SIHARBOR: The shore connection system for berthed ships

Knut Marquart and Thomas Kopel, Siemens AG

Workshop “Sustainable Energy Supply & Innovative Solutions for Emission Reduction Improved Ports – Cruise Line Collaboration”, Bergen/Norway

Bergen / Norway, November 8th-9th 2017
SIHARBOR: The shore connection system for berthed ships

Shore-side power supply for eco-friendly ports

siemens.com/sihabor
SIHARBOR introduction film
Shore-side power supply for eco-friendly ports

Climate protection

Reliable power supply

Ships and ports
Shore-side power supply for eco-friendly ports

Climate protection
Reliable power supply
Ships and ports
Shore-side power supply for eco-friendly ports

New challenges in harbors

• More and more trade ships docked in congested areas
• More and more 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
• Concentration of SOx, NOx emissions and PM represents a real danger for the thousands of residents in the port area

The solution

Power from the plug and socket for a sustainable environment in the port areas
Hard facts: Shipping-related pollution

Did you know? More than 90% of the global trade flow is transported across the world’s seas and oceans.

Source: United Nations Statistics Division, Millennium Development Goals indicators

Pollution by ships:
- CO₂ emissions: 15%
- Nitrogen oxide (NOₓ) emissions: 2%
- Sulphur oxide (SOₓ) emissions: 6%

Global emissions
Hard facts: Shipping-related pollution in ports

More than 100,000 vessels dock at 4,500 ports worldwide causing high environmental pollution:
- Noise and air pollution
- Emissions
- Vibration

Did you know? That 900 million metric tons of CO₂ are emitted annually at ports worldwide (as much as by 200 coal-fired power plants)
Hard facts:
Local emissions of a cruise vessel

Did you know? That a berthed cruise ship generates as much NO\textsubscript{x} emissions and particulate matters (PM) as thousands of cars a day?

- \(1.2 \text{ t NO}_x\) = 10,000 cars
- \(30 \text{ kg PM}^*\) = 6,000 cars in transit Paris - Berlin

\(8 \text{ hours at berth}\)
Reduction of emissions thanks to shore connection

- 95% VOC
- 55% N₂O
- 86% CO
- 90% PM
- 97% NOx
- 54% CO₂ *

*45% with modern diesel engines
SIHARBOR – Shore-side power supply for eco-friendly ports

Worldwide regulations

Canada
Shore Power Technology for Ports (SPTP) program
$27.2 million funding will be available from April 1, 2013 to December 31, 2015

California (CARB)
In 2014 shipping lines for container and cruise ships must have 50% of their fleet plugging into shore-side power, and must reduce total at-berth emissions by 50% (70% in 2017, 80% in 2020)

Spain
Port fees reduction for shipowners equipped with SSE

Alternative Fuels Infrastructure Deployment Directive (DAFI)
SSE should be implemented by 2025

Environmental ship index:
Vessels equipped with SSE systems get port fees reduction in ESI member ports

Sweden, Germany
Reduction of electricity tax rates for use of SSE (under Directive 2003/96/EC)

International Maritime Organization:
Shore-side electricity makes ships compliant with MARPOL 6 NOX, and SOX regulation

Spain
Port fees reduction for shipowners equipped with SSE

China (MoT of China)
Shore Connection should be included in project planning, design and construction for new container, bulk, cruise and ropax terminals
Shore-side power supply for eco-friendly ports

- Climate protection
- Reliable power supply
- Ships and ports
SIHARBOR – Shore-side power supply for eco-friendly ports
The challenge: frequency conversion

80% of the vessels operate with 60 Hz

Only 25% of the national grids operate with 60 Hz

The onshore frequency must be adjusted to the onboard frequency in 75% of the countries

The solution: SIHARBOR for all frequencies
SIHARBOR – Shore-side power supply for eco-friendly ports
System description with frequency conversion

SIHARBOR:
• Flexible solution for all kinds of board grids independent of frequency
• Conforms to the international standards IEC/ISO/IEEE 80005 and IEC 62613-2
SIHARBOR – Shore-side power supply for eco-friendly ports
Perfectly matched components for a reliable power supply

For all voltages and frequencies
- Adaptation to all performance classes, voltages and frequencies
- Galvanic isolation via isolating transformer

Power converter system
- Connects two or more medium-voltage AC grids of different voltage, phase sequence and frequency
- For any required transfer voltage
- Appropriate layout for each kind of electrical grid

Compact power supply solution with high efficiency, including:
- Frequency converter
- Control and HMI
- MV switchgear
- Possible integration in an E-house or existing electrical building

Efficient solution for ports and ships
SIHARBOR – Shore-side power supply for eco-friendly ports
Cable management system for connecting ships
SIHARBOR – Shore-side power supply for eco-friendly ports

Highlights of the shore connection system

- Fast and simple connection to the ship via a Cable Management System (CMS)
- All power requirements are covered by cascading power modules
- No trained personnel necessary for the shore connection
- Compliance with the international standards IEC/ISO/IEEE 80005 and IEC 62613-2
- Complete operation controlled from the ship
SIHARBOR – Shore-side power supply for eco-friendly ports
Joint standards worldwide

High voltage shore connection
Low voltage shore connection
Communication shore - ship
Plugs and sockets

Siemens contributes to the international standardization process
Shore-side power supply for eco-friendly ports

Climate protection

Reliable power supply

Ships and ports
SIHARBOR – Shore-side power supply for eco-friendly ports

Market dynamic

- Environmental & economical awareness
- Upcoming legislations and regulations
- Local funding programs
- No technological risk anymore
- Port expansion projects
SIHARBOR – Shore-side power supply for eco-friendly ports
Versatility of application for a large variety of ships

<table>
<thead>
<tr>
<th>Vessel type</th>
<th>Length (m)</th>
<th>Average (MVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container vessels (&gt; 140 m)</td>
<td>50-150</td>
<td>0-3 MVA</td>
</tr>
<tr>
<td>Cruise ships (&lt; 300 m)</td>
<td>100-200</td>
<td>3-11 MVA</td>
</tr>
<tr>
<td>Cruise ships (&gt; 300 m)</td>
<td>150-300</td>
<td>7.5-11 MVA</td>
</tr>
<tr>
<td>10-15 MVA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RoRo and vehicle vessels, bulk carriers</td>
<td>200-300</td>
<td>3-11 MVA</td>
</tr>
</tbody>
</table>
SIHARBOR – Shore-side power supply for eco-friendly ports

Advantages

Shipowners and shipyards profit from SIHARBOR:

• Safe and reliable power supply
• Financially attractive option in view of rising fuel prices
• Lower maintenance costs
• Lower port fees

The experts speak about SIHARBOR:
http://w3.siemens.com/powerrdistribution/global/EN/mv/power-supply-solutions/onshore-power-supply/Pages/siharbor.aspx

Lars Stücken
Hamburg Port Authority AöR
SIHARBOR – Shore-side power supply for eco-friendly ports
Reference: Cruise terminal Hamburg-Altona

Worldwide first 50/60 Hz OPS system for cruise liners

Basic technical data:
- 12 MVA – 6.0 kV / 10.0 kV / 11.0 kV - 50 Hz
- 12 MVA – 6.6 kV / 11.0 kV - 60 Hz

- Confirming the international standards IEC/ISO/IEEE 80005-1 and IEC 62613-2
- New developed cable management system for 300 meters along the berth and tidal difference of 10 meters
SIHARBOR – Shore-side power supply for eco-friendly ports
Reference: Flensburg Shipyard

Compact and flexible containerized solution with complete integration of the components

- Power capacity of 1 MVA
- Shore connection for powering ships in the shipyard with different voltages (400 V/50 Hz, 440 V/60 Hz, 690 V/60 Hz) from the 50 Hz shipyard grid.
- Max. acoustic pressure level of 45 dB(A) at a distance of 65 m
SIHARBOR – Shore-side power supply for eco-friendly ports
Turnkey solution from a single source

System dimensioning through the use of innovative calculation and simulation tools

Support financing

Optimizing solutions to ensure best lifecycle revenue or cost saving opportunities

Best fit technical solutions for specific application requirements

Technical performance guarantees and support through after sales

Support financing
SIHARBOR – Shore-side power supply for eco-friendly ports

Contact

Knut Marquart
Thomas Kopel

E-mail:
Siharbor.energy@siemens.com

siemens.com/siharbor

We design your complete system