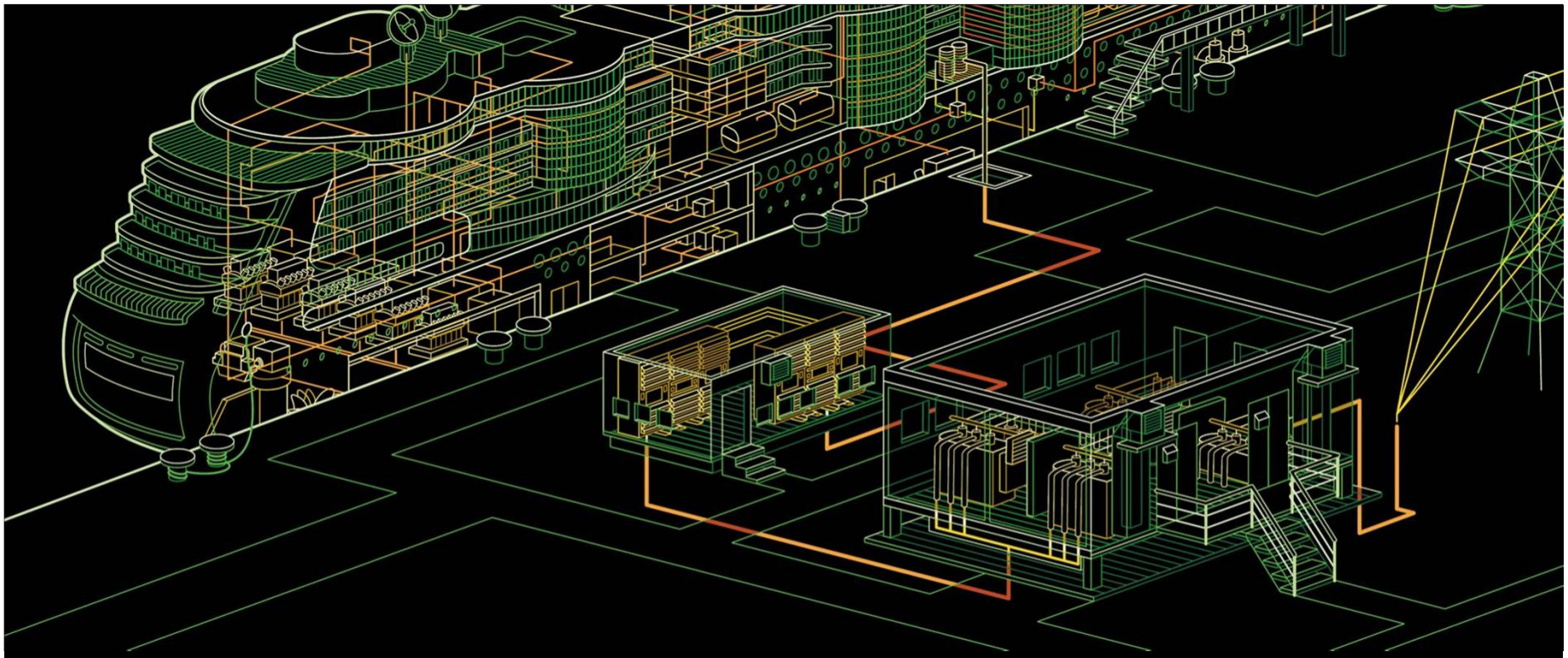


Luca Imperiali, Technical Specialist - Power Systems Division Italy, Genoa, 10-11 November 2011

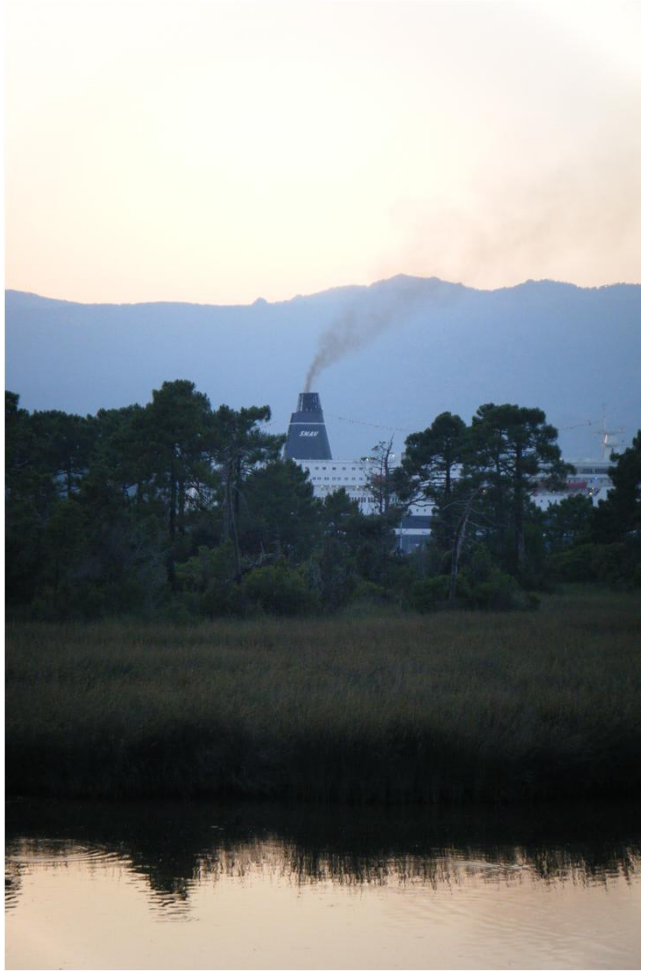
Shore to ship power
A key for Green Ports

Power and productivity
for a better world™

An environmental issue
Emissions from vessels docked in port

- Auxiliary engines run by ships in port produce SOx, NOx, CO_2 and particle discharge as well as noise and vibration
- These pollutants cause negative health and environmental impact on the surrounding communities as well as a negative impact on productive activities

An environmental issue
Emissions from vessels docked in port



- Ships produce(*):
  - 2% of global CO_2
  - 10 – 15% of global nitrous oxides (NOx)
  - 4 – 6% of global sulfur oxides (SOx)

(*)Of total global emissions

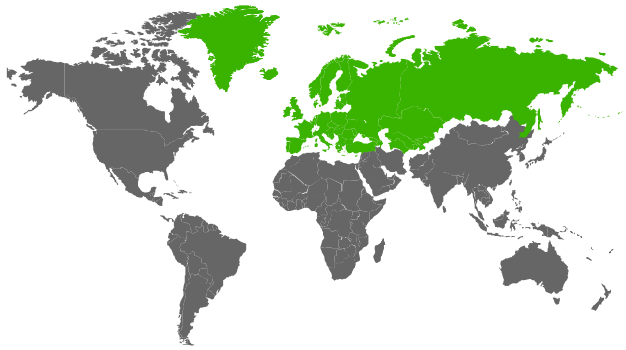
Port emissions reduction
New environmental regulations

- MARPOL 73/78 Annex VI places limits on sulfur oxide and nitrogen oxide emissions from ship exhaust and prohibits deliberate emissions of ozone-depleting substances

- EU Directive 2005/33/EC limits the amount of sulfur to 0.1% in all marine fuel used while at berth for more than 2 hours in European ports

Port emissions reduction
New environmental recommendations

Europe



- EU Recommendation 2006/339/EG for membership countries to promote shoreside electricity facilities
- EU Recommendation 2003/96/EG to subsidize shoreside power by cancelation of electricity tax

North America

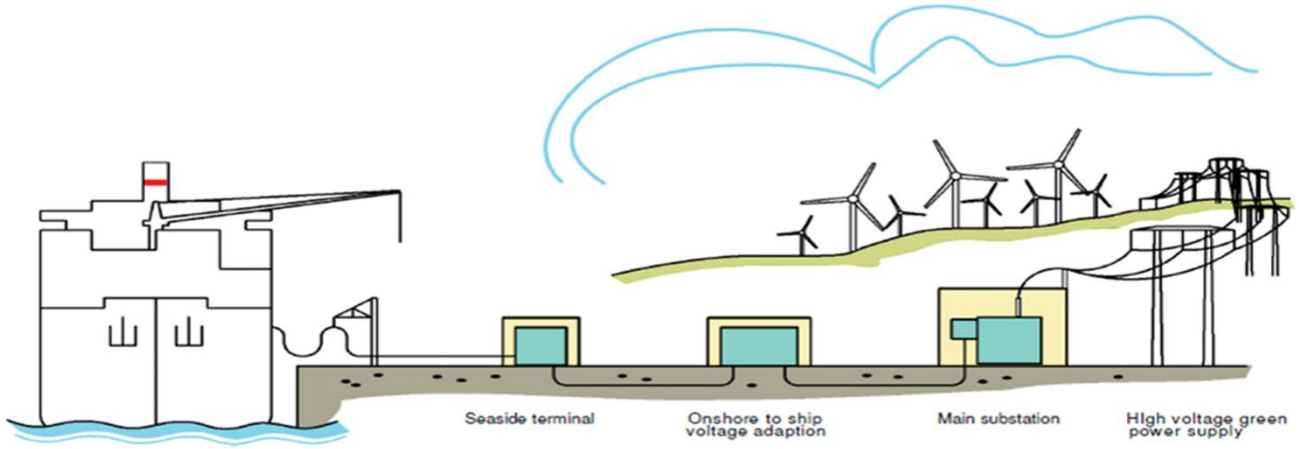
- MEPC 59/6/5 a joint proposal from USA and Canada to IMO to designate an Emission Control Area (ECA of U.S. and Canadian coastal waters

Port emissions reduction
Actual scenario and prospect developments

Photos show the Port of Long Beach, California (left) and Port of Juneau, Alaska (right).

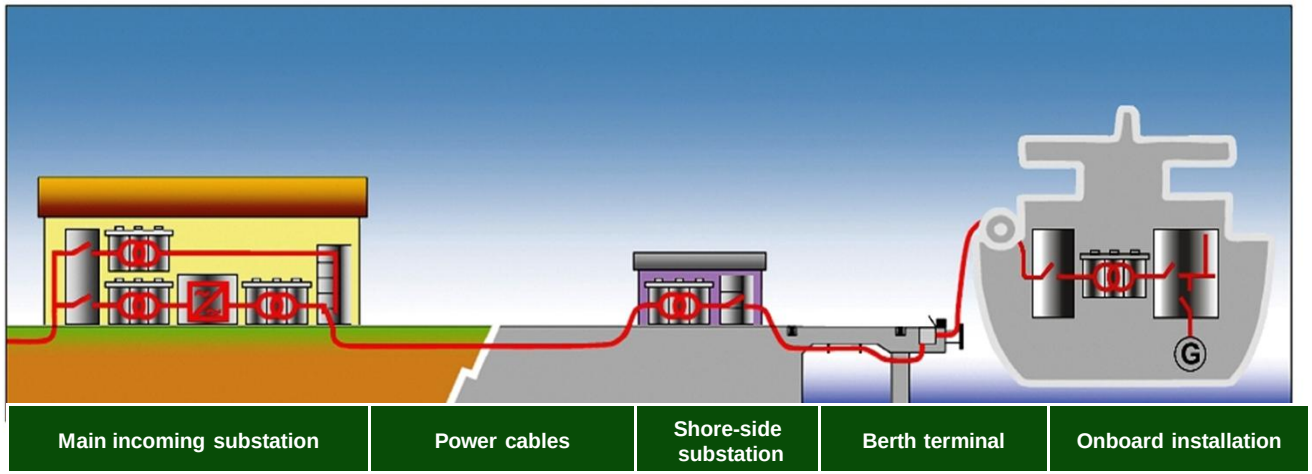
- Several ports around the world have already implemented shore-to-ship power including:
  - Antwerp, Gothenburg, Los Angeles, Long Beach, Lübeck, Juneau, Oulu, Seattle, Vancouver and Zeebrugge
- Other cities are currently planning to install shore power supply systems at their ports, including:
  - Barcelona, Bremen, Busan, Copenhagen, Marseille, Rome, Rotterdam, Stockholm, Venice, Livorno and Genova

Shore to ship power
Definition



Shore connection is the electrical connection between the ship docked at the port and the dockside, in order to reduce both carbon emissions and acoustic pollution. It is obtained by switching off power generators on board and using the power generated onshore

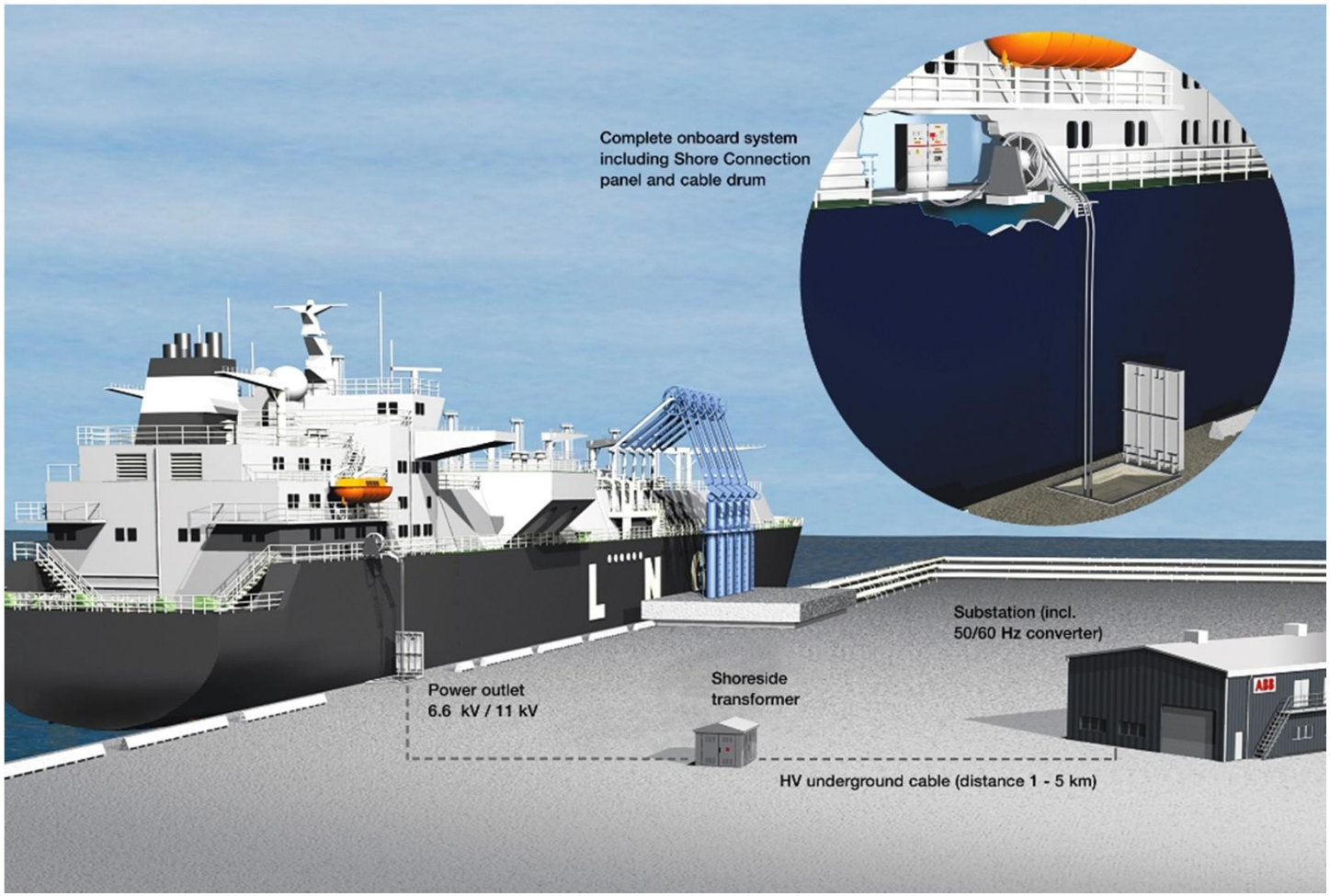
Shore to ship power
ABB solution



- As soon as the ship docks the engines are switched off and all the power the ship needs is generated by the local network without any black out during the passage
- The electrical power is converted to the requested frequency (US frequency is 50 Hz, EU is 60 Hz) and then transformed and directd to the ship through a single cable which is connected directly to a panel positioned on the ship
- ABB solutions can be adapted both to a single ship, a single dock and to the whole port electrification

ABB Shore to ship power
A complete solution

Example
- LNG Carrier
loading facility



Shore to ship power
ABB Marine experience



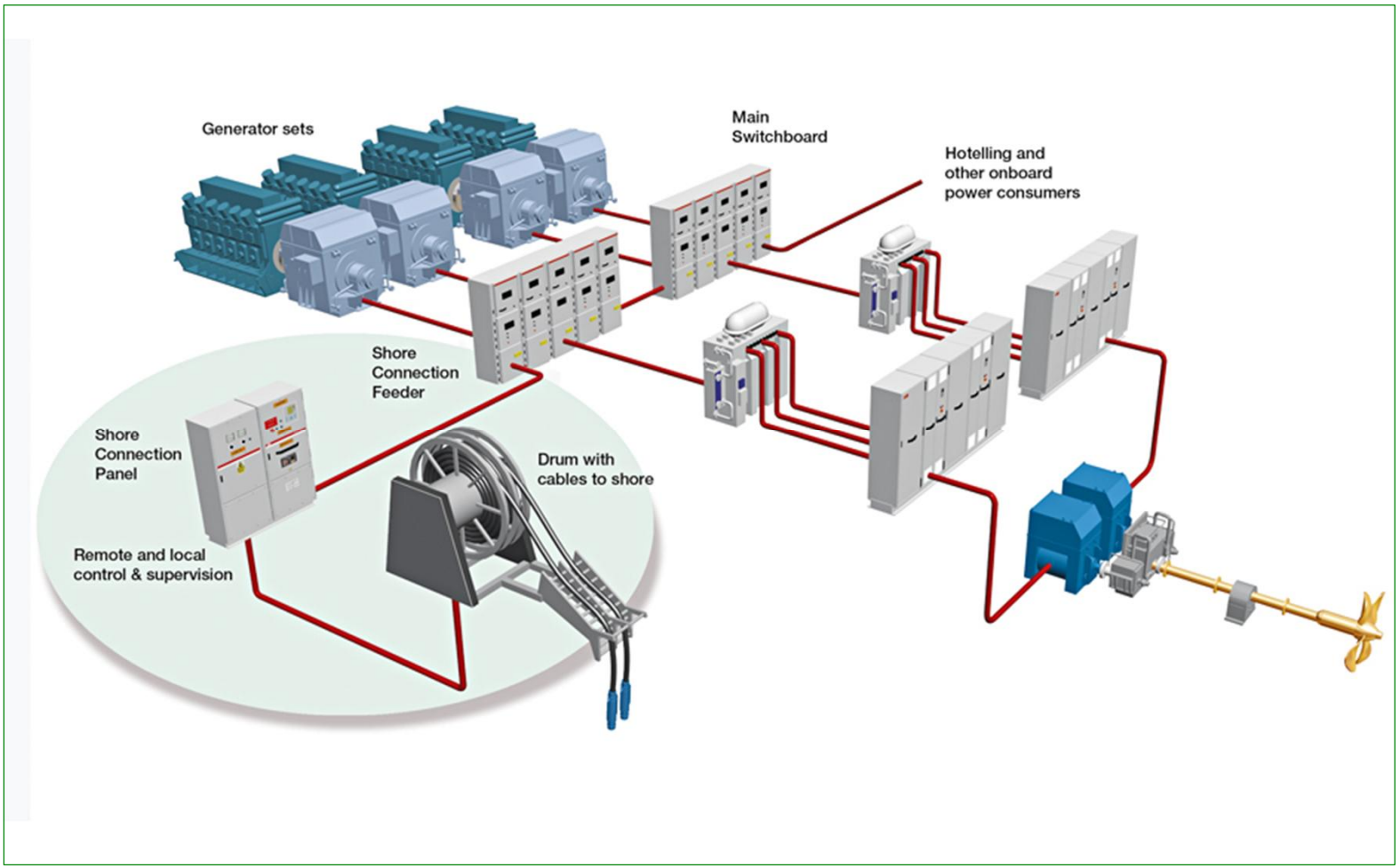
- ABB has been a pioneer in high voltage marine installations
- With safety and reliability in the forefront, ABB has developed a compact and complete Shore to ship power solution for ships
- The system is flexible and well suited for:
  - Vessels using any fuel type and propulsion system
  - Newbuild and retrofit projects
  - Ships with Low Voltage or Medium Voltage network

Onboard solution
Example 1 – ship with diesel-electric propulsion

Ship with diesel-electric propulsion.

Shore Connection system configured with the Shore Connection Panel located outside the main switch-board room.

An onboard cable drum lowers the cable down to the quay for onshore termination

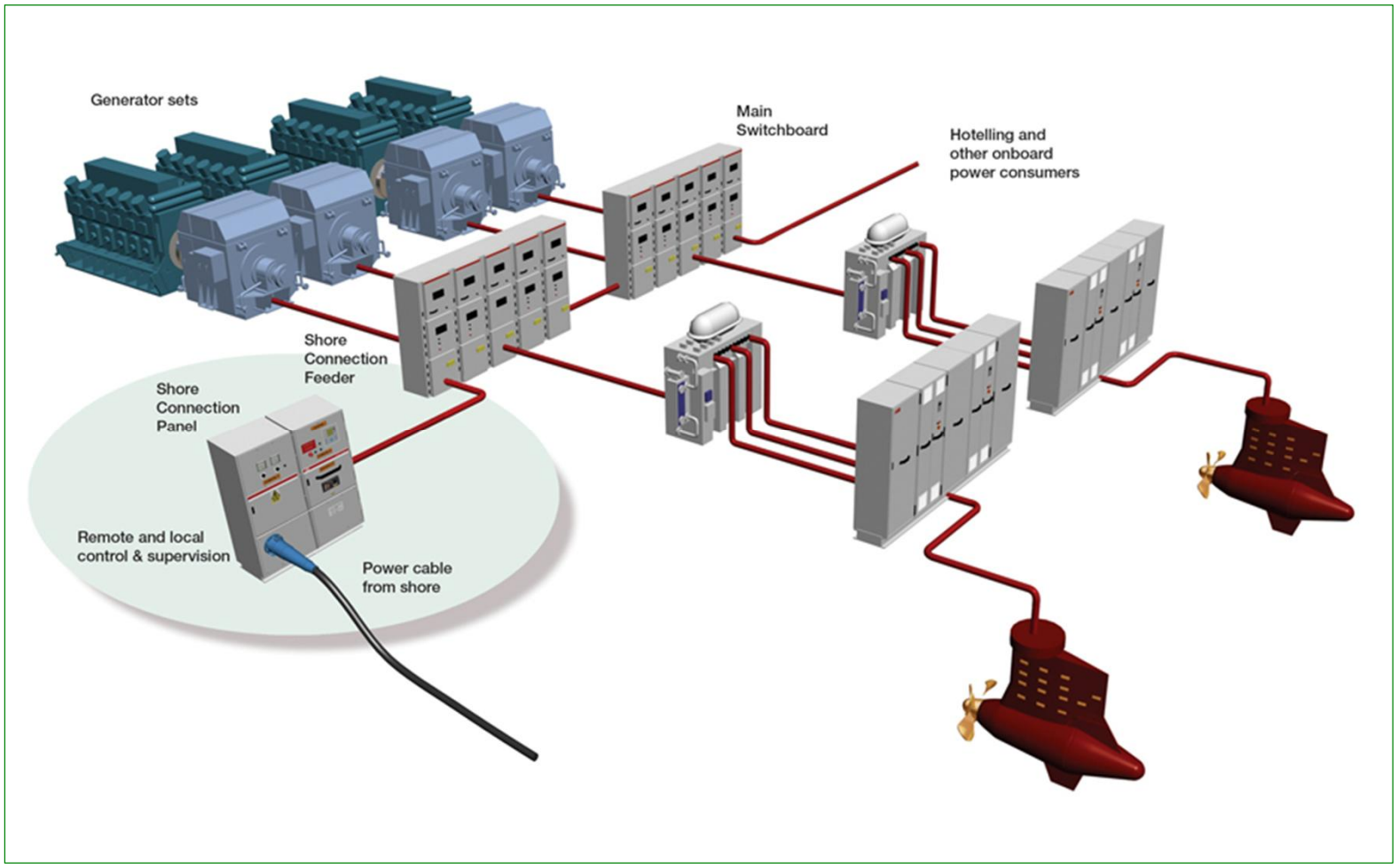


Onboard solution
Example 2 – ship with Azipod® propulsion

Ship with electric Azipod propulsion.

Shore Connection system with Shore Connection Panel located outside the main switchboard room.

Cable connectors front-mounted in cabinet.



Onboard solution
Example 3 – ship w/diesel machinery and LV el.system

Ship with diesel machinery and low voltage electric system.

The Shore Connection Panel is located outside the main switch-board room with cable connectors mounted in the front.

An onboard transformer steps down the power from high to low voltage.

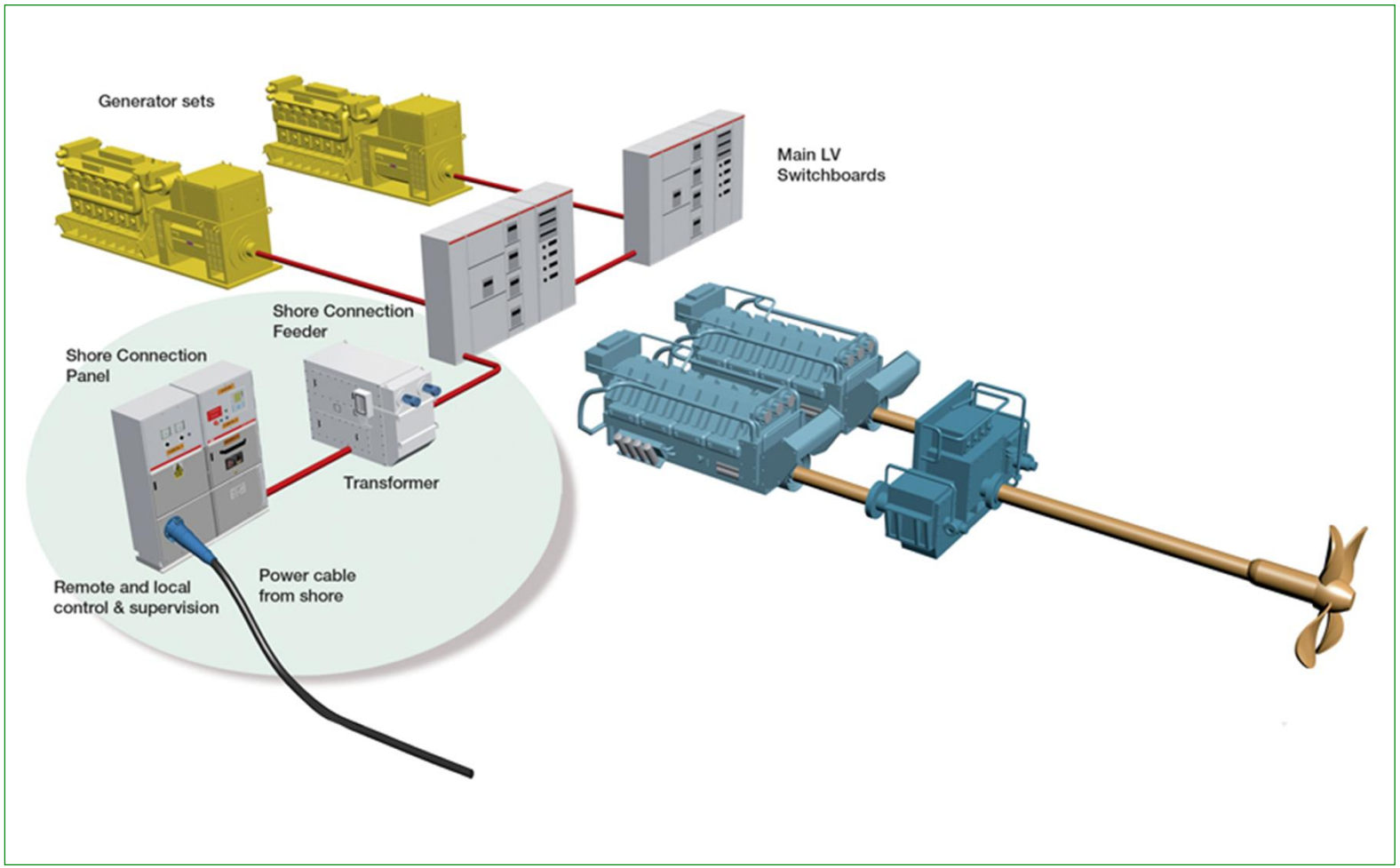


ABB Shore to ship power
Connection/disconnection sequence

The shore power connection/disconnection sequence includes the following steps:

1. When vessel docks, the shore side and ship side Shore Connection systems are grounded.
2. With system grounded, power cables and control cables are connected.
3. The safety system supervises that connectors are properly connected before enabling grounding disconnection and energizing the power cable.
4. The last running engine is automatically synchronized with the shore power grid.
5. After the Shore Connection circuit breaker is closed, the generator is off-loaded and the engine is stopped.
6. While connected, the system supervises any faults in the circuit such as a ground fault or short circuit.
7. Before the vessel departs, any engine can be started and synchronized with the shore power grid.
8. After the load is transferred to the generator, the Shore Connection breaker opens and the system is grounded.
9. Power cables and control cables are disconnected and the vessel is ready for departure.

ABB Shore to ship power
Turnkey supply – onshore and onboard

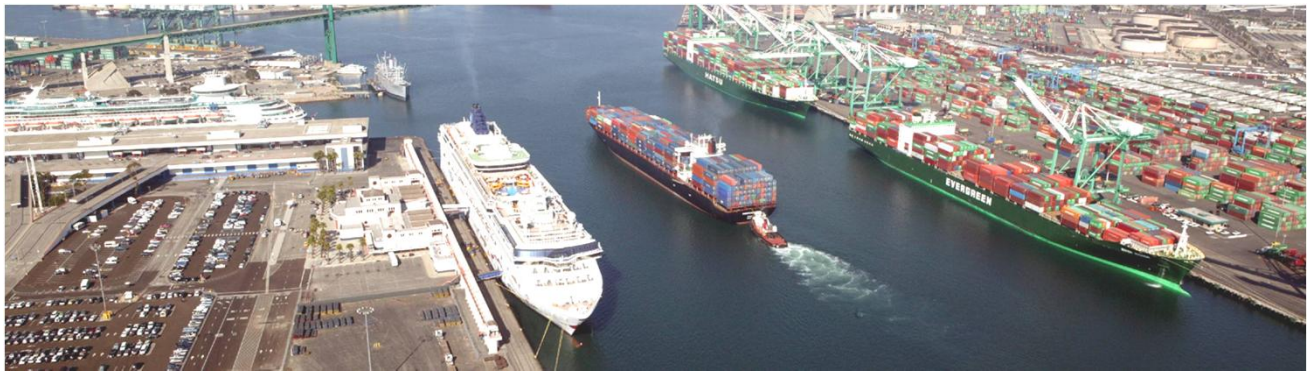


ABB supplies turnkey Shore to ship power solutions comprising the entire electrical infrastructure needed onshore and onboard

Engineered and integrated systems including transformers and frequency converters to match the grid power, voltage and frequency to the ship's power system, connecting cables and berth terminals, etc.

A comprehensive range of services for complete shore-to-ship solutions

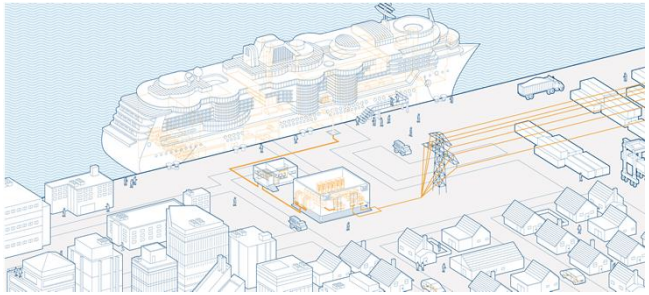
Port of Gothenburg 2000
World's first HV shore-to-ship power solution

An ABB shore-to-ship electric power solution developed for Gothenburg in 2000 was the first in the world to provide ships with High Voltage electric power delivered by cable from onshore during their time in port.

Shore-to-ship power solutions
Gothenburg for RoRo terminal,Sweden
Port of Gothenburg – 2.5 MVA, 11 kV and 60 Hz

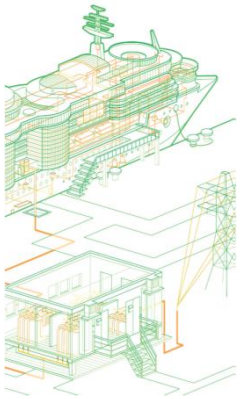
Customer:
Processkontroll Elektriska AB Stenungsund

Year of commissioning:
2010



- Customer needs
  - Shore power supply to a vast number of Stena Line vessels while at berth
- ABB's response
  - Turnkey 11kV substations, including Safe+ GIS switchgear 6 bays 50Hz, 4 bays 60Hz, and 2 transformers type Resibloc
  - Two frequency converters 1250kVA type SFC
  - PLC system type AC500
- Customer benefits
  - Dependable project execution from design to start-up, and state-of-the-art equipment
  - Reliable shore power supply to ferries
  - Reduced emissions, low-frequency noise and vibrations
  - Better environment for passengers, crew, dockworkers and local residents

Why Shore to ship power ?
Meet environment and business



Customer value – Shore side

- Upgrade port areas and make them attractive for residential and commercial investment
- Improved quality of life for local community – reduced emissions, noise and vibrations
- Green profiling of ports and port cities

Customer value – Ship side

- Compliance with local and international environmental regulations
- Better onboard comfort while in port
- Reduced lifecycle cost by reduced fuel consumption and maintenance cost
- Green profiling for shipping operators

Customer value – frequency converters

- Enabling the connection of any ship to any port grid regardless of their respective frequencies
- Improved power quality of the port grid – improved power factor, stabilized voltage and frequency

Your questions

Power and productivity
for a better world™