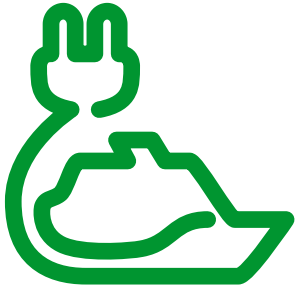


Shore connection – Regulations, benefits, success stories

International Conference

"Ports, Maritime Transport & Insularity: Business, Innovation, Environment"

10-11 March 2016, Piraeus



Konstantinos Kanellakis

Marine & Shore Connection Business Development

www.schneider-electric.com/shore-connection



Schneider Electric, the global specialist in energy management and automation...

€26,6 billion

FY 2015 revenues

~5%

of revenues devoted
to R&D

~170,000

people in 100+
countries

Four integrated and synergetic businesses

– FY 2015 revenues



Balanced geographies – FY 2015 revenues



Shore power, the best option at berth

- > With shore power while at berth, vessels:
 - > **Reduce fuel costs**, where electricity is less expensive than the bunkering fuel to use
 - > **Reduce auxiliary engines maintenance costs** and increase their life time
 - > Benefit from **port fees discounts**
 - > **Meet regulations**
- > ... and ports:
 - > **Reduce pollution** in coastal areas
 - > **Improve working conditions**
 - > Have a **new source of revenue**



THE NEED

Ships are the single largest source of port-related pollution.

Nearly half of the emissions come from ships at berth.



“If nothing is done, air pollutants from ships in the EU will exceed all combined landbased sources by 2020”

European Commission



Ships account for

90%

of the world's commercial goods transport*

2%

of global CO₂ 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

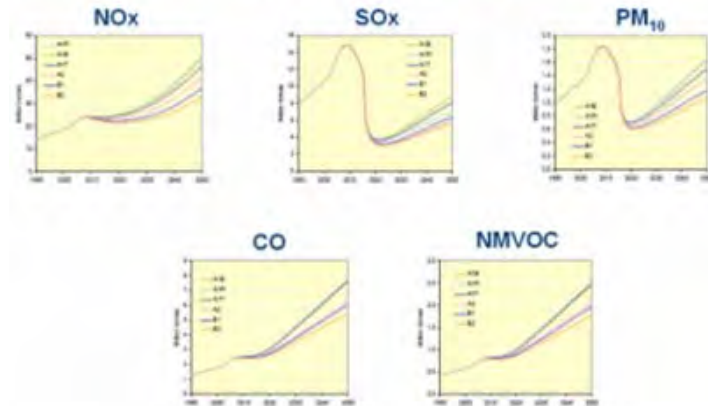
In Europe the shipping industry accounts for*

> 7% of total health costs

50 000 Premature deaths per year

* recent study¹ by the Danish Centre of Energy, Environment and Health (CEEH), using the EVA (Economic Value of Air pollution)
(Assessment of Health Cost Externalities of Air Pollution at the National Level using the EVA Model System, March 2011)

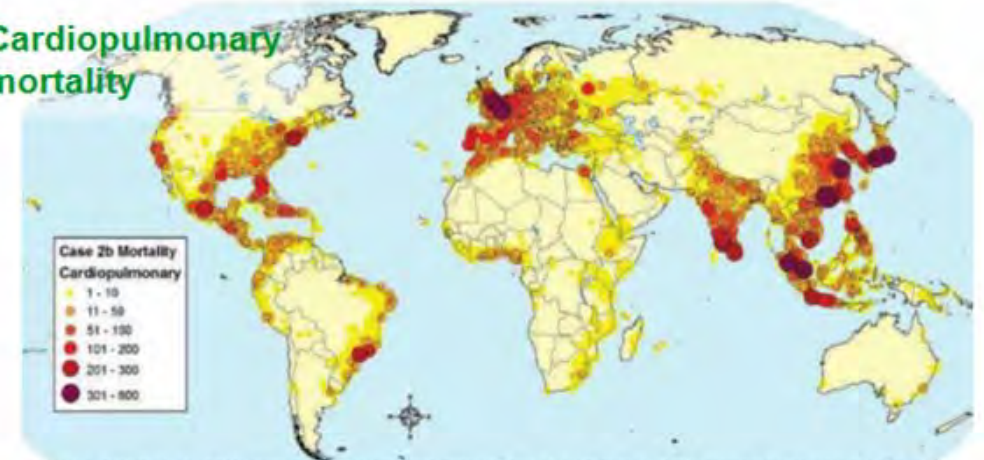
Emission Scenario Trajectories (Total Emissions)



Emission scenario trajectories for other relevant substance – total Shipping
Second IMO GHG Study 2009, presented to MEPC, July 2009

Schneider Electric – Shore Connection Solutions

Cardiopulmonary mortality



Source: J. Brandt et al., 2011: Assessment of Health-Cost Externalities of Air Pollution at the National Level using the EVA Model System, CEEH Scientific Report No 3, Centre for Energy, Environment and Health Report series, March 2011, pp. 98.
http://www.ceeh.dk/CEEH_Reports/Report_3/CEEH_Scientific_Report3.pdf

Shipping industry air emissions regulations

Global regulations to limit air emissions from vessels:

MARPOL Annex 6 (IMO)

IMO MARPOL Annex 6

**In force since May 2005, ratified by 75 countries
= 95% of WW ships traffic***



All ships flagged under countries that are signatories to MARPOL are subject to its requirements, regardless of where they sail and member nations are responsible for vessels registered under their respective nationalities

> 90% of the world's transport is by sea

> SOx and NOx limitations
for ships of 400 GT or above

Year	IMO	EU		
	MARPOL Annex 6	EU maritime fuel sulphur directive (2005/33/EC)		
	Average fuel oil sulphur content (g/t)	SO _x limit in fuel (% m/m)		
	High speed and heavy	SECA	Emission %	
2009			1.5%	1.5%
2010	11.8	4.5%	1.0%	0.1%
2010, July				
2011				
2012	9.6	3.5%	0.1%	
2015				
2016				
2020				
2021	2.3	0.5%		

> CO₂ limitation

Mandatory indexes per vessel:

EEDI Energy Efficiency Design Index

SEEMP Ship Energy Efficiency Management Plan

Examples of local regulations

EUROPE (EU directives)

> **Directive 2005/33/EC:** « Vessels berthing **more than 2h** have to switch to low sulphur fuel or use shore power »

« All ships in an **ECA** must use fuel **<0,1%S** as of 2015 »

« All passengers ships outside of an ECA must use fuel **<1,5% S** (<0,5% as of 2020) »

> **New DAFI Directive**

> **Directive 2003/96/EC:** Can be used to reduce rate of electricity tax to electricity provided to vessels at berth in port (Sweden and Germany already authorising it, Denmark under approval)

> **Coming soon: Guidelines to reduce port fees for green vessels, shore connection will be included in the criteria**

CALIFORNIA (CARB)

« **Since 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)»

CHINA (MoT of China)

« Shore Connection should be included in project planification, design and **construction for new container, bulk, cruise and ropax terminals** »

Sydney Harbour

As of October 2015 cruise ships must use low sulphur fuel <0,1%S at berth

DAFI Directive in Europe

(Deployment of Alternative Fuel Infrastructures, Directive 2014/94/EU, adopted in March 2014)

What does it state?

Article 4.

Member States shall ensure that the need for shore-side electricity supply for inland waterway vessels and sea-going ships in maritime and inland ports is **assessed in their national policy frameworks**. Such **shore-side electricity supply shall be installed** as a priority in **ports of the TEN-T Core Network**, and in other ports, **by 31 December 2025**, unless there is no demand and the costs are disproportionate to the benefits, including environmental benefits.

Article 5.

Member States shall ensure that shore-side electricity supply installations for maritime and inland waterway transport deployed or renewed as from [36 months from the date of entry into force of this Directive] comply with the technical specifications set out in **Annex III.1.3**.

Annex III.1.3

Shore-side electricity supply for inland waterway vessels or sea-going ships

Shore-side electricity supply for inland waterway vessels or sea-going ships, including the design, installation and testing of the systems, **shall comply with the technical specifications of the IEC/ISO/IEEE 80005-1 standard**.



Next Steps: Member states shall:

> **Implement DAFI directive including shore connection in their national policy framework by November 2016.**

→ The commission will provide them a National policy framework template end of 2015.

Variable port fees for green ships

- > The EU Commission is working on a **European guideline** to implement variable port fees - **environmentally friendly vessels will have reduced port fees.**
- > It should be ready by **middle of 2016**
- > Currently benchmarking the various existing schemes (Environmental Ship Index,etc.).
- > Shore connection capabilities will be part of the criteria.
- > Some countries are in advance, with such variable port fees already implemented.
 - > In Spain, vessels plugging into the port's electrical grid benefit from 50% T1 port tax reduction.

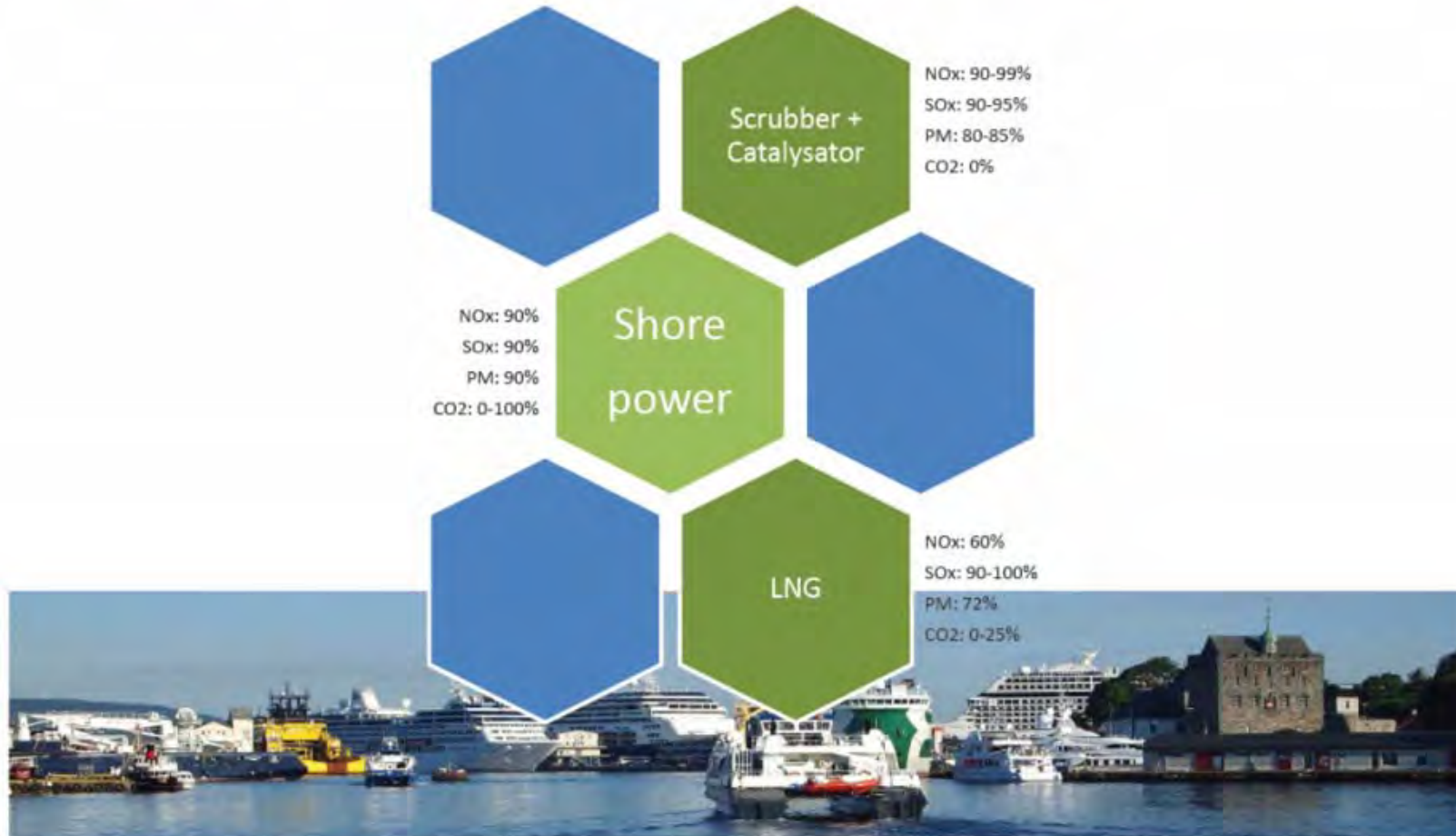




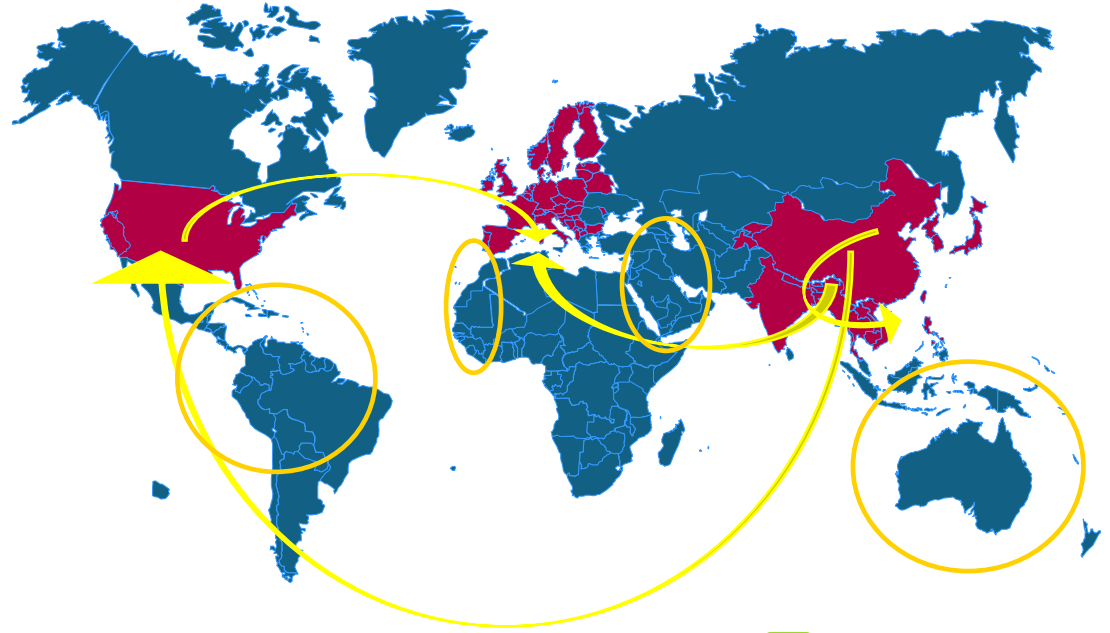
THE SOLUTION

Shore power eliminates almost all at-berth emissions. Plugging in a container ship for one day is the equivalent of taking 33,000 cars off the roads.

Shore power – Our best option



Shore connection international standards



Status of the standards

Main Standard :

IEC / ISO / IEEE 80005-1, HVSC
IEC / ISO / IEEE 80005-2, Communications Protocol
IEC / ISO / IEEE 80005-3, LVSC

Plugs & Sockets outlets

IEC 62 613, Plugs & Sockets Outlets



PUBLICLY AVAILABLE
SPECIFICATION
PRE-STANDARD

PAS

Working in progress,
FDIS* by end of
2016, but the PAS*
applicable from
September 2014



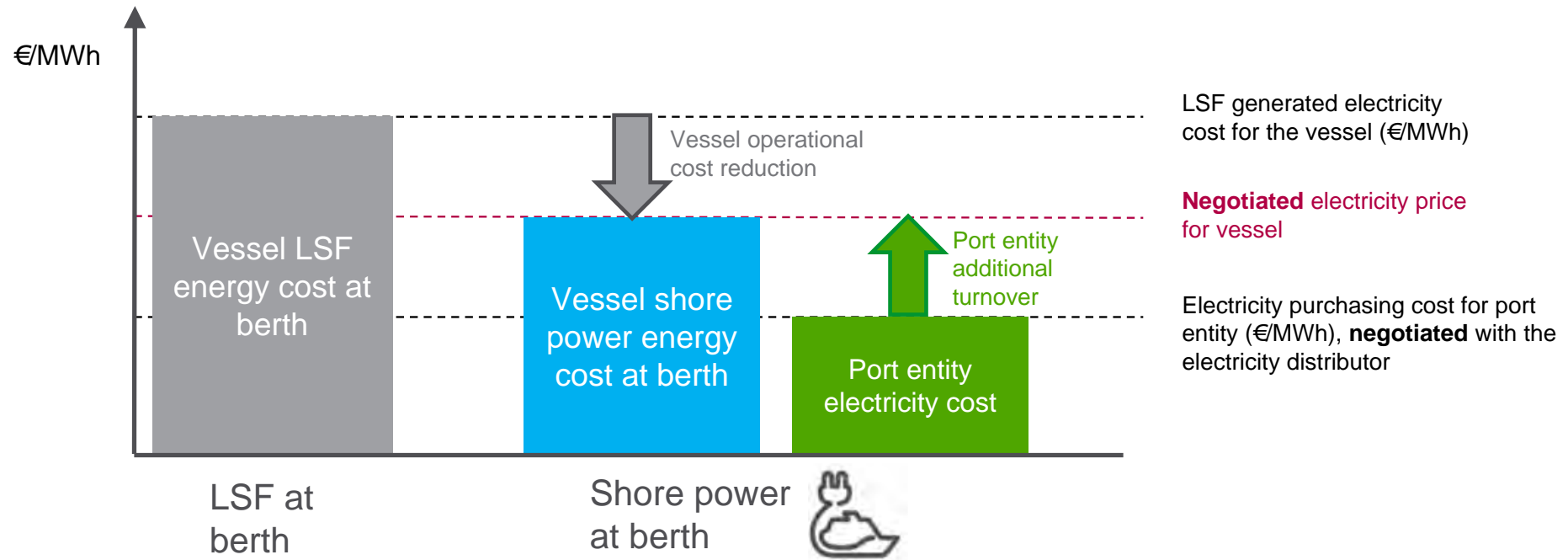
Working in progress,
CDV* expected by
end of 2016

* PAS Publicly Available Specification ,
CDV Committee Draft for Vote,
FDIS Final Draft of International
Standard

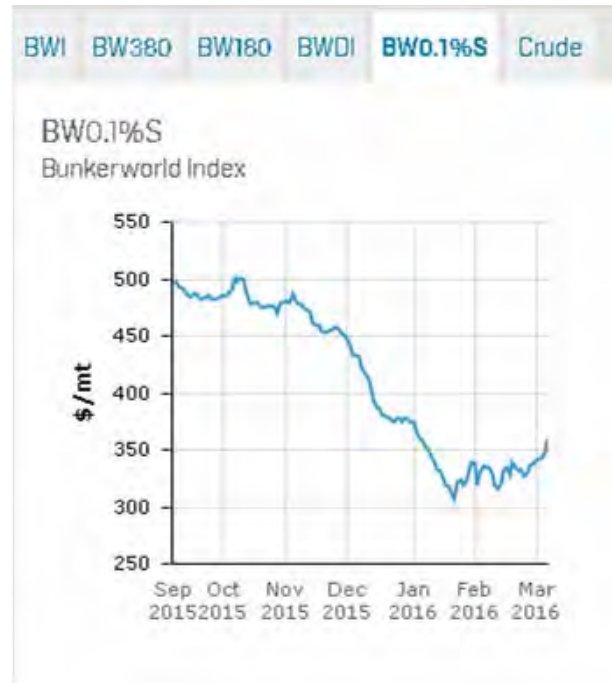
Recommendations to maximize profitability

Incomes and expenses for port and vessel entities

	INCOMES	EXPENSES
PORT AUTHORITY	<ul style="list-style-type: none"> ELECTRICITY SELL 	<ul style="list-style-type: none"> INITIAL INVESTMENT FOR THE ELECTRICAL SYSTEM IN PORT MAINTENANCE OF THE NEW ELECTRICAL SYSTEM ELECTRICITY PURCHASE TO THE SUPPLIER
SHIP COMPANIES	<ul style="list-style-type: none"> SAVINGS IN FUEL PURCHASING SAVINGS IN AUXILIARY ENGINES MAINTENANCE 	<ul style="list-style-type: none"> INITIAL INVESTMENT FOR THE SHIP RETROFIT MAINTENANCE OF THE NEW ELECTRICAL SYSTEM ELECTRICITY PURCHASE TO THE PORT AUTHORITY



Electricity cost when burning fuel



Assumptions:

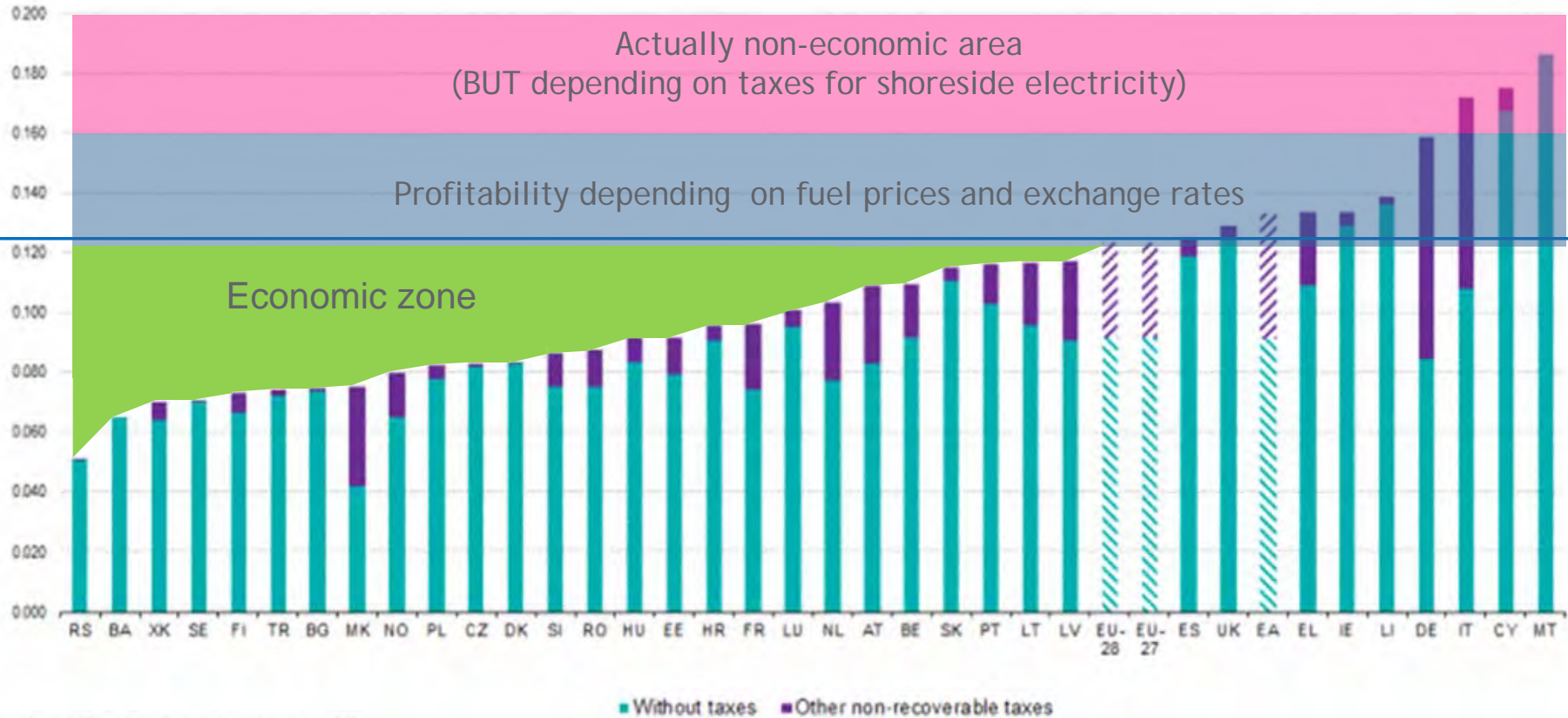
- Ferry: 230g LSF / kWh
- 350 – 500 € the ton of LSF

Result:

0,08 – 0,12 €/kWh

Comparison of shoreside electricity prices versus vessel own generation

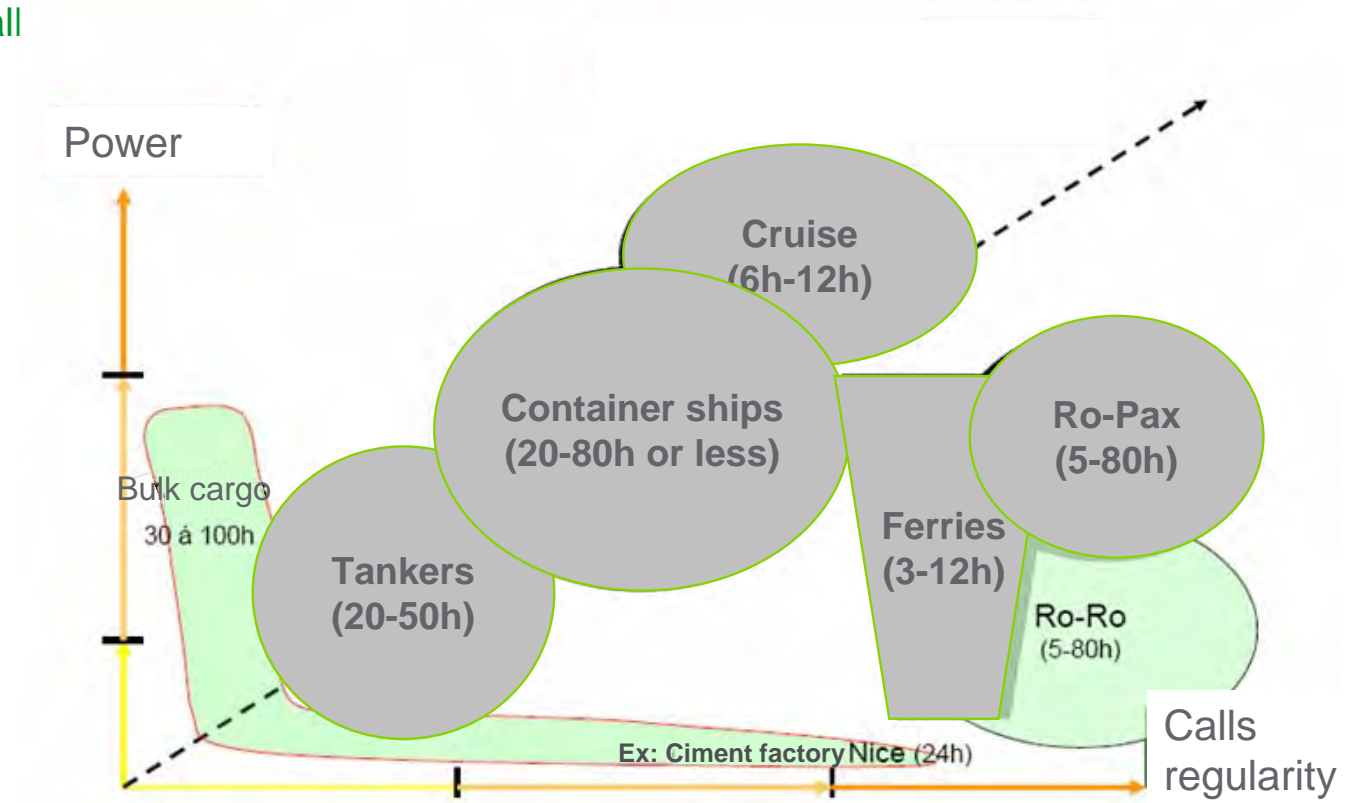
EU average
~0,123€/ kWh



Source: Eurostat (online data code: nrg_pc_205)
2014 S1

Other factors: Power and call frequency and duration

- > Vessel types and diesel auxiliary power on board
- > The number and the regularity of the calls realized by the ship every year at berth
- > The duration averages of every call



Recommendations



- > Conduct the **electricity prices negotiation** with all concerned entities **at early stages** of the project for a win-win situation for all
- > **Involve the Electricity Distributor / Utility in the project**; he is the entity with the highest benefits potential, therefore, should be involved in the investment
- > Re-contact shore connection equipment & solutions manufacturers. **The costs have substantially decreased in the last years.**
- > Start with the applications where it makes more sense: **vessels staying at berth long periods of time**
 - > Examples:
 - Military vessels always have shore power available at berth
 - OSVs in the North of Europe during winter time
 - Ferries and Ro-Ros in their overnight port
- > Are **port fees discounts** available for green practices?
- > **Are funds available to finance your project?**

EC funding for shore connection projects: TEN T / CEF program



> TEN T = TransEuropeanNetwork – Transport

- > Funding program aiming at improving European transport infrastructures, managed by the European Commission

> New TEN T program is covering 2014 -2020, under new name:

CEF (Connecting Europe Facility)

- > New call launched on NOV 6th and ended in February, with submission of more than 400 projects

<https://ec.europa.eu/inea/connecting-europe-facility/cef-transport/apply-funding/2015-cef-transport-calls-proposals>

▪ 3 subsections dedicated to maritime industry

- Technology & Innovation
- Motorways of The Sea (MoS) (at least 2 ports and a ship operator need to be involved)
- Infrastructure development

▪ 3 types of funds :

- Research (up to 50% funds)
- Deployment (up to 30% funds)
- Cohesion* countries (up to 85% funds)



New major change
compared to last program:
**Funds also available
for private
ports/operators**

Co-funding rates

Action		Maximum co-funding rate (% of eligible costs)
Studies		50%
Works	Motorways of the Sea	30%
	New technologies and innovation	20%
	Actions with synergies between at least two of the sectors covered by the CEF regulation (Transport, Energy, Telecom)	Up to 10% more
Cohesion countries		85%

EC funding for shore connection projects: TEN T / CEF program

>What to do to get the CEF funds?

>Ports/operator have to answer TEN T Call for project

>How can Schneider Electric can support you?

>Schneider Electric works with different **consulting agencies** based in Brussels that support ports / operators to write and build the dossier to apply to a call, and undertake the necessary lobbying actions to maximize chances to get the funds

>Schneider Electric has **access to the EU Commission** and can organize the first meeting for you

Article 25

3. Projects of **common interest for motorways of the sea** in the trans-European transport network may also include activities that have wider benefits and are not linked to specific ports, such as **services and actions to guarantee the seamless mobility of persons and goods in particular in the most remote, outermost and insular regions^[5]**, activities for improving environmental performance, **such as the provision of shore side electricity or emission scrubbers that would help ships meet stricter emission levels^[6]**, making available facilities for ice-breaking, activities ensuring year-round navigability, dredging operations, alternative fuelling facilities, as well as the optimisation of processes, procedures and the human element, ICT platforms and information systems, including traffic management and electronic reporting systems.

Article 26

2. Port operators **or the competent authority governing the port** shall **ensure that ports include equipment necessary to ensure the environmental performance of ships in ports, in particular electricity supply facilities as well as** reception facilities for ship generated waste and cargo residues in accordance with Directive 2000/59/EC of the European Parliament and of the Council of 27 November 2000 on port reception facilities for ship-generated waste and cargo residues **and with Directive 2012/.../EU on the sulphur content of marine fuels, and electricity supply facilities**

Shore Connection in the Juncker Plan

- > **Juncker Plan Objective:** Unlock €315 billion for the EU economy using only €21 billion in risk guarantees for investment projects.
- > **Financing: European Fund for Strategic Investment (EFSI):** The capital for guarantees will come from the EFSI, a joint venture between the EIB and the Commission as well as any Member States willing to contribute.
- > **Submission of projects:** Member states, as well as other entities, may submit plans for projects at any time. Projects are evaluated according to the following criteria:
 - > **EU value added** (projects in support of EU objectives)
 - > **Economic viability and value** – prioritizing projects with high socio-economic returns
 - > Projects that can start at latest within the **next three years**
 - > The projects' potential for leverage of **other sources of funding**
 - > Their **size and scalability** (e.g. the possibility to bundle smaller investments).

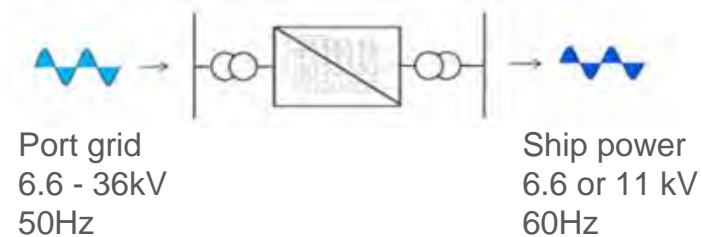
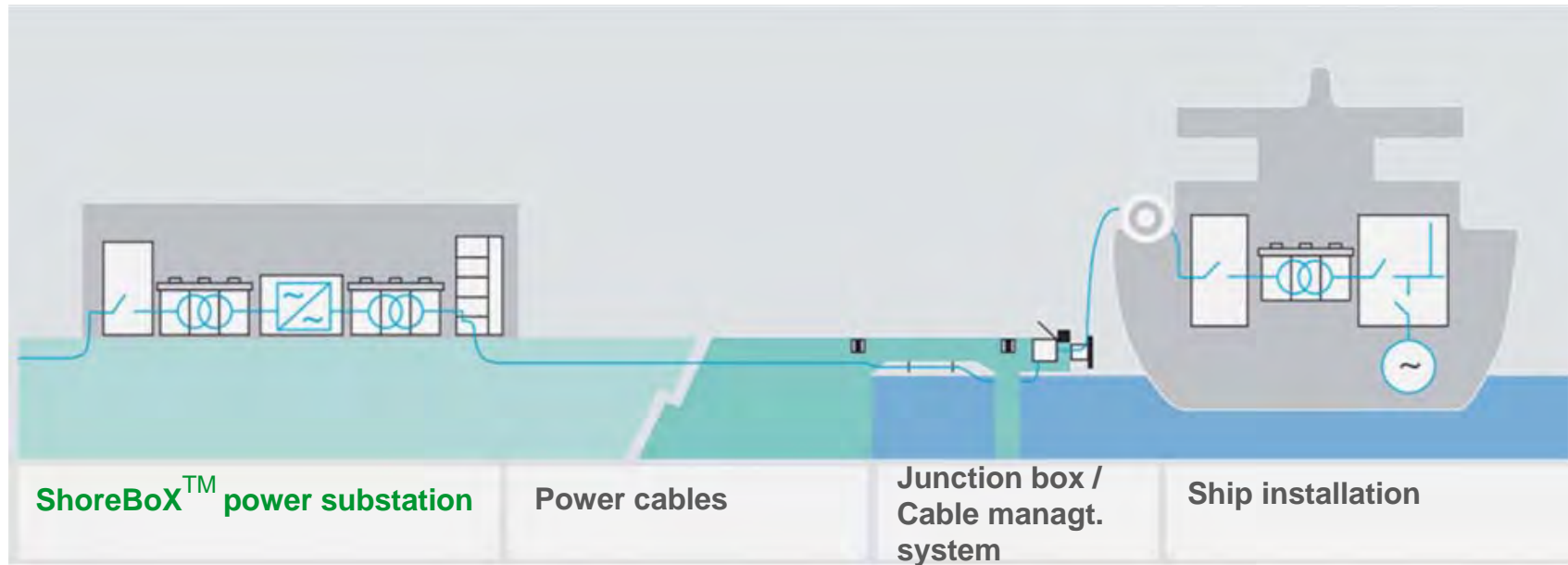


The Juncker plan does not provide direct funding but support with financial instrument.

Electrification of Transport being part of the Juncker Plan priority, Shore Connection projects are eligible.

The ShoreBox™

Typical layout of a shore connection system for containerships



Schneider Electric can take care of the execution of the entire project onshore and onboard

ShoreBoX™ Concept

- > Ready to use solution
- > All-in-one system
- > Manufactured and tested in a controlled factory environment
- > Reduced project costs and execution time
- > Minimized disturbance to berth's activity

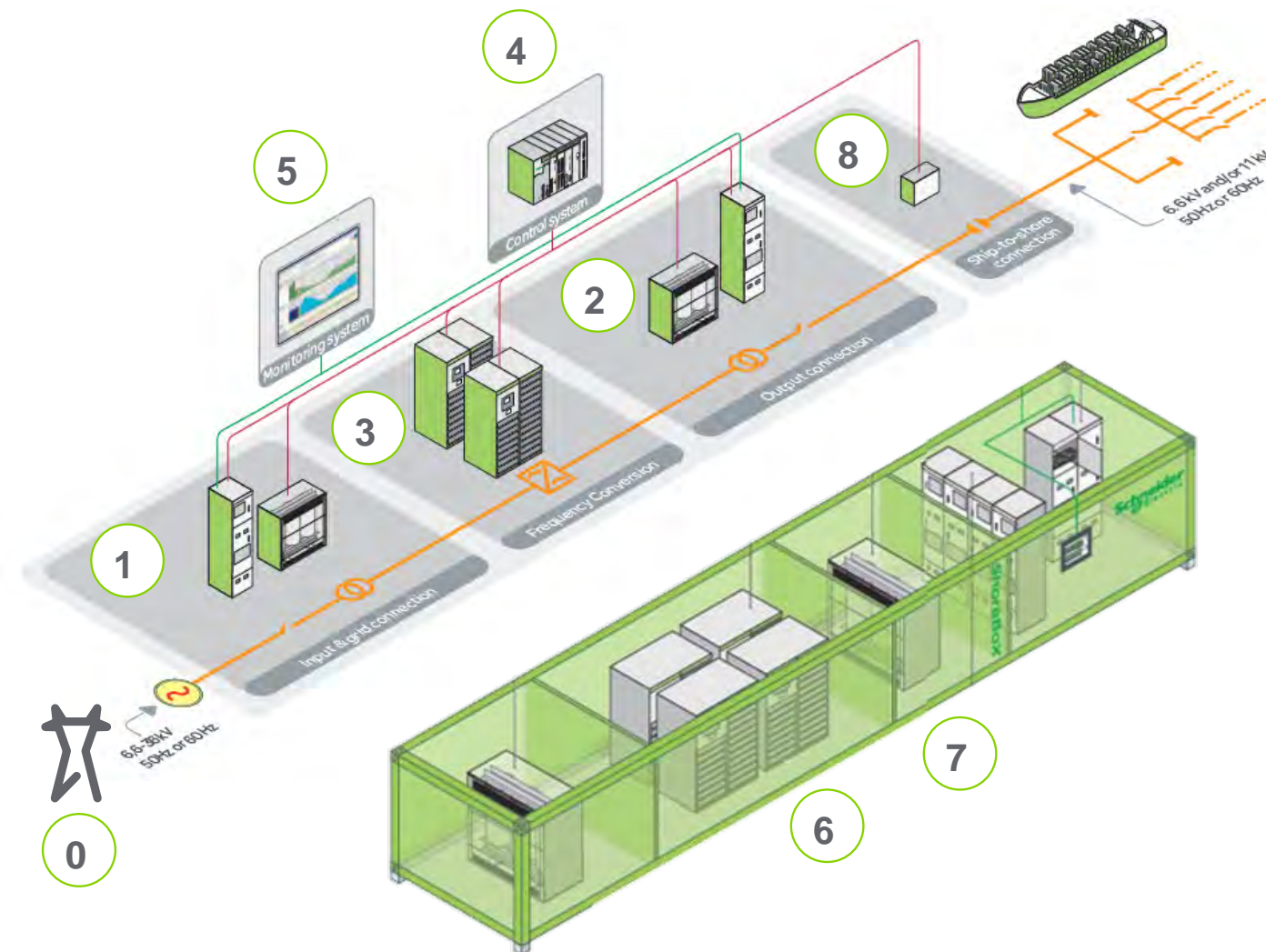


ShoreBoX™ functional Architecture

- 0. Supply from energy provider
- 1. Input & grid connection
- 2. Output
- 3. Grid Conversion frequency
- 4. Load Management
- 5. Monitoring
- 6. Thermal Management
- 7. Enclosure box
- 8. Ship to shore connection (HV or LV)



The ShoreBoX is made of defined component “bricks” that can be **adapted and installed in an existing building** as well



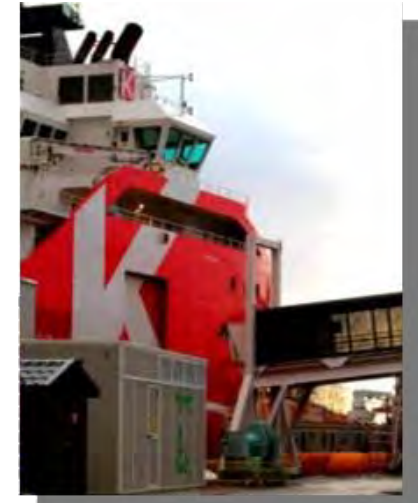
The ShoreBoX system integration is done in our factory.
The finalised ShoreBoX travels to final customer's site.



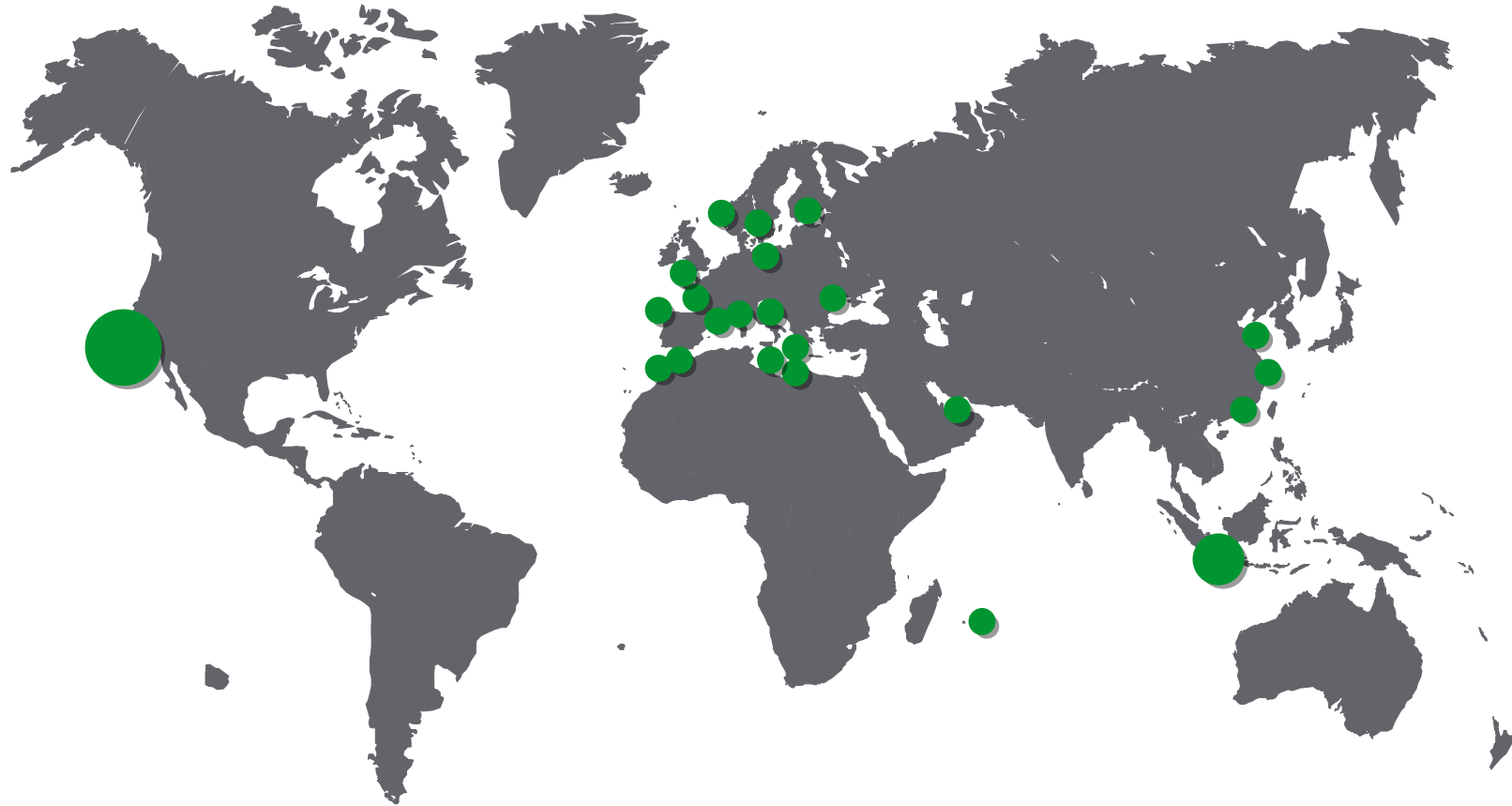
Shore connection implementation: Onshore

HVSC deployment in ports

- **ONSHORE:** This technology is already available in **more than 120 berths worldwide:**
 - > 50 berths in **North America** (containership, cruise)
 - > 60 berths in **Europe** (ro-ro, ferry, navy, super-yacht)
 - > 10 berths in **ME and APAC** (containership, cargo)



Schneider Electric worldwide references



Strategic USA's largest container port

The California-based port is the largest in USA



Needs

- Succeed as the first US shore connection site
- Comply with strict Californian regulations
- 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 PM, NOx and SOx
- Compliant: meeting Shore Power System and UL standards
- Open: committed to providing shore power infrastructure to all container, cruise, and liquid bulk terminals



Future Kalibaru Container Terminal

- Existing port does not have the capacity to host the increasing sea freight volumes
- Development of the new **KCT** (Kalibaru Container Terminal) **started in March 2013**
- Future capacity **13 M 20-foot containers / year**
- First phase is scheduled for **completion in late 2017**
- When fully operational, it will be the **country's largest industrial port** and the **3rd** in South East Asia



- New green, modern port** in South Asia
- First phase includes **9 berths equipped with Schneider Electric 5-MVA shore connection systems**
- 2nd and 3rd phases will equip berths** with shore connection as well



Navy ship connection at Toulon naval base



ShoreBoX



- > Facility to provide 60hz to the base network
- > 2x ShoreBoX MV-> MV 4MVA with frequency conversion
- > Installation already operational since September 2015
- > 2 types of ships being powered
BPC 2,2MVA & FREMM 1,2MVA



OSV connection at Port of Bergen



- > Facility to provide electricity to Offshore Supply Vessels (OSV) at berth in the North Sea zone (ECA zone). OSVs are often required to stay at berth for long-time periods, especially during winter season where sea's meteorological conditions tend to be more critical.
- > First installation to be operational middle of 2015. Several more to come, with the aim of equipping all OSV berths
- > ShoreBox MV-> LV 1 MVA with frequency conversion
 - > 3 Cables
 - > 2 output: 440V or 690V
 - > Frequency: 50 or 60hz



Fincantieri Ancona

2 MVA MV/LV ShoreBoX to power The Viking Sea cruise ship during its construction ShoreBoX operational since end of July 2015



Shore connection implementation: **Onboard**

Shipping companies interested in Shore Connection

ONBOARD:

- Standard application for shipyards, navy, yachts, etc.
- Major shipping lines have started retrofitting their ships

CONTAINER

NYK	CMA CGM
APL	MSC
MAERSK	Hapag Lloyd
ICL	China shipping
K-lines	OOCL
MOL	Matson
Evergreen	Yang Ming
Peter Döhle	NSB Conti
Messina Shipping	Hansa Shipping

FERRY / RORO

Color line
Stena line
Stora Enso
Cobelfret
Viking line
Wagenborg shipping
Scandlines
Allendia Rederi

BULK & TANKER

COSCO
Pohang Iron & Steel
BP

CRUISE

Disney Cruise	MSC Cruise
Holland America	Amet Cruise
Norwegian Cruise Line	
Princess Cruise	
Royal Caribbean	
Cunard	
Costa Cruise	

Number of vessels already equipped:

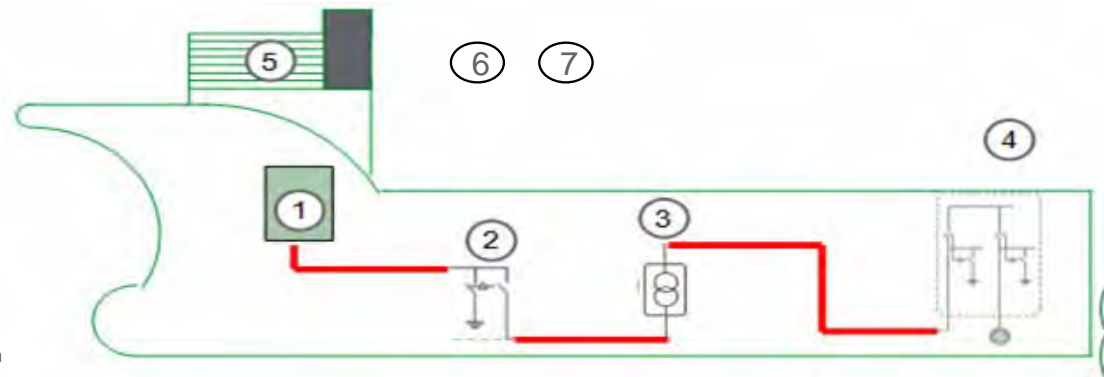
- Cruise vessels: 10% -> 30
- Ro-ro / Ro-Pax / Ferry: 30
- Deep sea container vessels: 8% -> 300
- All new cruises, and all containerships > 10.000TEU come pre-equipped



Ship retrofit for Shore Connection

What to do ?

- 1 Make a door on the hull to receive the socket outlet and the cable(s) & Install a MV electrical panel to receive the power. For container ships, install cable reel.
- 2 Install the MV cells to manage the vessel connection and the grounding
- 3 Install a transformer to step down from 6,6 or 11kV to the LV level of the vessel
- 4 Modify the existing LV or MV main switchboard to host the reception of the onshore power
- 5 When needed, software adaptation in the vessel management system to manage the shore connection and disconnection operations
- 6 Installation commissioning
- 7 Request the certification of the installation by the corresponding classification society/ies



Ship retrofit for Shore Connection

Example of realization - France

- > **Shipowner:** CMN
- > **Ship type:** Ferry operating between France & Corsica
- > **Scope:** 3 ships, 1.8 MVA 11 kV 50 Hz
- > **Model:** SE in partnership with STX Service. Ordered in 2014, the three ships are now retrofitted and operational.



Piana



Girolata

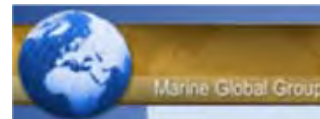


Kalliste

Ship retrofit for Shore Connection

Example of realization – Gothenburg, Sweden

- > **Shipowner:** Stena Line
- > **Ship type:** Ferry
- > **Scope:** 5 ships
- > **Model:** SE products installed & commissioned by a partner (Marine Global). Implemented in 2011.



Conclusions & take-aways

Conclusions



Shore connection is a reality today, installed and available in many terminals and ports worldwide, and in many vessels.



The regulatory and normative frames are set, and push for the integration of this technology in the years to come.



Profitability is achievable in many cases **for both shipowner** (operational costs reduction) **and port entities** (new service to offer and to invoice to their customers).



Schneider Electric ShoreBoX solutions mean **safe, standards-compliant, reliable systems, backed-up by an accountable manufacturer** that is investing in R&D and in the technological development of these systems.

Questions?
Thanks!



ShoreBoX™
Plug in to
Green Power

Life Is On

Schneider
Electric

