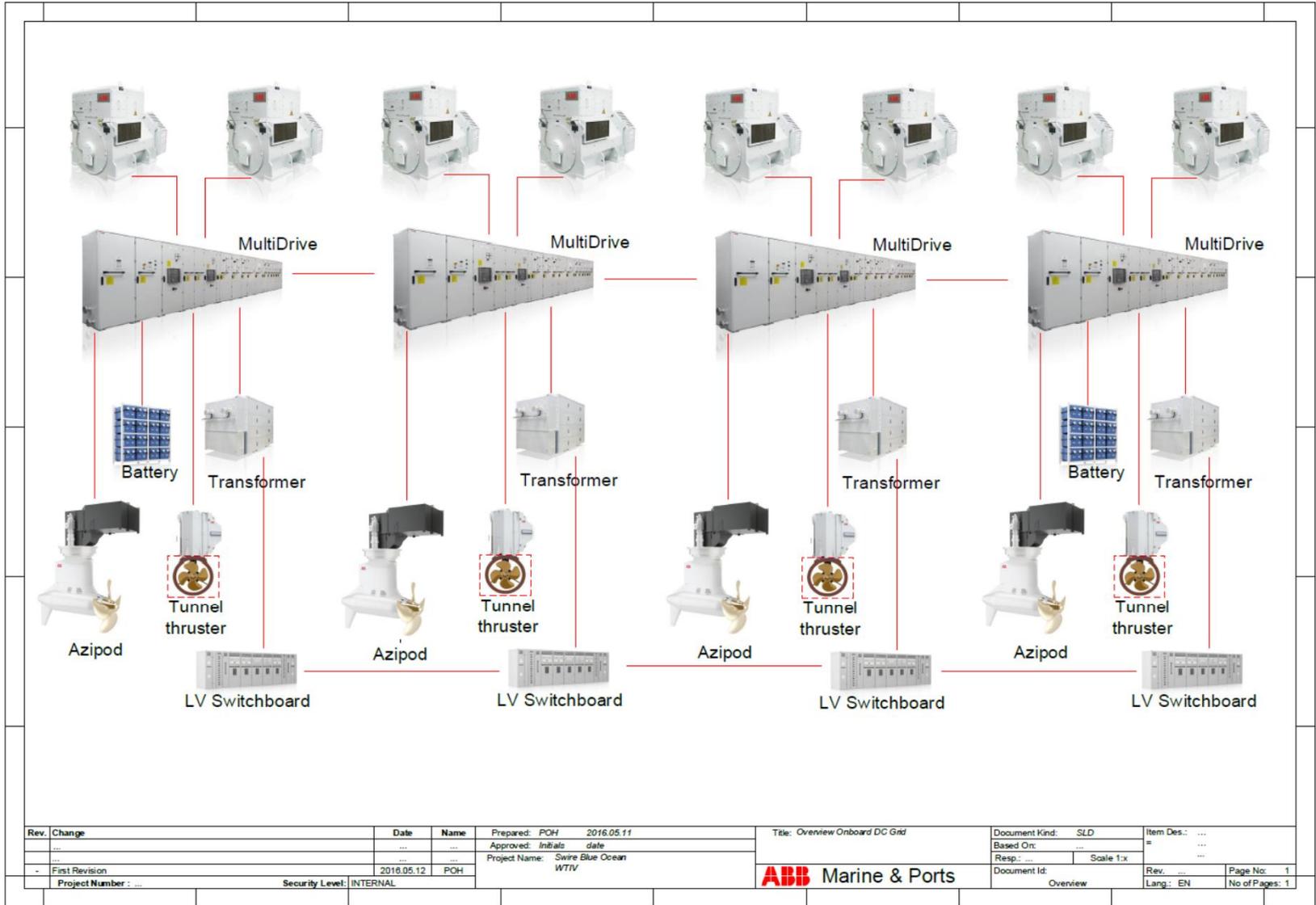


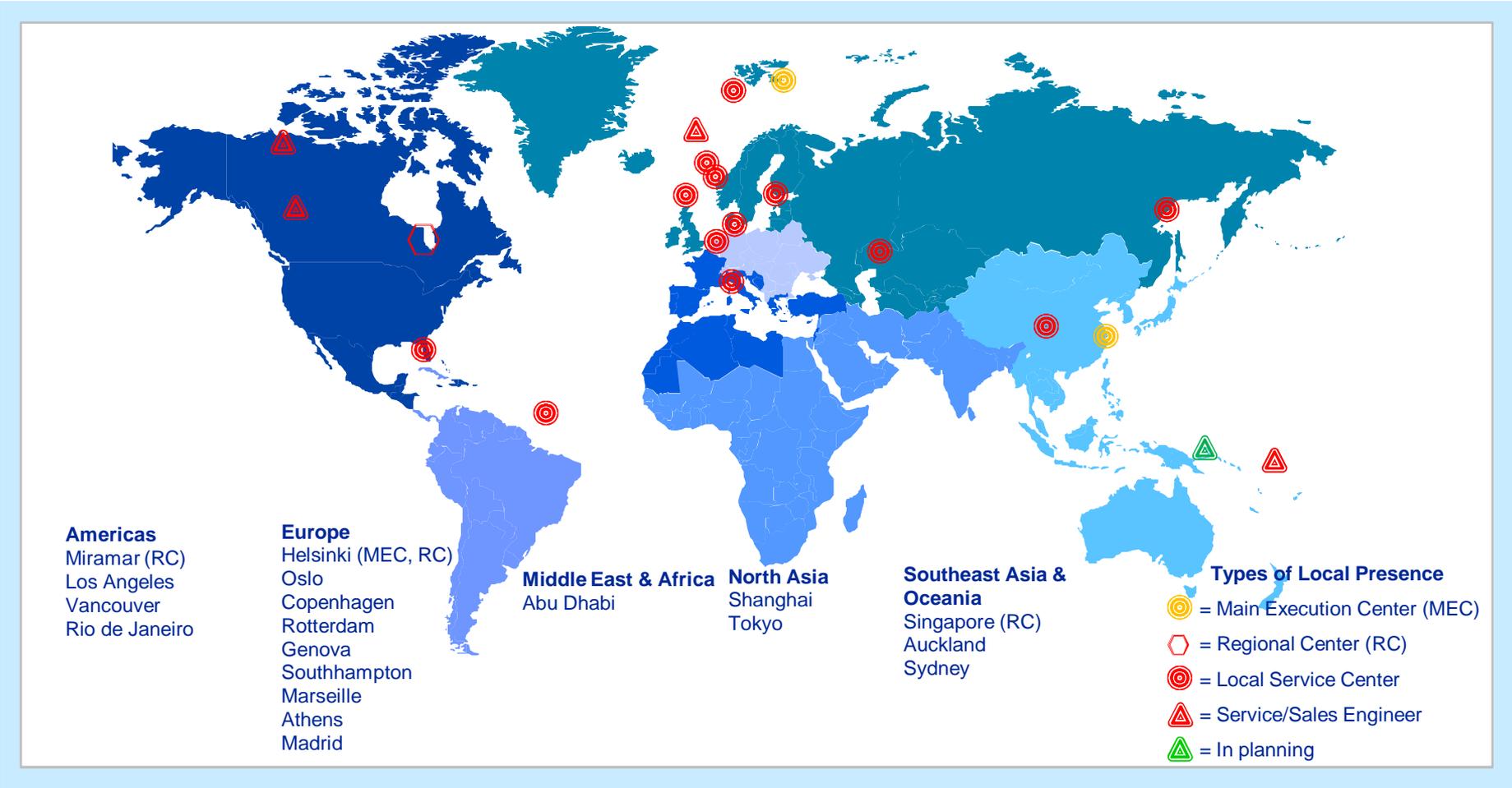
ABB Next Generation Solution – Windmill Installation Vessels

Onboard DC Grid & ESS



Global service network

Largest network in the industry



May 19, 2016



Integrated Operations Center

Taking safety and productivity to the next level



Integrated operations

Connecting ABB and customer on- and off-shore as operations partner

Integrated Operations

- 2 IOCs opened 2015; 3 planned 2016 (50 staff in total)
- Integrated with 3 customer operation centers in 2015
- Digital service business approx. 25 MUSD REV 2015
 - Condition monitoring (120 ships; drives and Azipod^R)
 - Global technical support (>1000 tickets/month)
 - Advisory for Speed, Motion, Power (380 ships)
 - New web portals (myABB and Advisory)
 - Analytics services (piloting phase)



Vessels

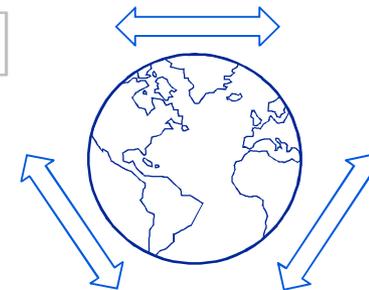


ABB
Operation
Centers

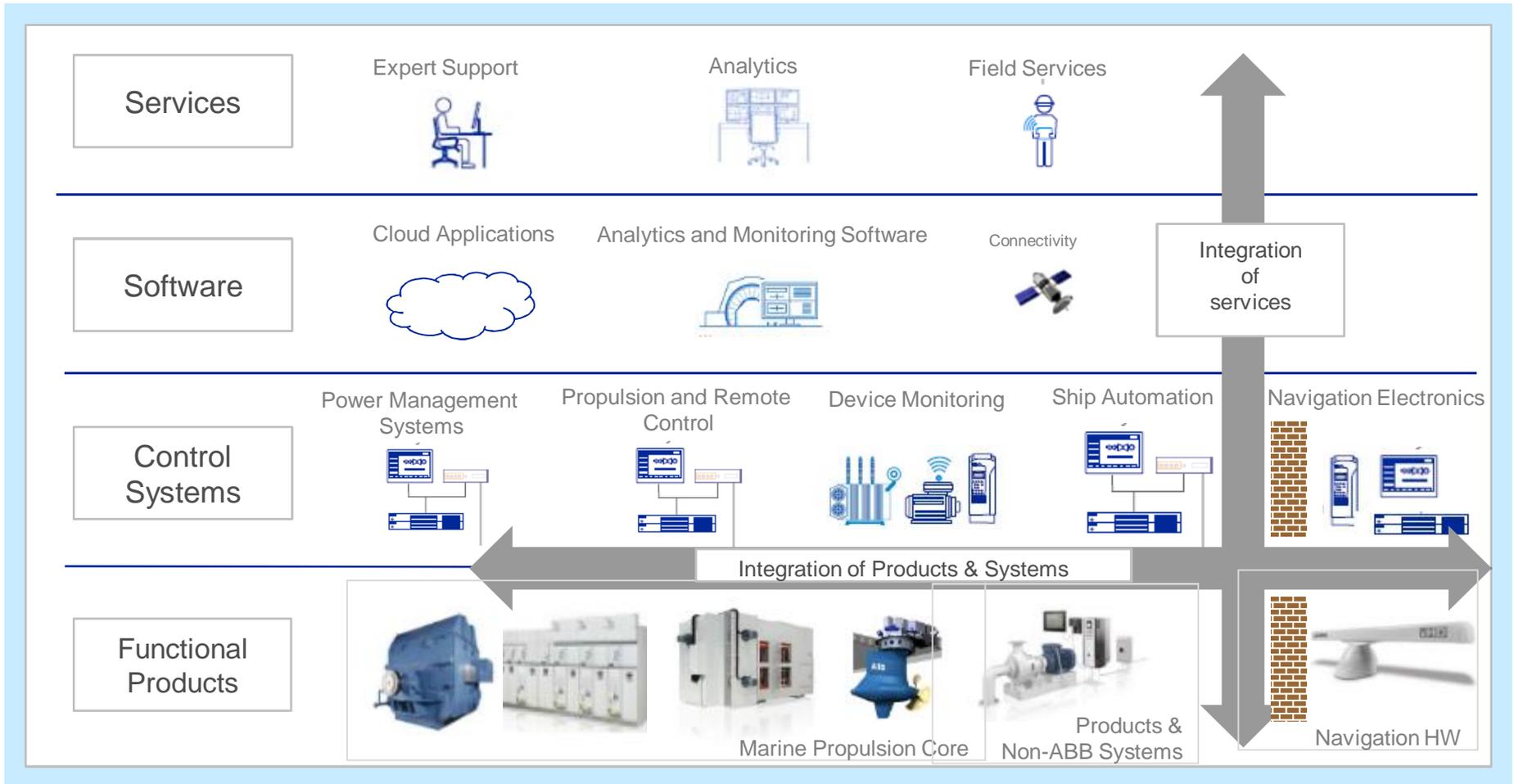


Customer
Operation
Centers

Currently 500 vessels are connected to ABB's Integrated Operations Center

Moving towards autonomous operation

This requires functional integration and digitization



Power and productivity
for a better world™

