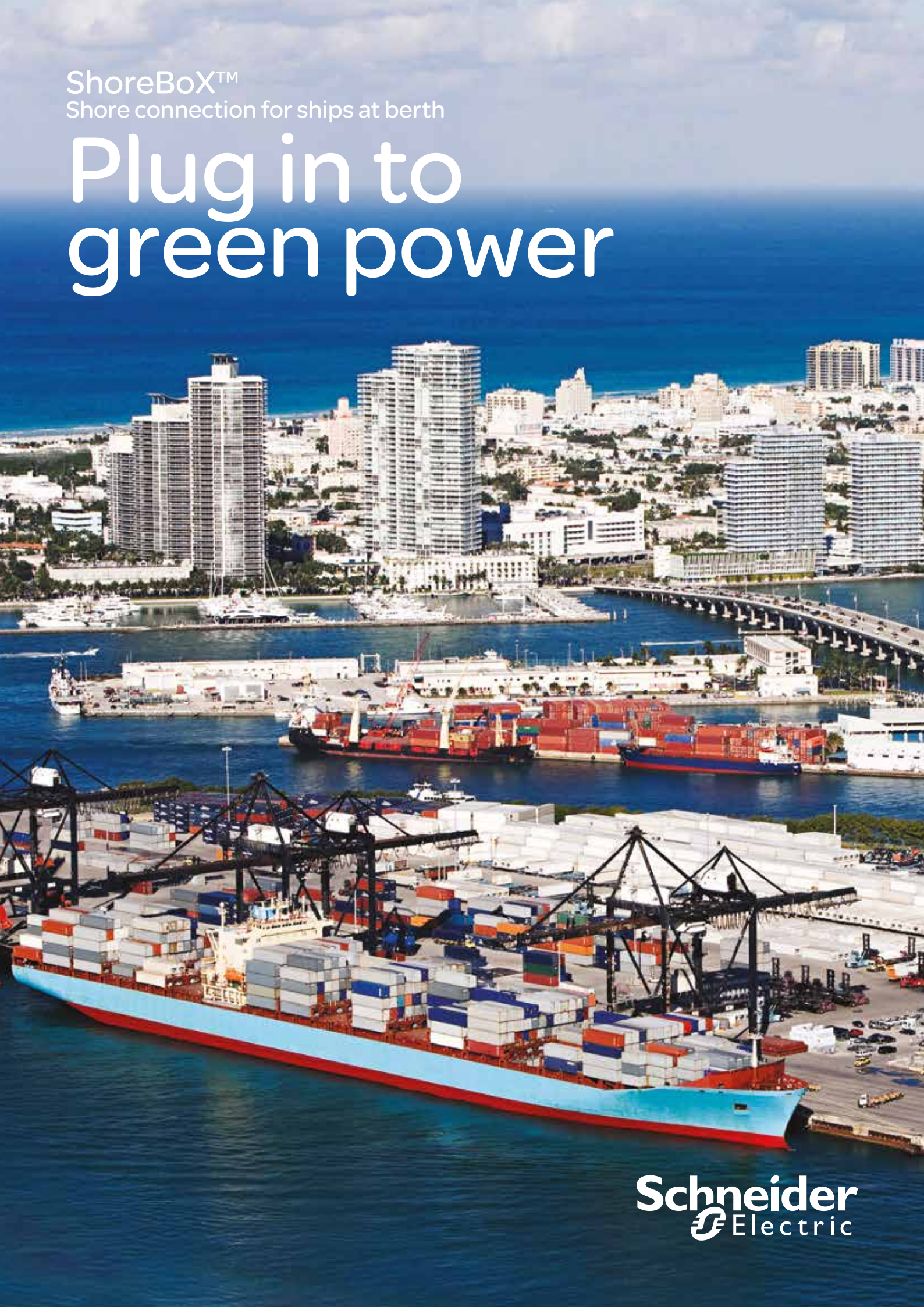
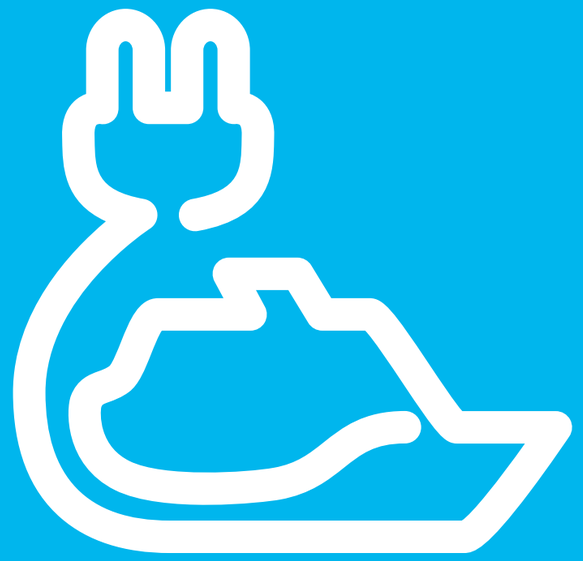
ShoreBoX™
Shore connection for ships at berth

Plug in to green power



Schneider Electric



Meet environmental regulations with shore connection solutions for ports and ships

Your port makes your city

The majority of large port cities were established to provide vital access to the sea. Now, more than ever, ports are a driving force for economic development, international trade, and cultural exchange. However, ports are often perceived by the local community as a nuisance – especially in terms of pollution. Of particular concern is the pollution generated by ships at berth, which has become unacceptable to today's environmentally aware citizens.

Ships account for

90%
of the world's commercial goods transport*

2%
of global CO_2 emissions**

15%
of global nitrogen oxide (NO_x) emissions**

6%
of global sulphur oxide (SO_x) emissions**

**www.unctad.org*
***United Nations Statistics Division, Millennium Development Goals indicators*

Do the ships in your port meet the new environmental regulations ?

Ship emissions represent an ever-increasing environmental concern. Around the globe, strong measures are being taken on several fronts to dramatically cut the emissions of berthed ships and, hence, to improve the quality of life for the communities around the port.

Global measures to cut ship emissions

International regulations

The IMO

The IMO (International Maritime Organization) acts on SO_x and NO_x emissions by:

- Drafting regulations such as the MARPOL 73/78 Convention.
- Marking out Emission Control Areas (ECAs) in conjunction with national governments, primarily in the Baltic and North Seas, as well as around the Atlantic and Pacific coasts.
- Making mandatory in 2013 the Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP) on CO_2 emissions for ships over 400 tons.

Year	IMO MARPOL Annex 6		EU EU maritime fuel sulphur directive (2005/33/EC)	
	Average NO_x limit in fuel (g/kWh)	SO_2 limit in fuel (% m/m)		
	High sea and berth		SECA	Berth [1]
2009	11.8	4.5%	1.5%	1.5%
2010				
2010, July			1.0%	0.1%
2011	9.6			
2012		3.5%		
2015			0.1%	
2016				
2020		0.5%		
2021	2.3			

As a major actor in the port industry, Schneider Electric is a member of the IAPH and AIVP associations.

Local and federal regulations

The European Union

The EU acts by:

- Proposing environmental regulations, such as Directive 2005/33/EC, which restricts the sulphur content of marine fuel used by ships docked for more than two hours to no more than 0.1%.
- Adopting a Directive of Deployment of Alternative Fuels Infrastructures (DAFI) that establishes the implementation of Shore Connection in all ports by 2025 and makes the standard IEC/IEEE 80005 mandatory.
- Reducing taxes in electricity to vessels at berth as stated by the Directive 2003/96/EC
- Implementing subsidised programs such as Marco Polo and Trans European Network Transport (TENT T) to co-finance shore connection projects.

China

As part of its five-year plan 2011 - 2015, the Chinese Ministry of Transport has addressed the pollution problem in ports and identified shore connection as a solution.

California, USA

The California Air Resources Board is a leading environmental body. Its decisions serve as a benchmark for the entire USA.

In California:

- Ships equipped with shore connection systems have been required to use them since January 1, 2010.
- In 2014, ships wishing to dock must have shore connection systems and 50% of the power they use will have to be electrical. This percentage will increase to 70% in 2017 and 80% in 2020.

Proactive organisations

Port associations such as the World Port Climate Initiatives (WPCI) or the International Network of Port Cities (AIVP) encourage members to go for further regulations.They promote technologies and best practices that are better for the environment, the community living around the port, and the port's competitiveness. As a major green solution for ports, shore connection power supply is supported by several associations.

Meet environmental regulations in the most profitable way

Today, berthed ships have two different ways to meet environmental regulations: they can either generate their own electricity using clean fuel, or they can connect to power sockets at the port. Research has shown that the latter is the most sustainable solution, in every way.

Reducing port fees

Created by WPCI, The Environmental Ship Index[2] (ESI) measures the quantities of NO_X, SO_X, PM and CO_2 emissions from a ship and give grades accordingly to assess ship environmental performance. As shore connection is a green technology, ships equipped with the solution receive a higher grade. To promote best practices, several ports are using ESI as a factor when calculating port fees. Greener ships can enjoy fees rebate up to 10%.

Cutting SO_X, NO_X and PM

One of the main benefits of shore connection systems stems from the fact that electricity generated on land by power plants has a smaller eco-footprint than that produced by ship engines.

Reducing CO_2 emissions

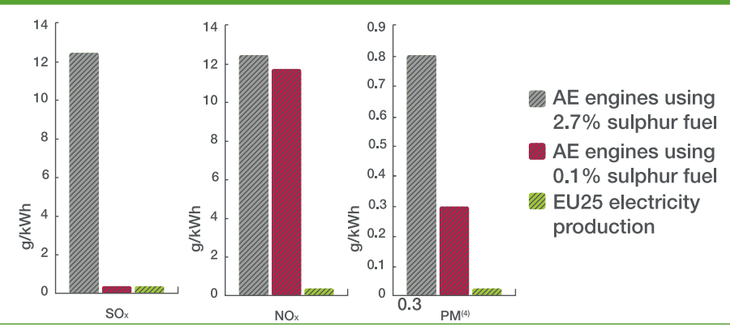
The total CO_2 emission reduction depends on how the electricity used is produced. In the European Union, the use of shore-side electricity rather than electricity generated by a ship using low-sulphur fuel will cut CO_2 emissions by an average of 50% [3].

Elimination of noise and vibrations

The main cause of noise pollution in ports is the use of auxiliary diesel engines to generate electricity on ships. The noise can reach 120 dB near the engines and the associated vibrations are unpleasant for crew, passengers, and port personnel.

However, all of this noise is eliminated by using a shore connection system.

Reduction of SO_X, NO_X and PM[2]



(2) An enterely voluntary programme for ports, ship owners, and charterers
(3) Entek report
(4) Particular Matter

Shore connection technology enables ships to be compliant with MARPOL 6.

New standard supports shore connection deployment

The IEC/ISO/IEEE 80005-1 standard sets the general requirements for shore connection systems in ports (voltage rates, cables, sockets, standardisation, etc.) and enable ships to plug in to any port worldwide. Schneider Electric is an active member of this standardisation committee.

Sustainable development and economic growth are not mutually exclusive. In fact, many port cities have been able to incorporate both economic and environmental factors into their development plans.

Low-sulphur fuel prices on the rise

Global demand for fuel is set to rise significantly. The United States Energy Information Administration forecasts that demand for refined petroleum products will grow by 1.5% per year over the next five years. Current fuel prices make shore-side electricity a financially attractive option [3].

Lower maintenance costs

Motor maintenance costs (estimated at 1.6 €/h/motor) fall sharply when shore-side electricity is used as the main source of power. The annual average saving per ship is estimated at €9,600 [5].

New business

Ports installing shore connections at their berths would provide a new service to ships and so be rewarded. By selling electricity when ships plug in to their shore connection installations, ports enjoy revenues which enable them to have a return on investment.

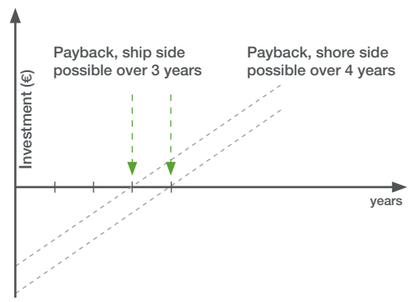
Measurable savings

Electricity consumption
- Ferry: 2,400 MWh/year [6]
- Container ship: 1,270 MWh/year [7]
- Cruise ship: 3,640 MWh/year [8]

Electricity cost
- Generated on board from marine diesel fuel: €200/MWh [9]
- Provided by a grid: €160/MWh

Annual savings per vessel
- Ferry: €200,000
- Container ship: €180000
- Cruise ship: €520000

Measurable average payback for ships and ports



Parameters for payback calculation, shore side
- Level of investment
- Occupation of the berth
- Power supplied
- Electricity purchased from utility
- Electricity sold to ships

Parameters for payback calculation, ship side
- Level of investment
- Time at berth
- Energy consumed
- Electricity purchased on shore
- Difference between energy costs and LSD (low-sulphur diesel)

(7) Based on 11 stopovers per year, 72 hours per stopover, average consumption of 1.6 MW
(8) Based on 52 stopovers per year, 8 hours per stopover
(9) Based on the average price of marine diesel fuel in 2011 of 800€/ton

The growing demand for low-sulphur fuel could see a significant price increase over the coming years.

Did you know?

Studies conducted by the California Air Resources Board demonstrate that the electrical power supplied by a grid generates less pollution than that produced by a ship – and displays the best cost/efficiency/pollution profile.

Differentiate your port by providing efficient, green energy

Shore connection solutions from Schneider Electric include an EMCS (Energy Management and Control System) and an EMIS (Energy Management Information System) that allow you to track how you meet your environmental obligations all while you establish your port as a provider of clean energy to ships.

Create a preference for your port, all while you minimise your operational costs and carbon footprint.

Have a green port operation, and show it!

Monitor and control the performance of your new installations

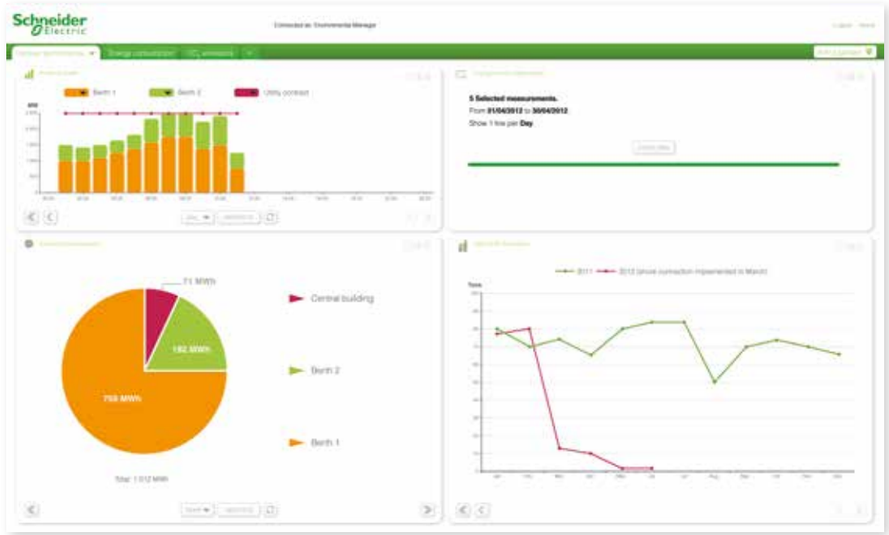
The implementation of a shore connection solution in your port will require a new infrastructure, and new operations and processes will need to be put in place. To be able to monitor, control, and ensure best-in-class performance of your new installations, high-performing EMCS and EMIS systems are required.

Our EMCS and EMIS systems not only monitor, control, and ensure high performance of your installations, they also merge the collected data into your port's operation management and control system and allow you to:

- Get visibility of your energy profile at terminal or port level (or multi-site level) and measure, monitor, and analyse your energy consumption down to load level
- Take energy-management decisions based on relevant, accurate, and reliable data
- Give ships best-in-class energy and services
- Predict your energy consumption
- Negotiate better contracts with utilities
- Sell negawatts* back to the grid
- Collect and report your environmental KPIs

*A negawatt is an unused electrical watt that is saved due to energy-efficient electricity usage.

Our EMCS and EMIS systems track and report all the data you need in real time, letting you manage your shore connection systems in an integrated way in relation to the rest of your port's operations and processes.



Become an energy provider and create new business for your port!

Offer ships:

- Clean energy
- Safer and more reliable power supply
- Controlled energy costs

Environmental performance indicators

Become an energy provider and supply ships with energy that is:

Safer for people and goods

- Real-time monitoring of your electrical network performance
- Fast reaction in the event of an incident

More reliable thanks to maximised uptime

- Good quality energy, preventing blackouts and maximising continuity of service
- Equipment monitoring, operation diagnostics, and maintenance

More efficient due to minimised operational costs

- Measure and predict your energy consumption
- Strengthen negotiations with utility
- Maximise your infrastructure usage

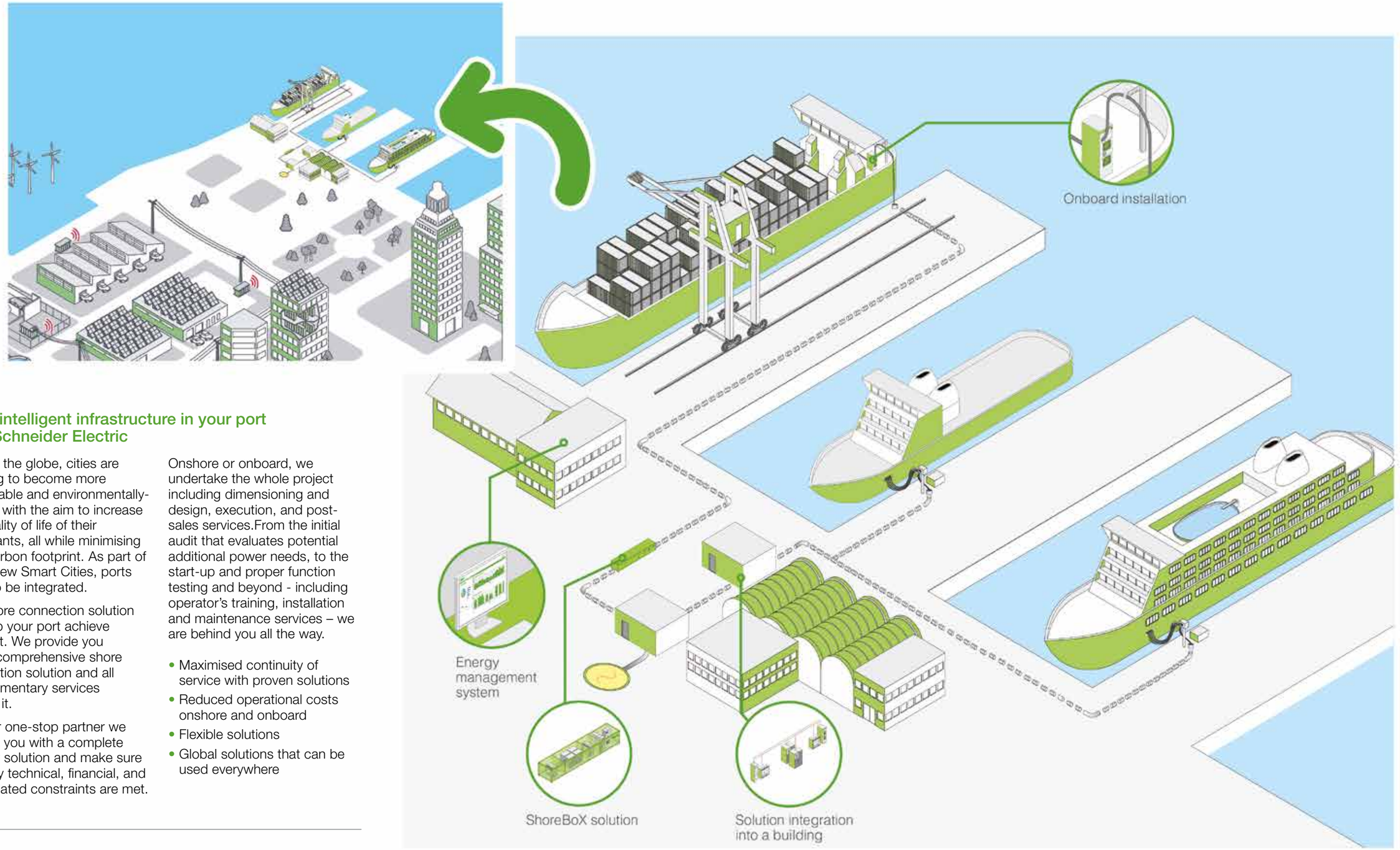
More productive through integrated energy management

- Monitor operations efficiency, equipment usage, capacity, and availability
- Manage energy supply services contracts with ships and collect elements to invoice

Greener

- Document how you contribute to the reduction of your port's carbon footprint all while proving compliance with environmental regulations

Plug your port in to the Smart Grid



Build intelligent infrastructure in your port with Schneider Electric

Around the globe, cities are evolving to become more sustainable and environmentally-friendly with the aim to increase the quality of life of their inhabitants, all while minimising their carbon footprint. As part of these new Smart Cities, ports need to be integrated.

Our shore connection solution will help your port achieve just that. We provide you with a comprehensive shore connection solution and all complementary services around it.

As your one-stop partner we provide you with a complete turnkey solution and make sure that any technical, financial, and time-related constraints are met.

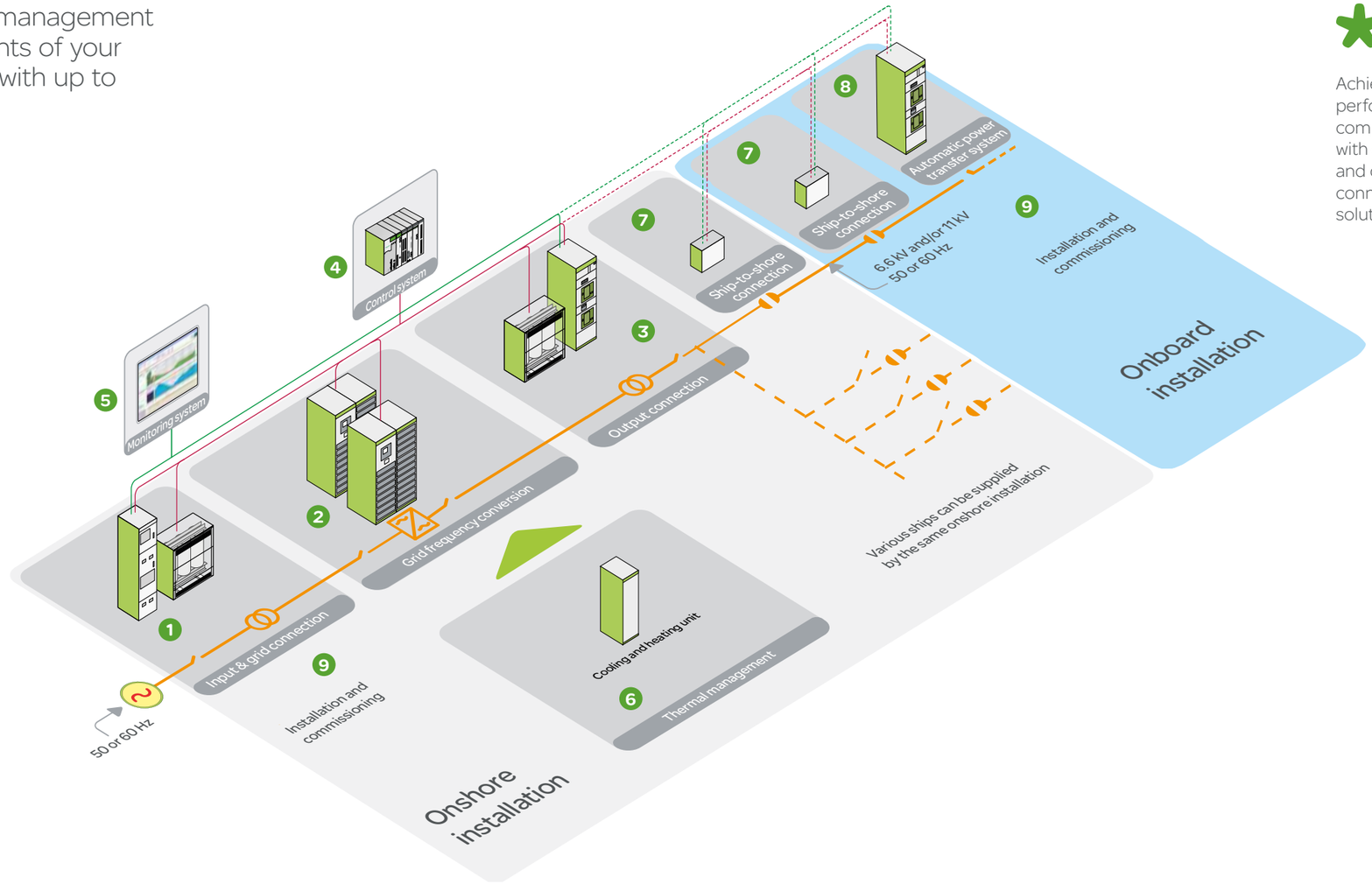
Onshore or onboard, we undertake the whole project including dimensioning and design, execution, and post-sales services.From the initial audit that evaluates potential additional power needs, to the start-up and proper function testing and beyond - including operator's training, installation and maintenance services – we are behind you all the way.

- Maximised continuity of service with proven solutions
- Reduced operational costs onshore and onboard
- Flexible solutions
- Global solutions that can be used everywhere

Our flexible shore connection solutions can be installed at any port and adapted to any berth topology and power need.

Turnkey solutions for ports and ships

We offer you a complete distribution and energy management solution designed to meet the specific requirements of your ports and ships. Our systems can supply a vessel with up to 20 MVA of power.



Achieve the highest performance of your complete system with our onshore and onboard shore connection turnkey solutions.

Tested, Validated, and Documented

Shore connection modules, like all Schneider Electric solutions, include Tested, Validated, and Documented (TVD) architectures, products, and services.

Tested

All possible configurations have been tested and results-approved by independent, certified labs.

Validated

All solutions have been platform-tested.
The lifecycle management of each component is documented.

Documented

In addition to a strong support, our customers receive a full set of documents and training programs to achieve all the benefits from the solution.

Comprehensive solution including the ship's onboard installations

With more than 90 years' experience in the marine and offshore industry, Schneider Electric has developed an unparalled expertise in onshore and onboard electrical systems and is capable of providing, executing, and supporting both the onshore and onboard shore connection systems.

With our global marine services we are never far away, and you can always count on maintenance and service of your electrical installations - no matter where your ship is.

All components of the onboard shore connection system are standard and consistent with other Schneider Electric solutions. As they are manufactured in several sites around the world, spare parts will be locally available.

Our onboard solutions are certified and approved by classification societies such as ABS, BV, DNV, CCS.

1 Input and grid connection

- MV electrical distribution unit
- Input transformer unit

2 Grid frequency conversion

- Grid frequency converter unit
- LV electrical distribution units (optional)

3 Output connection

- Output transformer unit
- MV electrical distribution unit

4 Control system (EMCS)

- Auxiliary electrical distribution unit

5 EMIS / SCADA

- Energy management and information system

6 Thermal management

- Cooling and heating unit

7 Ship-to-shore connection

- Shore connection interface unit: control, communications
- Connection unit: outlets and cable reel on shore / on board

8 Automatic power transfer system

- Synchronisation device
- MV distribution unit
- Transformer unit

9 Installation and commissioning

- TVD Installation and commissioning services are included in our standard offer

Tested, Validated, and Documented

ShoreBoX range: Integrated solutions to maximise available berth space

Fully packaged in a single box, the ShoreBoX solution has been designed with utmost concern for space and cost optimisation, and provides the highest level of safety, efficiency, and reliability, all while providing best-in-class performance.

Maximised performance and enhanced availability through fully standardised components

Innovative and Efficient reducing energy consumption

- Best-in-class energy quality and efficiency with GFC (Grid Frequency Conversion) technology. Its disposition within the ShoreBoX consume just the energy needed at any given moment and no more.

Safer and more reliable

- Proven components and systems
- Tested, Validated, Documented architectures
- Compliant with IEC 80005 international standard

Scalable and movable

- Can be relocated when there's a change in berth configuration
- Different Compact ShoreBoX units can be installed in parallel for further power extension

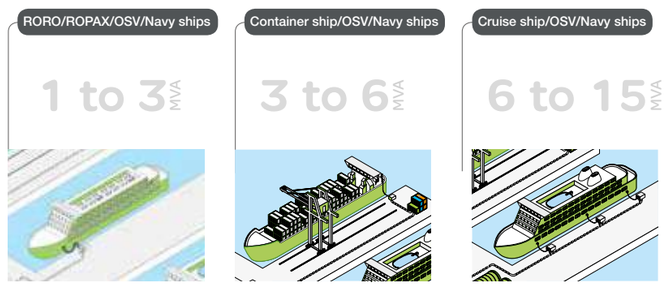
Simple plug-and-play solutions

- Packaged solutions
- Easy to install
- Easy to maintain

Cost effective

- Standard components
- Optimised footprint
- Minimal commissioning

Power extension through parallel installation:



Make the most of your installation with our comprehensive services

No matter where your port is located, no matter where your ship is heading, Schneider Electric is never far away with the support you need. With the marine market leader as your partner, you benefit not only from a global presence, but also from our wide range of locally-managed support and services.

Site audits to make sure the installation is possible

- Installations providing onshore power to ships will have a significant impact on the local electricity supply and, in many cases, the electrical distribution network around the port will need to be strengthened
- We offer a comprehensive analysis of the system to examine the effects on the local distribution network before installing the shore connection solution

Installation upgrades for maximised uptime

Maximise uptime of your installation through services such as:

- Software upgrades
- Retrofit of obsolete products
- Spare part availability

Best-in-class project execution for peace of mind

We offer you complete turnkey projects including:

- Project analysis and management during the design phase
- Project execution in line with your budget, investment, and schedule constraints

Energy management services: proven steps to cut energy costs

Our experts are available to offer you:

- Energy consumption data monitoring, collection and analysis
- Identification of ways to improve energy usage, leading to cost savings and reduced environmental footprint

Our comprehensive range of services are supported by highly trained and skilled teams that have the experience and dedication required to keep your installations up and running.

Installation and commissioning

Installation and commissioning are simplified in the standard offer thanks to the Tested, Validated, Documented architectures (TVD).

These services include:

- Unpacking
- Installation and commissioning
- Power cabling
- Remote monitoring system (RMS) cabling
- Pre startup
- Startup and settings
- Proper operation testing
- Operation training

Dedicated services to GFC and cooling units

Standalone preventive maintenance

Comprehensive inspection to ensure that components are performing to defined technical and environmental specifications. This service includes all labour and travel expenses with a 7 X 24 scheduling upgrade option, including weekends and holidays, and is available as a stand-alone service or in conjunction with any service agreement.

Save headaches, time, and money with our Advantage Plans maintenance services

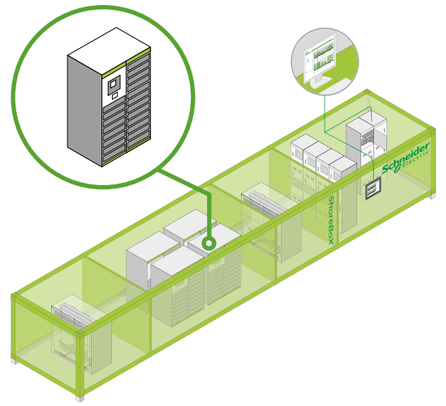
Our GFC and cooling units maintenance contracts will provide maximised continuity of service and the most efficient operation of your installations. Our contracts are divided into three levels to meet your exact needs.

Our highly skilled and dedicated project teams are ready to support you, when you need it.

Best-in-class energy efficiency through patented technology

The Grid Frequency Conversion (GFC) technology, patented by Schneider Electric, is a key element in the shore connection solution.

Grid frequency converters installed in series maximise the solution's flexibility, and are at the heart of its energy efficiency and energy cost savings.



With Schneider Electric you have a one-stop partner behind you all the way!

Select the best shore connection solution for your port

More than 100 shore connection solutions have already been installed in a number of ports across the world.

- What is the voltage specifications of your port's power supply?
- What are your total power requirements?
- Do you need a frequency conversion system?
- How do you plan to manage the power of your installation?
- What type of vessels come into your port?
- How many docks or terminals do you want to equip?
- Do you need to track consumption at each terminal?
- How much space do you have?

The answers to these questions will help you select your installation's architecture and the most effective method for managing the power supplied to ships.

85% The ports who participated in the survey responded "yes" or "maybe" to the question; "Does your port plan to introduce or expand shore connection systems in the next five to ten years?"

WPCI survey Feb. 2010 (55 major ports).

USA's largest container port has chosen Schneider Electric

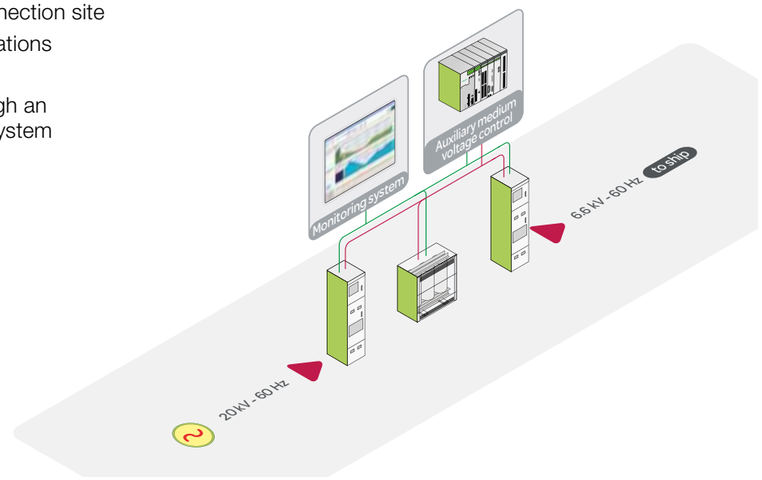
The California-based port is the 3rd largest in the world

Needs

- Succeed as the first US shore connection site
- Comply with strict Californianregulations
- Be the US reference port
- Ensure energy management through an energy management information system

Our solution

- Green: 95% per vessel call reduction of hotelling emissions of DPM, NO_X and SO_X
- Compliant: meeting Shore Power System and UL standards
- Open: committed to providing shore power infrastructure to all container, cruise, and liquid bulk terminals



Results

- Improved energy visibility, traceability, and accuracy
- Real-time monitoring and control
- Full integration with port information system
- Reduced emissions

We help ports and ships increase efficiency everywhere

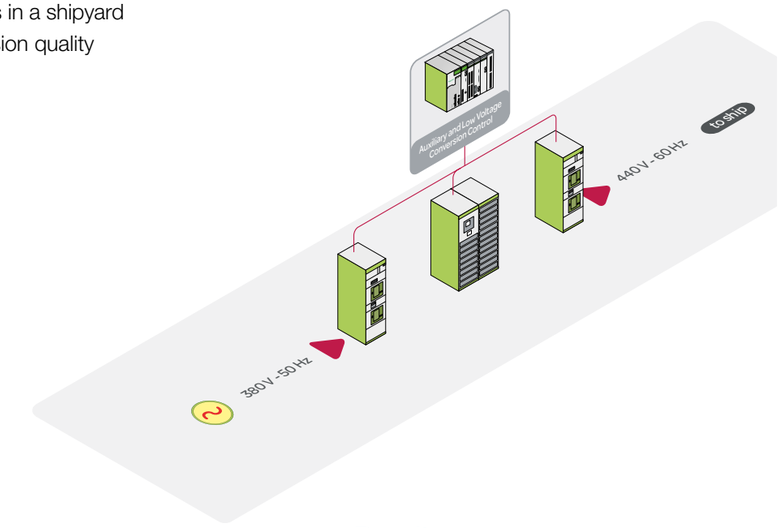
Shanghai, China / Waigaoqiao shipbuilding

Needs

- Ensure secured supply for vessels in a shipyard
- Provide a high-frequency conversion quality
- Be a reference in China

Our solution

- Modular: complete integration of products in container
- Efficient: high-technology grid frequency converter
- OpEx optimised: cost-effective solution compared to fuel



Results

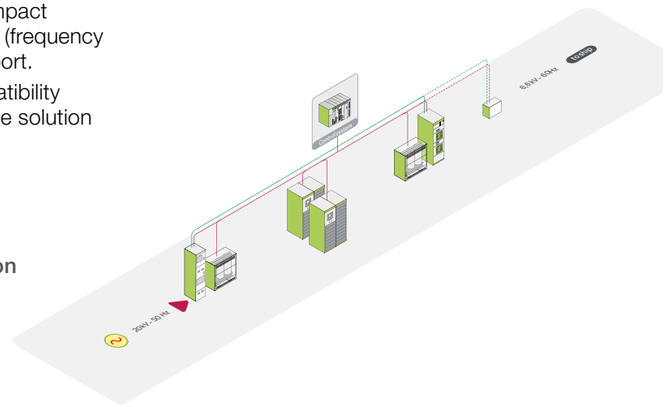
- Secured energy
- Shipyard can focus on its core activities
- High-performance conversion technology
- Reduced OpEx costs due to long-term berthing (large quantities of fuel)

Shore connection supplies power to naval ships

Naval base - FREMM Frigates

Needs

- Customer needs assure a complete and compact solution to supply power to FREMM Frigates (frequency & voltage adaptation), while mooring at the port.
- In order to ensure full electrical supply compatibility with the multi-mission FREMM class ships the solution needed to be :
  - **Simple to implement**
  - **Have a short delivery time**
  - **Be upgradable to 2 MVA**
  - **Be movable to an alternate location**



Our solution

- Customer based assistance of Schneider Electric to deliver its ShoreBoX differentiating values: **An all- in-one, movable system, short lead times and expertise in energy management.**
- 2 ShoreBoXes delivered to customer as a working and tested solution. Each equipped with grid frequency conversion, fire detection systems, power management systems (local LV/MV protection & control), IT Room Management (Cooling control)

Results

- **ShoreBoX turnkey solution was installed for two harbor installations, each of 1.5 MVA, with a lead-time of 6 months. The short delivery time is possible thanks to our local presence and to the design of the ShoreBoX.**
- **Complete ShoreBoX, shore power connection system built with Schneider Electric standard components, integrated and tested at our facilities.**

We have helped cut power costs by 50%

Göteborg port, Sweden / Stena Line ferries

Needs

- Equip ships to be able to connect to the existing low voltage shore-to-ship power systems in Goteborg port ferry terminals
- On board installation with minimum footprint to optimize available space
- Reduce ships' energy costs while at berth, moving from electricity produced onboard, to grid supply

Our solution

- Onboard installation for 5 ships, installed and commissioned by Marine Global Group

(1) Supported by the tax incentive programme in place in Sweden

Results

- **Minimised footprint onboard**
- **50% energy cost reduction on ships while at berth (1)**

"Stena Line estimates that thanks to the shore connection solution they have cut their power bill by 50% compared to power produced onboard by ship engines."

Carl Dahlberg,
account manager of Marine Global

ShoreBox helps building green port cities around the world

Bergen, Norway

Needs

- Prevent increase of emissions due to steady augmentation of maritime traffic within the North Sea area.
- Comply with established limits of SOx emissions (less than 0.10%) within the Emission Control Area (ECA), or special areas of prevention of air pollution by ships defined by MARPOL 6 from January 2015.

Our solution

- Industrialized solution: Integrated and tested in factory and directly shipped to port
- Plug and Play : Minimum onsite civil work. Fully automated ship connection procedure
- Adaptable: Movable for berth configuration evolution. Right-sized to ship power demand

Results

- **Ships compliant with ECA requirements at berth**
- **More attractive green operations zone: respectful of environmental standards and improved working conditions at the port**
- **Improved energy management: higher accuracy of measures of energy consumed**
- **Active support to economic growth and social concerns of the city of Bergen**

Contact our experts

> www.schneider-electric.com/shore-connection

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