SIHARBOR: reliable shore power supply

Shore-side power supply for eco-friendly ports

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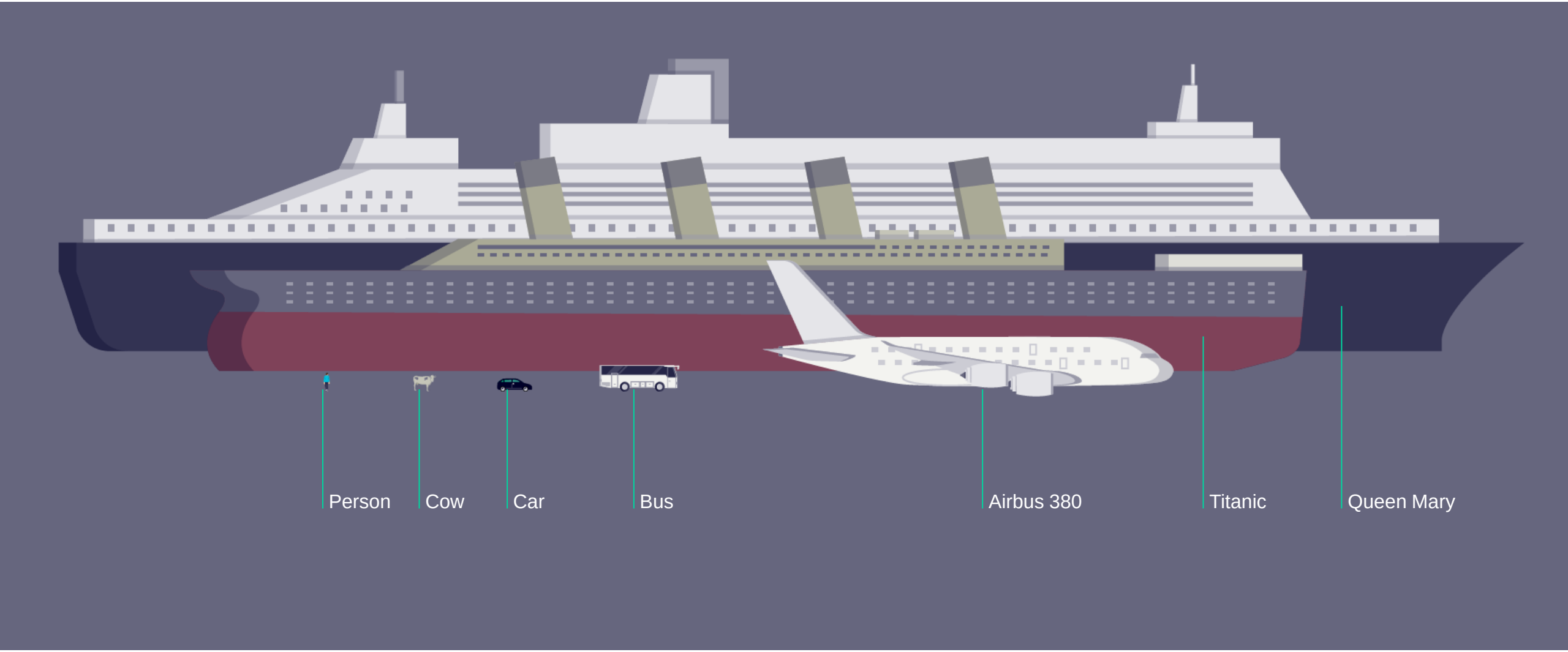
Great challenges require great solutions



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Siharbor: reliable shore power supply
Basis for eco-friendly ports

Climate protection

Reliable power supply

Ships and ports

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Basis for eco-friendly ports

Climate protection

- Trade ships docked in congested areas
- berthed cruise ships in the center of cities
- Activities on board the ship require power
- On-board diesel generators are permanently in operation
- High environmental pollution through combustion of fuels

Reliable power supply

Ships and ports

- Handling of different ships/ length/ power demands
- Environmental & economical awareness
- Upcoming legislations and regulations
- Local and European funding programs
- No technological risk
- Must part of port expansion projects

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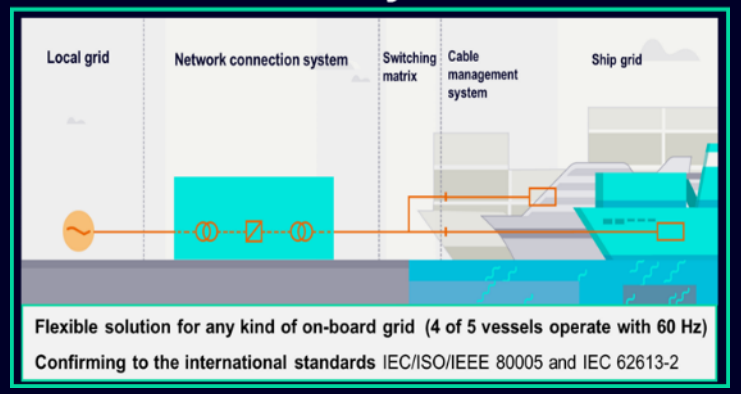
Siharbor: reliable shore power supply
Basis for eco-friendly ports – concept inputs

Basic System



variety of ship types / demands

several flexible berthed ships

Goals

Simplified operation	easy handling by operational port staff
Reliability	ready to use/ easy error identification/ early service identification
Sustainability	seeking for highest efficiency/ reduced process losses
Technology	use of latest compact Blue GIS approach (SF6 gas-free)

Approach

Simple power supply | By-pass power supply | Parallel power supply | Matrix power supply

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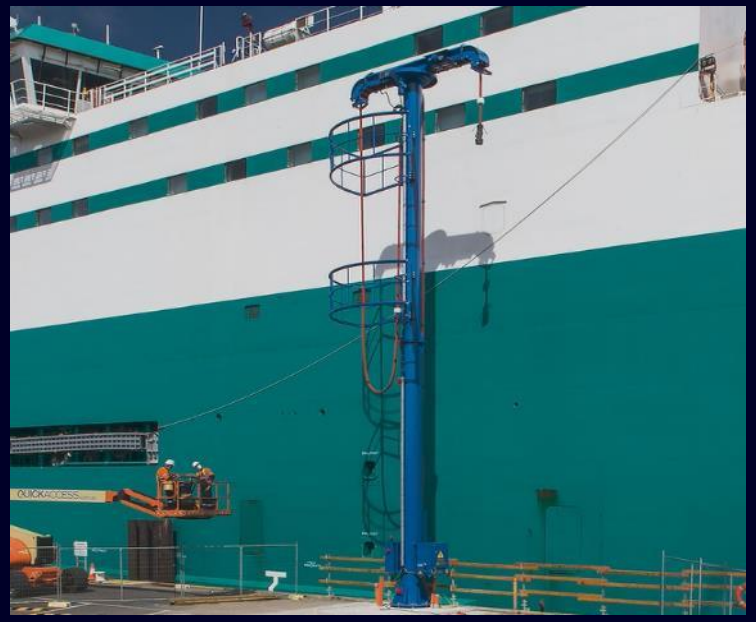
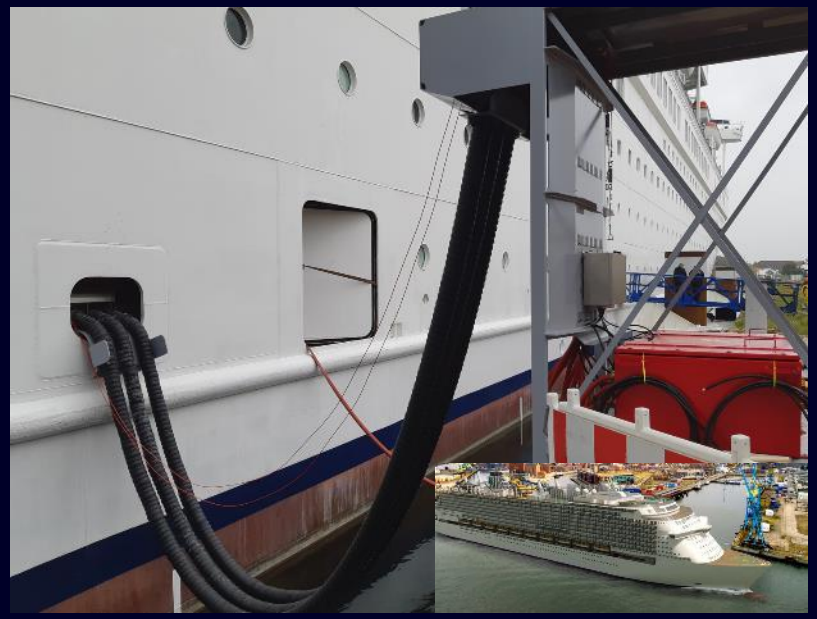
Basis for eco-friendly ports – several locations and flexible berthed ships



Ferry 5 MVA

Simple power supply

- Synchronizing the system



Hotel Ship 4 MVA

Simple power supply

- Synchronizing the system
- Power conversation to 60Hz

Cruise 12 MVA

combined power supply with 50/ 60Hz

- Synchronizing the system
- Power conversation to 50/ 60Hz
- Using different voltage levels

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Cruise+ Ferry 16 MVA

Parallel synch ship supply

- Compensation of cable length
- Earthing and switch process
- Load changes between the consumer

Container 8 MVA

Switching matrix supply

- Save switching/ powering of consumer
- # of switch cycle of breakers (~10.000)
- Automation system for simplified operation

Cable length:

- Keep distances always short ✓

Switching:

- # of switch cycle of breakers ✓

Load changes:

- Fast control loop ✓

Earthing/ Switching

- Combination of HW/ SW locks ✓

Safe and simple operation

- Highly visualized system ✓

Efficiency

- Keep process losses low ✓

Extension:

- Consider spare cabinets/ space ✓

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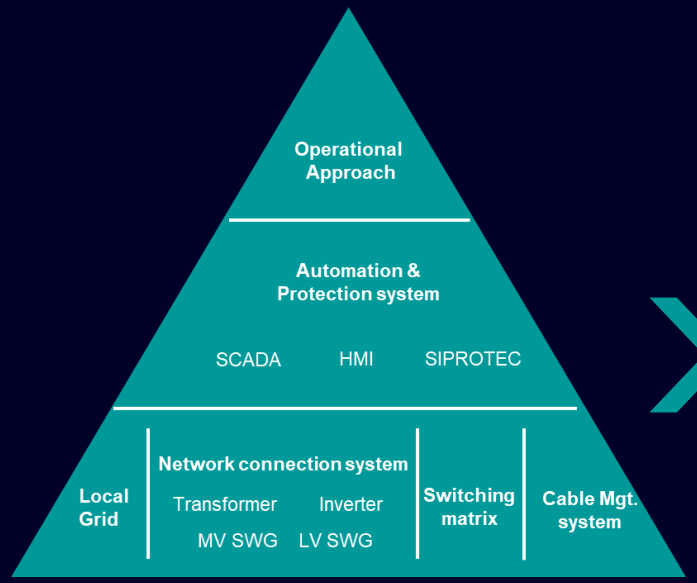

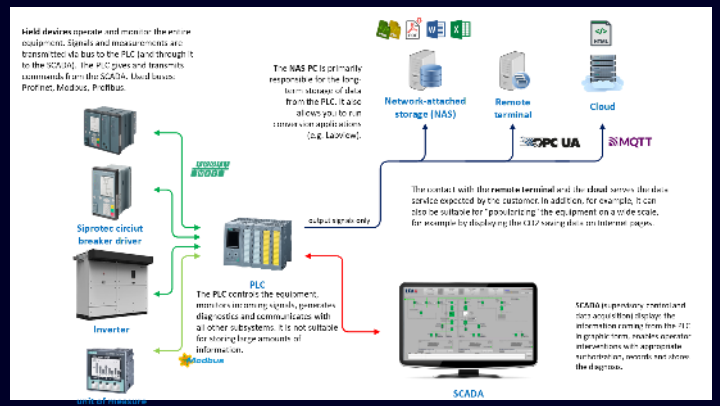

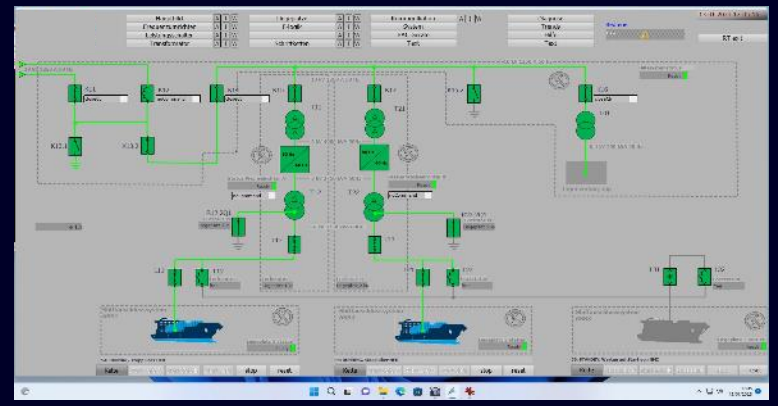

- Process control with proven step chains for switching on and off with internal monitoring functions (runtime, feedback,...) ✓
- Proven implementation of security loops ✓
- Proven integration of measured values, signals, monitoring ✓
- Familiar structure of operating elements and operating philosophies ✓
- Safe switching via the protective relay ✓

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Backup

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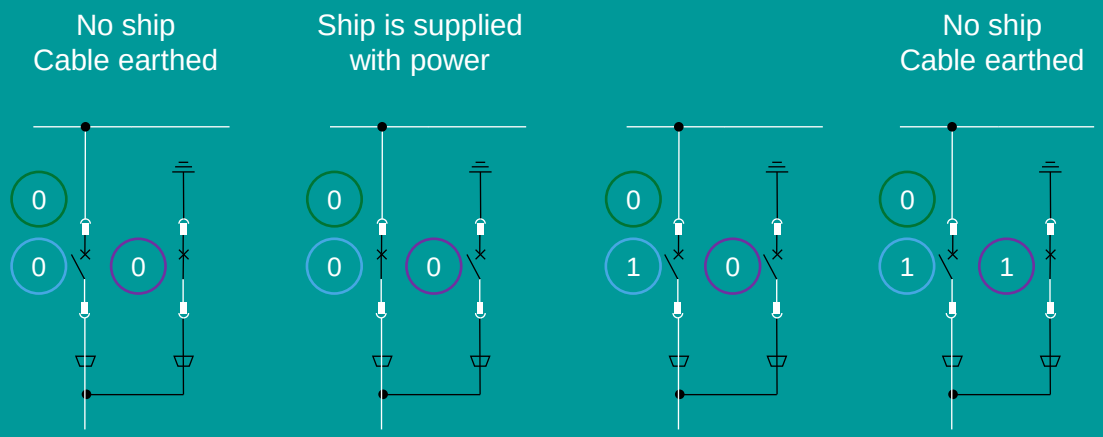

	LS 1	Einschub1	LS 2
Switching cycle per ship event [1)]	1	1	1
Max switching cycle per device	10000	1000	10000
Max ship events	10000	1000	10000

1) 1 ship call means: switch position 1 → switch position 2 → switch position 1

→ All panels to be equipped with circuit breakers to ensure 10,000 switching cycles

→ Movable withdrawable part remains in initial position, separation point closed

→ Number of switching cycles 10,000

→ Replacement circuit breakers for increase to 30,000 considered in the maintenance plan

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