Shore Power Connection – Worldwide Implementation

AAPA - Energy & Environment Seminar

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Shore Power Connection

Shore Connection

Alternative Maritime Power

Cold Ironing

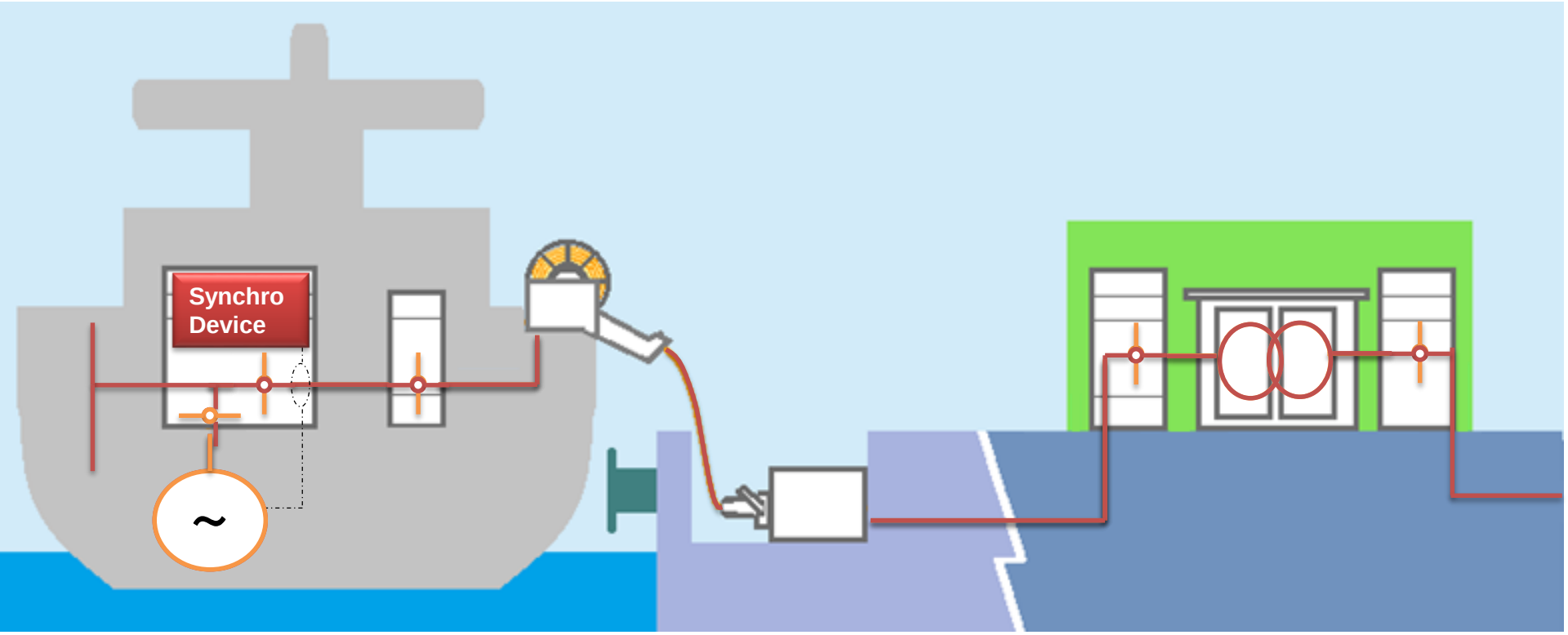
HV Electrical shore to ship connection

On Shore Power supply

Different wording to describe the same technology:

Ship switch off Auxiliary Engines during the port-stays receiving power from the electrical power grid of the port itself

Shore Power Connection Technology



Shore Power Connection Technology

Since beginning of 2000 new High Voltage electrical shore to ship power systems have been developed .

High Voltage required the implementation of more equipment on board and on shore to achieve the results of a safe and reliable electrical connection

HV shore supply systems consist in following major parts

Shore equipment

- Primary Circuit Breaker on shore (connection to the Power Utility Grid)
- Shore Step-down transformer
- **Frequency converter**
- Secondary Circuit Breaker on shore (distribution)

Interface equipment

- Socket outlet JB (Ship or shore based)
- Cable Management System (ship or shore based)

Ship equipment

- HV Shore connection Panel
- Step down transformer in case of LV ships
- Shore incoming panel

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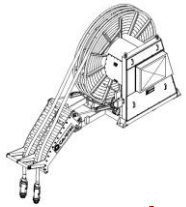
Cavotec solutions – Interface equipment

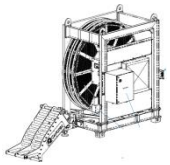
Cable Management System

Socket outlet

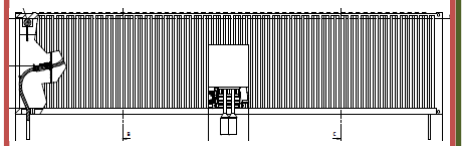
Ship Based



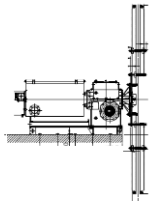
AMPReel



AMPReelS

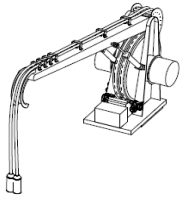


AMPTainer



Centrally mounted reel

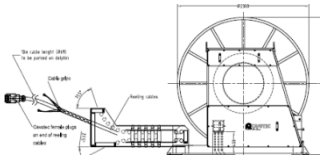
Fix Shore based



AMPTelescopic

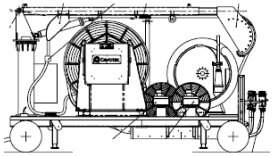
AMPDispenser

AMPDispenserM

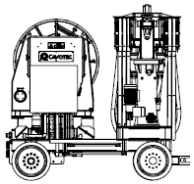


AMPShore

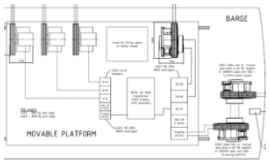
Mobile system



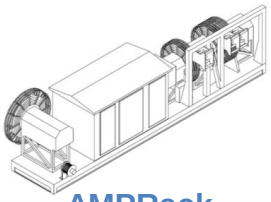
AMPMobile



AMPMobile Mini

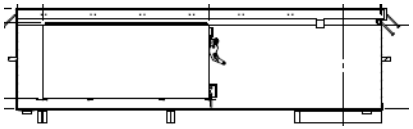


AMPBarge

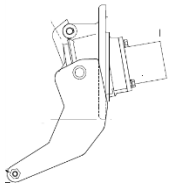


AMPRack

Shore and ship



AMPVault



AMPSocket

Container ship – AMP Container

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Cruise Ship – AMP Mobile

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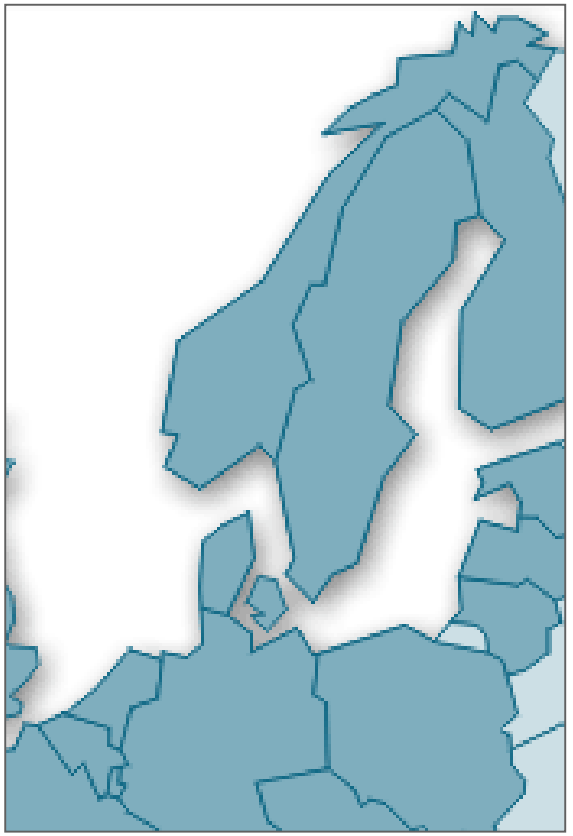
Shore Power Connection Implementation – North Europe

- Port of Gothenburg: Ro-Ro terminals
- Port of Luebeck : Ro-Ro terminals
- Port of Kemi : Ro-Ro terminals
- Port of Oulu : Ro-Ro terminals
- Port of Karlskrona: Ro-Ro terminals
- Port of Antwerp: IMT Container terminal
- Rotterdam Ro-Ro terminals
- Port of Trelleborg Ro-Ro terminals
- Port of Ystad Ro-Ro terminals
- Port of Hamburg Grasbrock Cruise Terminal
- Port of Hamburg Altona Cruise Terminal
- Lavik – Oppedal - Norway Battery Ferry



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Automated mooring and Automatic Plug-in System (APS)

Project location

- Norway
- Norled project
- Battery ferry
- Automatic Plug-in System APS

Site picture

Project definition

Introduction

- The Norwegian parliament has decided that Norway is to become carbon neutral in 2030
- Government`s goal is that in 2020 10% of energy consumption for transport shall be renewable

Benefits of battery ferries

- On onshore power and thus renewable energy
- No particle (soot) emissions
- Electric motors will generally have a very low noise level
- Efficient use of energy - fully electric propulsion from batteries via onshore power have an efficiency that may reach 0.75.(0.4 for diesel combustion engine)
- Lower OPEX (fuel cost vs electricity, maintenance, cruising time…)

Solution

- APS (Automatic Plug-in System) with Automated Mooring, ensuring a fast and safe mooring and electrical shore power plug-in

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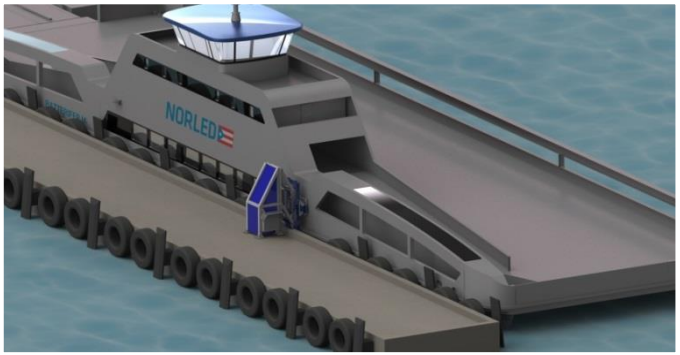
Battery charging challenges and solutions

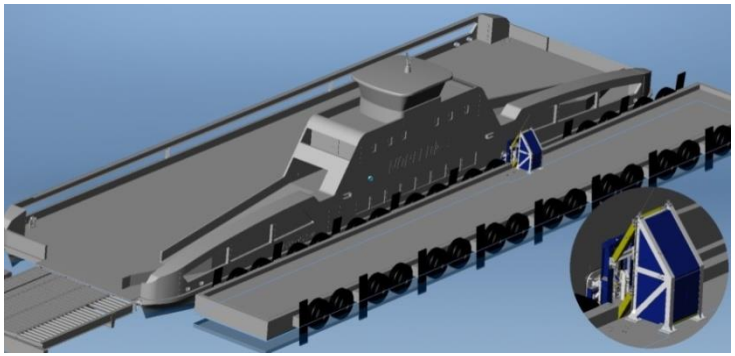
Current ferry: output of 1,500 kilowatts (kW) or more than 2000 horsepower

Battery ferry: output of 800 kW. In normal conditions, at a speed of 10 knots, battery power of 400 kW will suffice

The charging principle brought up the following technical & operational challenges:

- At berth for 10 minutes, need to charge for as long as possible
- Need to connect & disconnect fast, < 1minute





- 2 MM400 units, 1 in each of 2 terminals, for 23 daily bow moorings of battery driven ferry
- 2 customized Automatic Plug-in System (APS) towers

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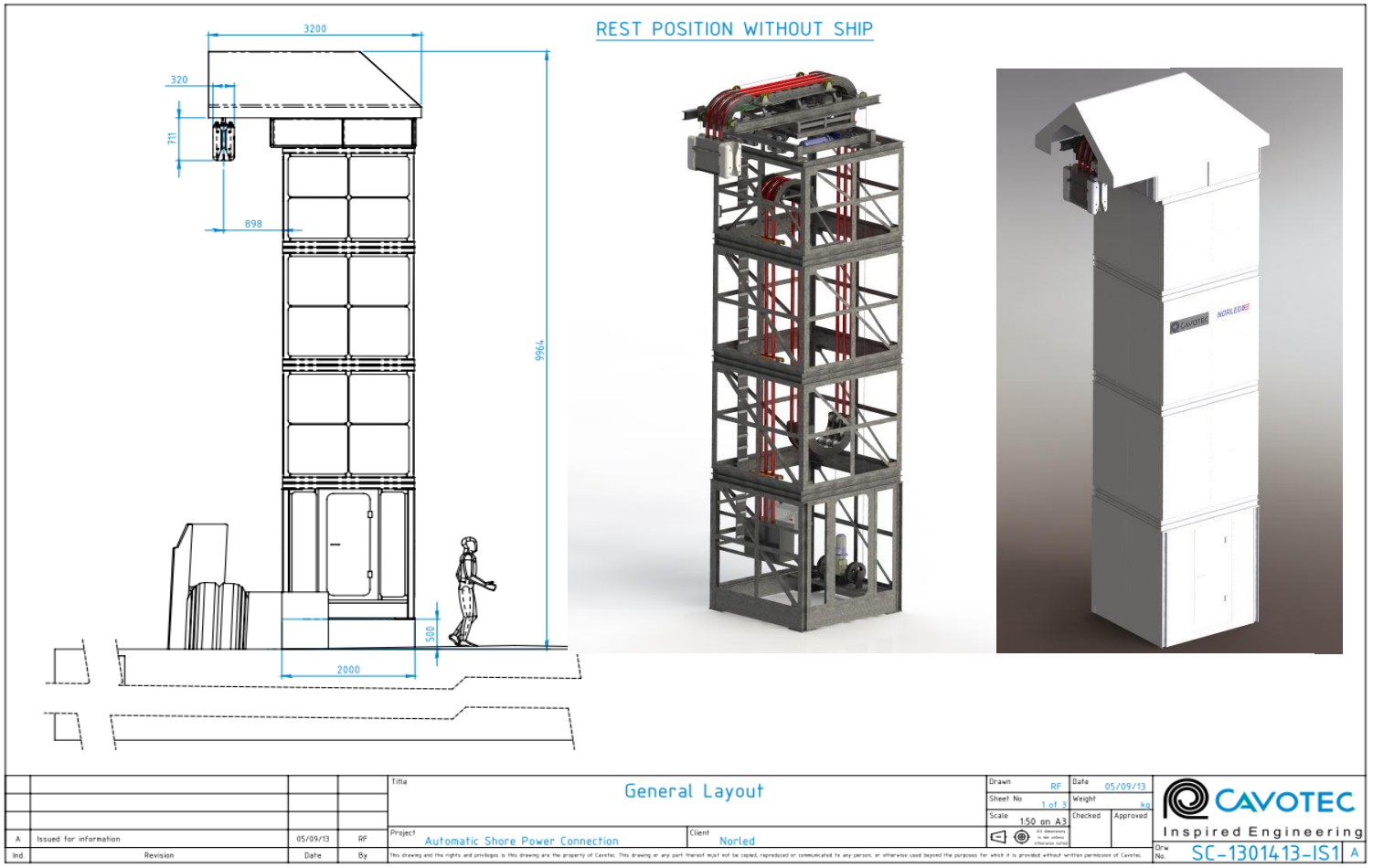
Shore Power APS (Automatic Plug-in System)

- Dimensions: 9,5m high tower, on a 2x2m foundation platform
- The tower frame is composed by 4 different structural blocks bolted together



Port of Hamburg –AMP Mobile

LNG Hybrid Barge will for the first time be delivering energy to a cruise ship as part of a joint project with AIDA Cruises.

The LNG Hybrid Barge has a length of 76.7 m, a breadth of 11.4 m and draught of approx. 1.7 m and is equipped with five generators with an overall output of 7.5 MW (50/60 Hz)

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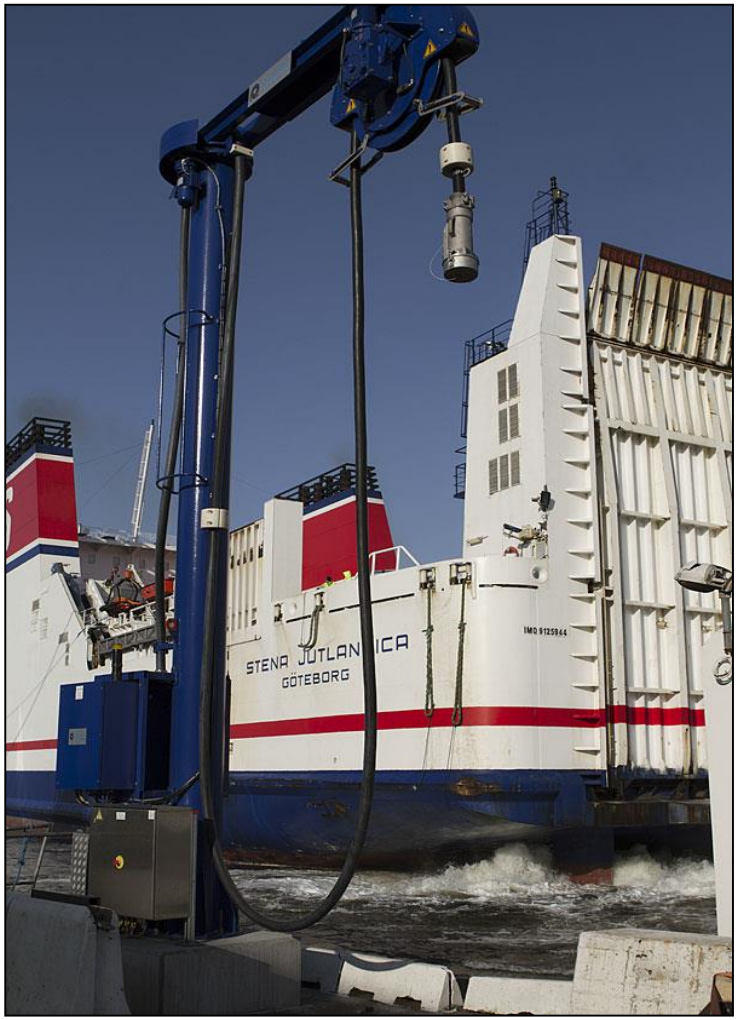
Ro-Ro ship – AMP Cable dispenser system

Baltic Ports

9 units for Ro-Pax and Ro-Ro



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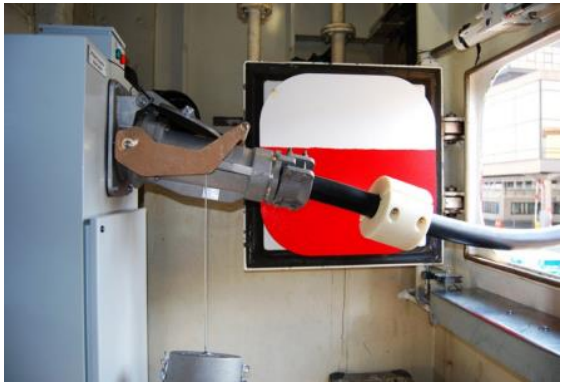
Ro-Ro ship – AMP Cable dispenser system



Ro-Ro ship – Telescopic crane fixed

Port of Rotterdam – NETHERLAND
1 unit for RO-PAX

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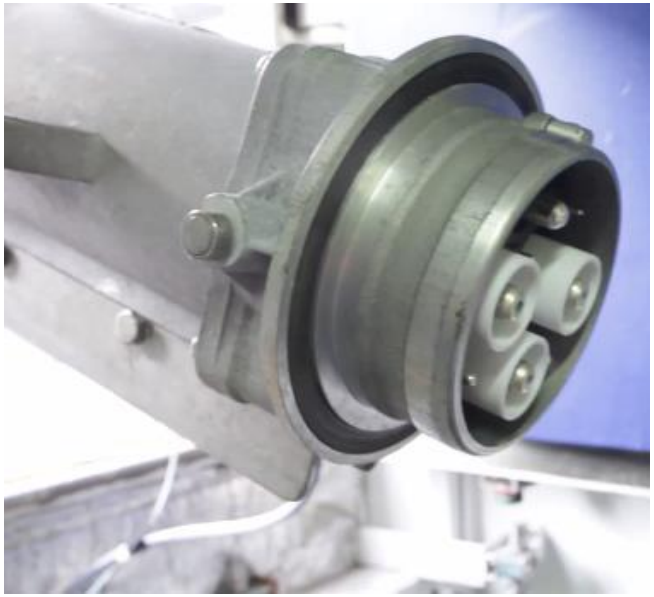
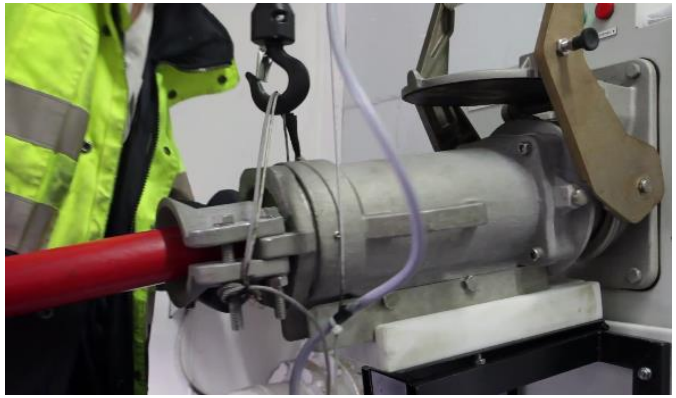
Ro-Ro ship – Telescopic crane fixed





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Shore Power Connection Implementation – Asia

- **Port of Osaka (Japan)**
  Nanko Ferry Terminal
  In operation

- **Shenzen (China)**
  SCT
  In Operation

- **Port of Kaohsiung (Taiwan)**
  T4 – Yang Ming
  In operation

- **Port of Kaohsiung (Taiwan)**
  T6 – Evergreen
  In operation

- **Kalibaru (Indonesia)**
  Container terminal
  Under construction

- **ShenHua Group (China)**
  8 bulk terminals in service

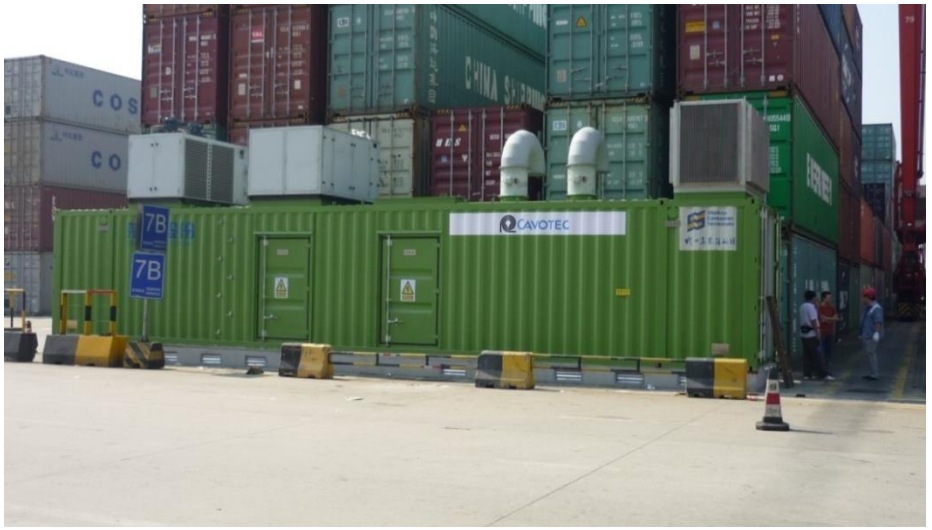
- **Petronas Gas Behrad (Malaysia)**
  LNG Regasification Facilities

Container ship – Flat rack

Shekou Container Terminal

Provision of shore power for both low voltage (440V – 60Hz) and medium voltage (6.6KV – 60Hz) vessels.

Power supply at port: 10KV – 50Hz



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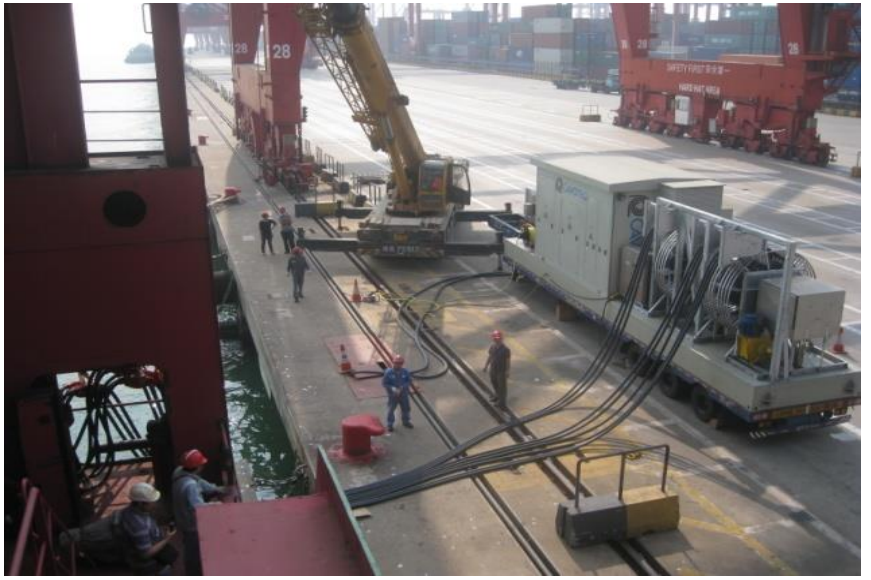
Container ship – Flat rack



LNG – Cable dispenser system

PETRONAS GAS BERHAD LNG Regasification Facilities Sungai Udang, Malaysia

2 CDS has been installed to power a FSU

LNG – Cable dispenser system

- Shore supply nominal voltage 6.6 kV
- Max deliverable power 4 MVA (45° C)
- Column height 17 m
- Rotating arm 3.1 m
- Maximum deployed cable 28 m from the top

Bulk Carrier – Monospiral deck reel

SHENHUA GROUP

- Approx. 30 Bulk carrier equipped
- 8 Terminals equipped with Shore Power
- Shore supply nominal voltage 6.6 kV
- Max deliverable power 2,5 MVA

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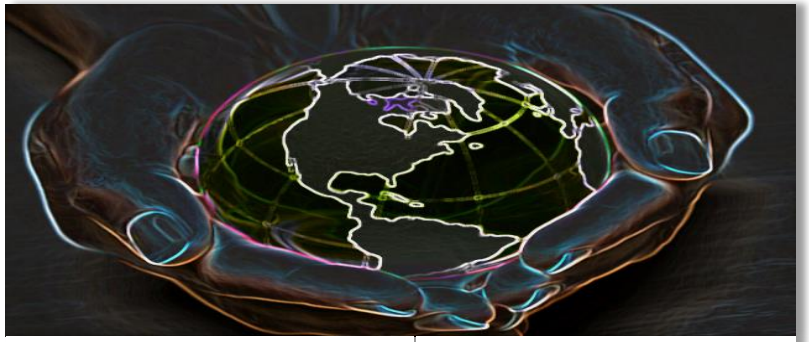
Ship implementation

Ocean going carriers committed/fitted with AMP



- NYK Japan
- CSL China
- Peter Doehle Germany
- NSB-Conti Germany
- Evergreen Taiwan
- MSC Switzerland
- CP Offen Germany
- Patjens Germany
- COSCO
- Matosn
- Stora Enso
- APL
- PIL
- UASC
- Yang Ming Taiwan
- B & N Transocean Finland
- Messina Shipping Italy
- China Shipping Lines
- Hansa Shipping
- Lloyd Triestino
- K-Lines
- MOL
- Danaos
- Synergy
- Totem
- Stena Line
- HMM

500

Number of ships that will be equipped with Cavotec AMP systems by

2015

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Thank you for your attention