



*Seminar*  
**'Teaming up in the retrofit market'**

international trade ) innovation ) professional training

<b>15:30</b>		
<b>15:45</b>	Opening and introduction	Chairman (CMTI) R. Brink
<b>15:55</b>	Upcoming legislation: prepare for changes	Ministry of Infrastructure & Environment D. Brus
<b>16:10</b>	Sea of unprepared vessels	Holland Shipbuilding Association R. Dazert
<b>16:25</b>	pitch Damen	Damen Ship Repair & Conversion T. Luggens
<b>16:35</b>	pitch Alfa Laval	Alfa Laval BV P. Brands
<b>16:50</b>	pitch Wärtsilä	Wärtsilä B. Kruyt
<b>17:00</b>	pitch D. van de Wetering	D. van de Wetering J. van Woerkom
<b>17:10</b>	pitch Axces	Axces Emission Technology K. Remmen
<b>17:20</b>	Discussion	
<b>17:45</b>	Network reception	



Ministry of Infrastructure and the  
Environment

# Upcoming Environmental Legislation

Dick Brus

Ministry of Infrastructure and  
the Environment

[dick.brus@minienm.nl](mailto:dick.brus@minienm.nl)

1 April 2014



## shipping environmental legislation

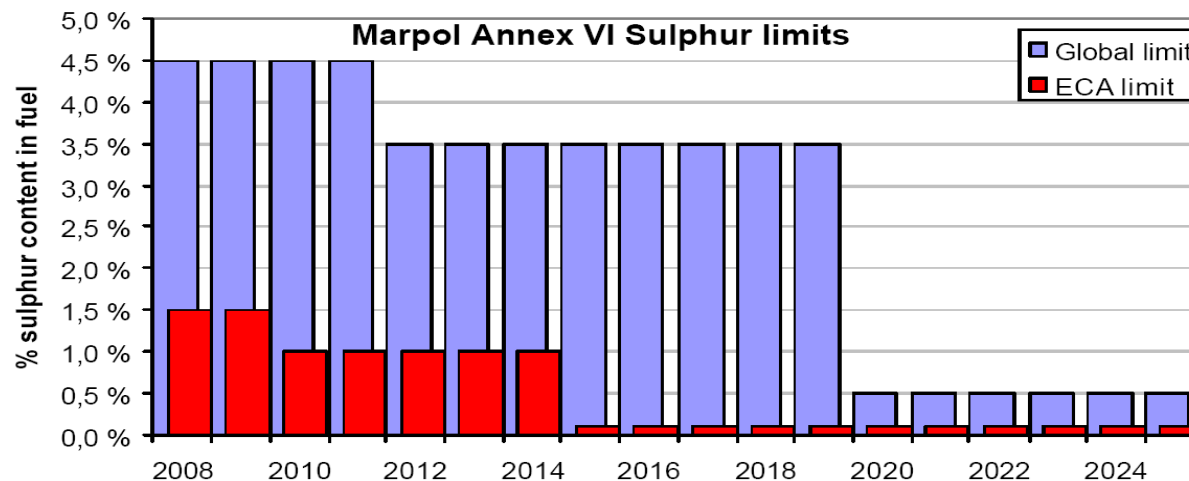
Recently approved or expected environment regulations, need for new technology

- |                           |  |
|---------------------------|--|
| 1. SO <sub>x</sub> and PM | cleaner fuel, scrubbers and LNG  |
| 2. NO <sub>x</sub>        | SCR technology, EGR  |
| 3. CO <sub>2</sub>        | ship design and construction   |
| 4. Ballast Water          | Ballast Water Treatment systems  |
| 5. Recycling              | Stricter regulations for recycling facilities<br>Stricter regulations for the use of hazardous materials |



## SOx and particulate matter

- Regulated by a maximum limit for the sulphur content of fuel.
- In 2015 Sulphur Content in Sulphur Emission Control Area's to 0,1 %
- In 2020: global 0,5 % sulphur content
- Review ultimately 2018 on the availability of compliant fuel oil, next week in IMO MEPC proposal United Kingdom and the Netherlands on this review.





## EU Sulphur Directive

EU sulphur directive was approved in 2013:

- Implementation of the IMO sulphur regulations.
- Global 2020 sulphur limit in EU waters, regardless of the outcome of IMO review on availability.
- Stimulate use of scrubbers and LNG, (Marco Polo, Toolbox).
- European Sustainable Shipping Forum ESSF
- ESSF working groups on scrubbers and LNG
- Create conditions for the use of marine LNG as ship fuel.
- Create conditions for the use of scrubbing technology in shipping.

### News:

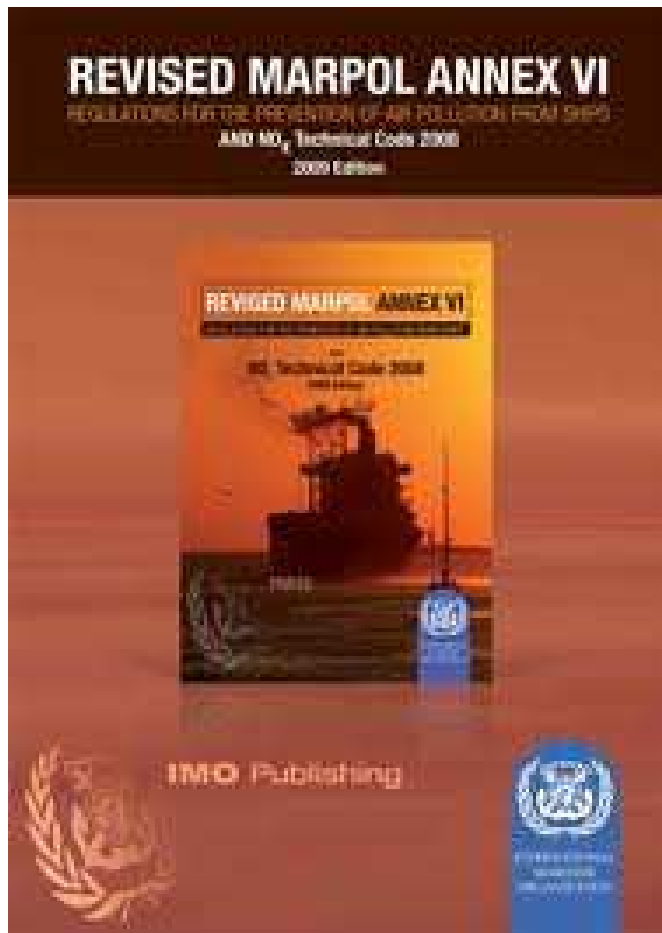
#### European Commission set up sustainable shipping forum

**On 25th September 2013, the European Commission announced the establishment of the European Sustainable Shipping Forum (ESSF) in response to the challenges created by the Sulphur Directive.**

The aim of ESSF is to assess the developments towards compliance with the IMO 0.1% sulphur content in marine fuel, which are due to enter into force as from 1st January 2015 in the SECAs (Sulphur Emission Control Areas). Furthermore, with ESSF, the Commission intends to bring together Member States and maritime industry stakeholders in order to enable a structural dialogue, exchange of best practices and coordination, while providing the opportunity to discuss practical issues that could be encountered during the implementation process, in particular during the transition phase before the entry into force of the new standard.



## 2008, REVISED MARPOL ANNEX VI

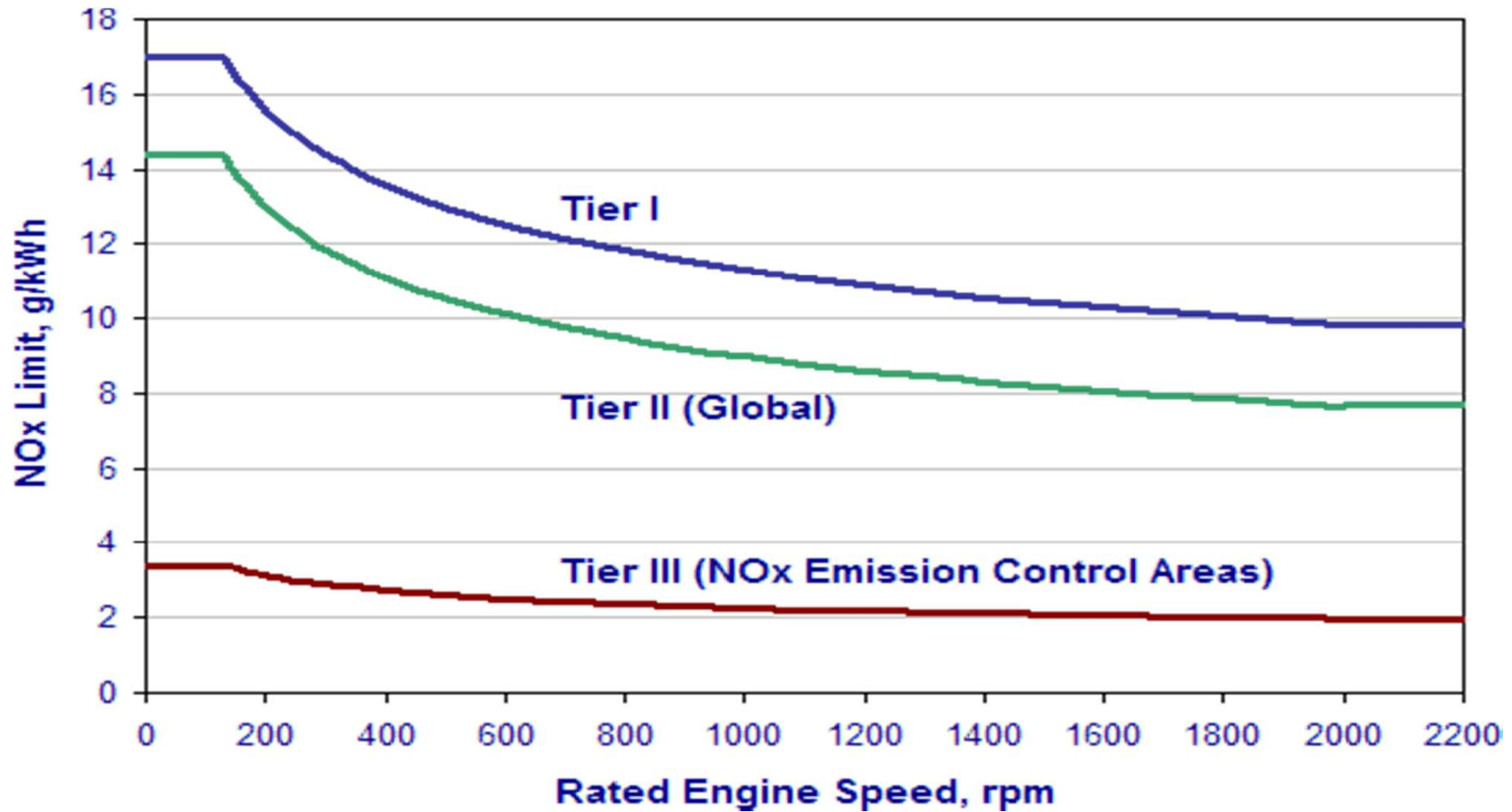


For NOx Engines installed on a ship:

1. 1990-2000, large engines with a power output of more than 5,000kW and cylinder replacement above 90 litres must comply with the existing (after 2000) limits, provided that there is an approved method
2. 2000-2010 existing limits (Tier1)
3. 2011- Tier II, on average 20% stricter than tier 1
4. 2016- Tier III, ships in NOx emission Control Areas NECA's, on average 80 % stricter



## 2008, REVISED MARPOL ANNEX VI







## NECA area's



### Approved:

- North America Coast
- US Islands in the Caribbean

### Expected:

- Baltic Sea

### Mentioned as possible future NECA's:

- North Sea
- Japan
- South East Asia (Singapore with others)
- Australia/New Zealand
- Northern America including Mexico
- Mediterranean



## NOx reducing technologies

Wartsila:

- The NOx Tier III measure is far reaching compared to the NOx Tier 1 and Tier 2 measures
- Wärtsilä sees a good future for gas-fueled engines, gas is an attractive alternative to meet the Tier III standards.
- Selective Catalytic Reduction (SCR) can be combined with fuel > 1,0% sulphur.
- SCR is compatible with scrubbers.
- The costs of SCR are 5 -10 % of the fuel costs.
- The experience with SCR in the Baltic is good: 90 % NOx-reduction. Ships with SCR receive reduction on Swedish harbour dues.
- In development: combining technologies
- Wärtsilä will be ready in 2014 to supply engines that comply to Tier III-standards.





## CO2-emissions Maritime Shipping:

Potential for improvement of energy efficiency in shipping sector: technical and operation measures: 25 -75 %

July 2011: IMO adopts in Marpol Annex VI:

1. Energy Efficiency Design Index (EEDI), a kind of 'energy efficiency performance standard': only for new ships
2. Ship Energy Efficiency Management Plan (SEEMP; all ships)

Also *with* EEDI en SEEMP the CO2-emissions of maritime shipping will grow substantially. This requires, according to IMO, marketbased measures.

Marketbased measures => two options:

1. Emission Trading Scheme (ETS)
2. Levy on fuel price, revenues in fund



## EU system for monitoring, reporting and verifying – Proposal Regulation

- Goal: deliver robust data, with reverence to reductietargets
- Scope:
  - Journeys to and from EU ports
  - Ships above 5000 GT
  - Only CO<sub>2</sub>
- Limit administrative burden
- Use of private verifiers



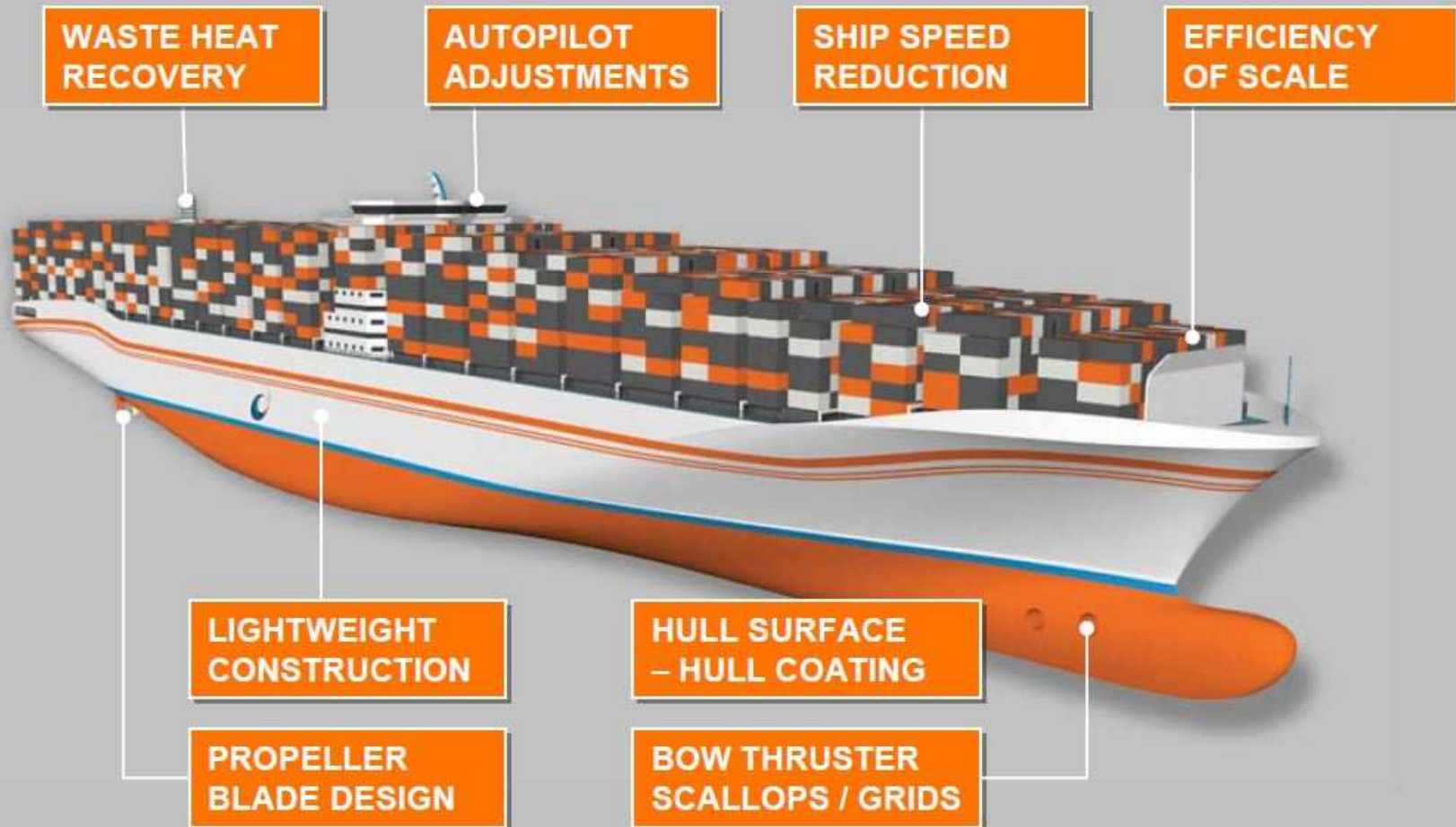


## Opportunities for new technology:

A policy of reduction of CO<sub>2</sub>-emissions and regulation on energy efficiency (EEDI and SEEMP) will lead to opportunities for new technology:

- Exhaust waste heat recovery
- Propellor blade design
- Lightweight construction
- Hullsurface / hullcoating
- Energysaving lightning
- Etcetera

# CONTAINER VESSELS





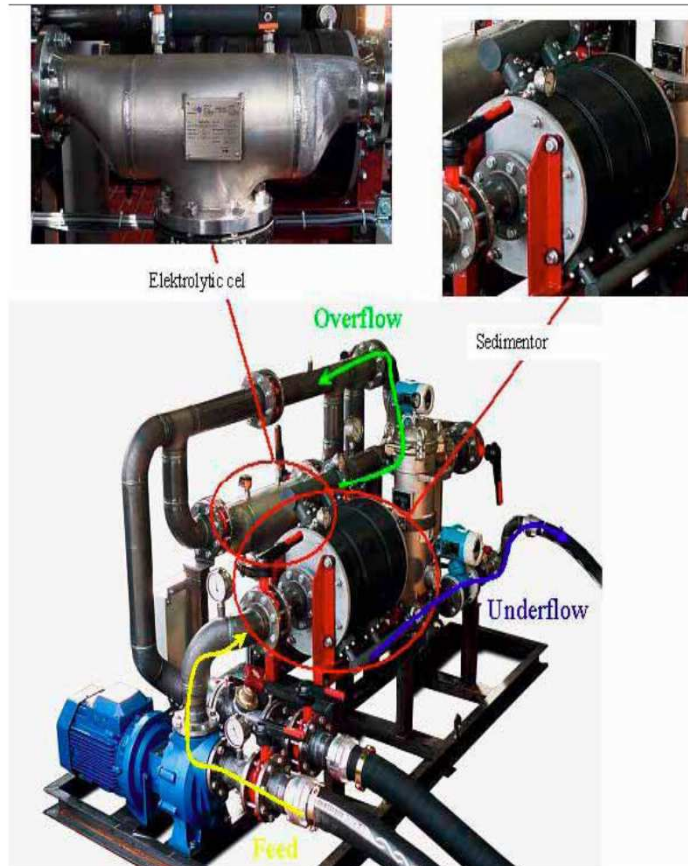
## Ballast Water Convention

- Convention sets exchange standards, discharge performance standards organisms and indicator microbes
- Use of active substances may not be harmful, approval procedures
- Convention does not apply to ships which only operate in waters under the jurisdiction of the party, or under the jurisdiction of another party when that party gives authorization for that exclusion
- Each party designates ports with adequate reception facilities
- Party shall ensure that ships are surveyed and certified according to Rules of the IMO
- Nothing in this convention shall prevent Parties taking more stringent measures





## Ballast water treatment systems



IMO Basic approval 46

IMO Final Approval 32

Type approval 39





## When does the convention come into force?

- **Conditions of entry into force: 12 months after the ratification of 30 States, 35% of the world's tonnage**
- **Febrary 2014: 33 states have ratified, 30,4% of world tonnage**
- **Coming into force: 2015??**





# Recycling, IMO Hongkong Treaty



Adopted in 2009

Aim: ensuring that ships, when being recycled, do not pose any unnecessary risks to human health, safety and to the environment

Issues addressed:

- ships sold for scrapping may contain environmentally hazardous substances such as asbestos, heavy metals, hydrocarbons, ozone-depleting substances and others
- concerns raised about the working conditions at many of the world's ship recycling locations.
- concerns raised about the environmental conditions at many of the world's ship recycling locations.



## IMO recycling guidelines



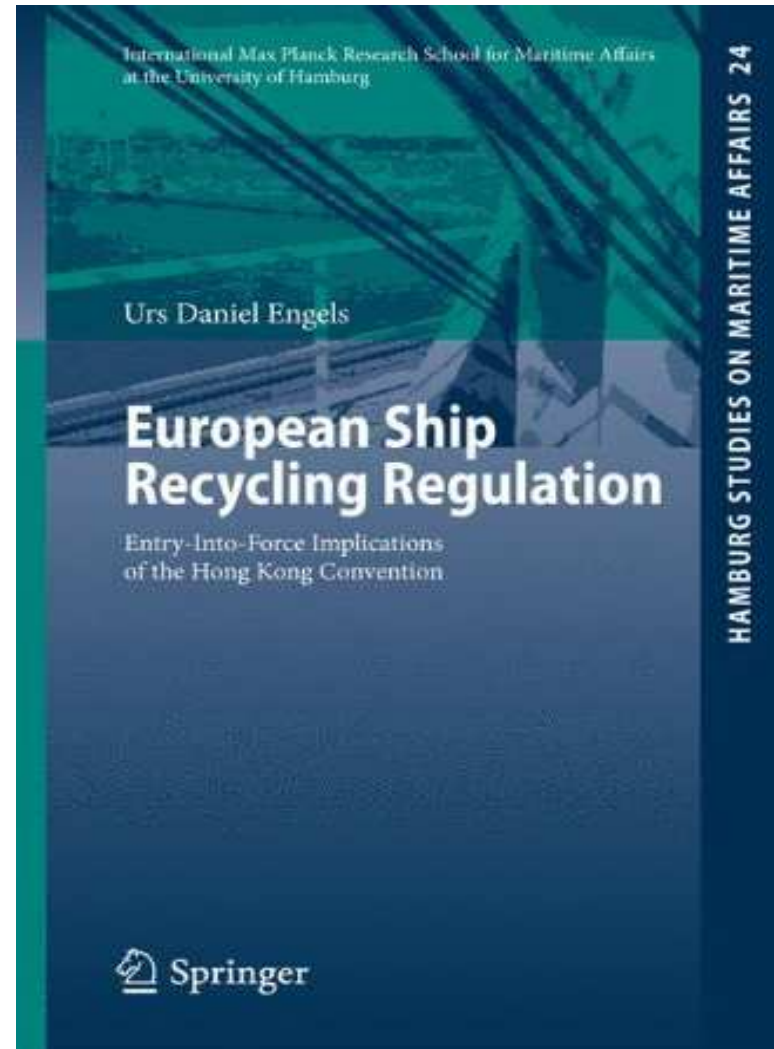
IMO guidelines:

1. the development of the Inventory of Hazardous Materials;
2. survey and certification;
3. for inspection of ships;
4. the authorization of Ship Recycling Facilities;
5. safe and environmentally sound ship recycling;
6. the development of the Ship Recycling Plan; and
7. other guidelines or circulars as may be identified by the Marine Environment Protection Committee of the Organization,



# Hongkong Convention

Hongkong Convention  
Possible entry into force:  
2020???





## EU recycling regulation



EU ship recycling regulation  
adopted in 2013,

- Aim: early ratification Hong Kong Convention, both within the Union and in third countries by applying proportionate controls to ships and ship recycling facilities on the basis of that Convention.
- When interpreting the requirements of this Regulation, consideration should be given to the guidelines developed by the IMO ('IMO guidelines') to support the Hong Kong Convention.
- No ship recycling fund now, further study and proposal from the Commission



## EU recycling regulation 2

- entered into force 31 December 2013
- This regulation applies to ships at the earliest 31 December 2015 and at the latest 31 December 2018, the eventual date depending upon when the recycling capacity of facilities on the EU list exceeds a threshold of 2.5 million light displacement tonnes (+ 6 months).
- The provisions on ship-recycling facilities will apply from 31 December 2014
- Some exceptions: Ships going for recycling must have a inventory of hazardous materials already this year.





**SCHEEPSBOUW**  
**NEDERLAND**

Sea of unprepared vessels:  
*Assessing the market size for scrubber  
and BWTS retrofits*

Ralph Dazert  
Seminar "Teaming up in the retrofit market"  
Harderwijk, 27/3/14

# Scrubbers: defining the market size

- Roughly 87,000 merchant vessels in world fleet\*
- About 20,000 vessels eligible for retrofit\*\*
- Break-even point for scrubber retrofit: vessel to trade 40% or more of its time inside ECA's\*\*
- About 2,200 retrofits expected in period 2015-2020\*\*\*
- Retrofits so far performed, ordered or scheduled: about 100 ships
- Majority of projects announced in last half year or so, market is picking up!

\*UNCTAD, 2013

\*\*Alfa Laval, 2014

\*\*\*Spliethoff, Alfa Laval, 2014



## Why so few projects?

- Lack of funding, installation very costly (several million €)
- Shipowners willing to take the gamble on MGO price and further development of scrubbers
- Scrubber takes up a lot of (revenue earning) space on smaller ships
- Doubts among some shipowners about environmental issues with wet scrubber + open loop system



*Wärtsilä hybrid scrubber system installed in funnel of Solvang LPG ship (left)*

# Market expectations

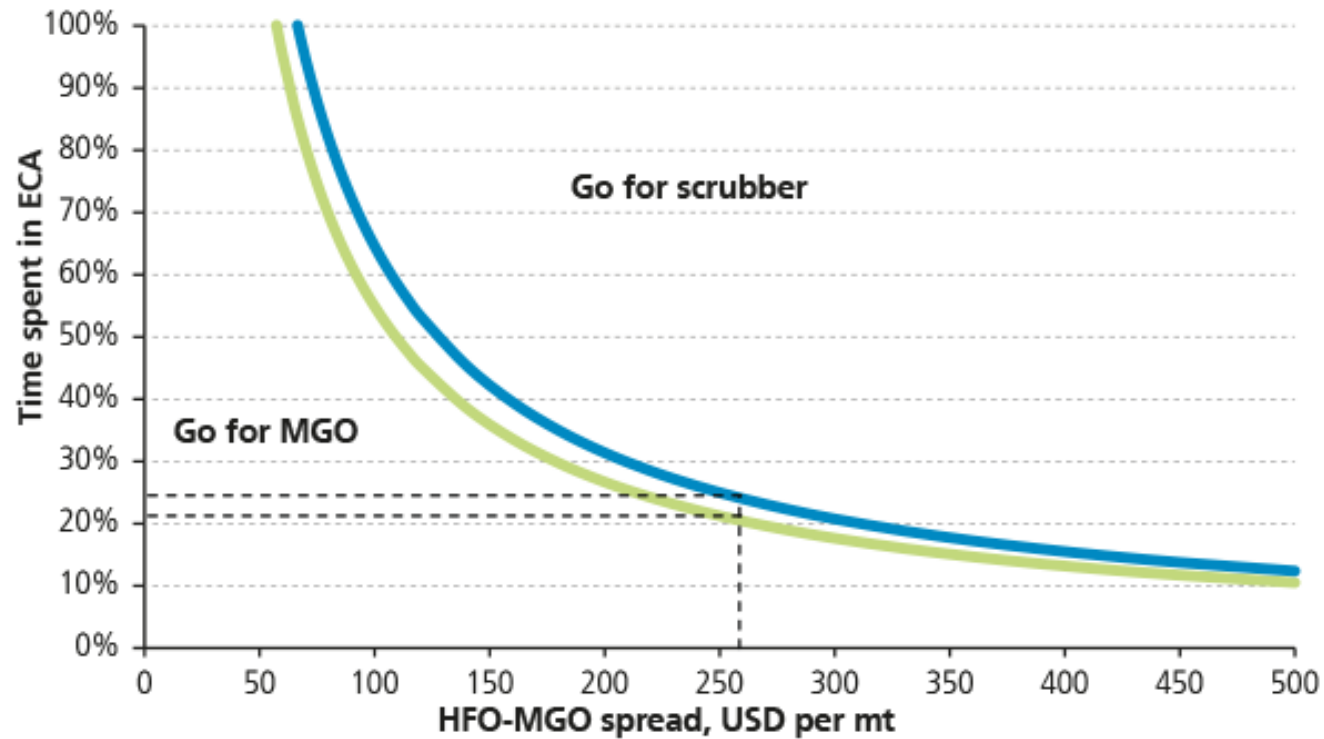
- First movers could be at a disadvantage
- MGO price will rise, probably by 15-20%\*
- So far, almost all retrofit projects are for cruise ships, ropaxes and ro-ro's (clear schedule, high fuel burn)
- Finland to provide subsidies for retrofit (€12.6 million for 45 vessels)

*\*Lloyds Register, March 2014*



## Investment Function for Scrubbers

Fuel Spread



*Any point above the line for each ship type indicates that investment in a scrubber is an economically better option than MGO, while any point below the line indicates that MGO is an economically better option than scrubbers.*

Standard vessel      ECO

Source: BIMCO

Source: BIMCO, April 2013

# Ballast Water Treatment Systems market size

- Some 68,000 ships need to be refitted within 5-6 years after coming into force of regulation\*
- BWTS market to peak in period 2017-2019 at between 1-3 billion USD per year
- Comparison: sales in 2013 were USD466 million\*\*
- Market estimates vary based on speed of coming into force or regulation
- Over 50 BWTS systems in various stages of approval\*\*
- Prices of BWTS systems from \$500,000 to \$3 million\*\*\*\*

*\*Maersk Maritime Technology, 2013*

*\*\*Frost & Sullivan, 2012*

*\*\*\*IHS, 2013*

*\*\*\*\*P66, Nov 2013*

# What's holding things back?

- Systems fitted 2013: 67 (2010: 49), a long way to go!\*
- Movement in IMO on BWTS ratification is still slow
- However, USCG is also pushing for mandatory ballast water cleaning (EPA), which could speed up things a lot
- Why invest early when you keep the money in the bank till end 2014 at least?
- Technology development in systems is still ongoing
- Ships built before 2000 might be sent for scrap rather than be retrofitted
- Shore-based treatment systems also being studied by Damen and others

*\*Chelsea Technologies Group, 2014*



*Ballast Water treatment barge: a threat to onboard systems?*

**Thank you for your attention**  
**Any questions?**



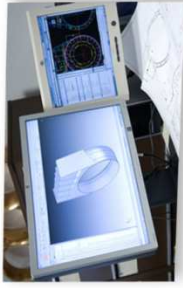


**Ballast Water Treatment:  
Retrofitting service to compliance.**

27 March 2014, HME Harderwijk

**Speaker:**

*Tjitse Luggens  
Project Manager Ballast Water Treatment  
Damen Shipyards Group, The Netherlands  
tl@damen.nl*





86 YEARS OF EXPERIENCE

ABOUT DAMEN



SHIPBUILDING



SHIPREPAIR & CONVERSION



SERVICES

## ABOUT DAMEN – Facts & Figures

**Annual Turnover:** €1.7 bn

**Annual Deliveries:** 157

**Annual Repair jobs:** > 1,000

**The Damen Family:** 8,000 Employees

**Global Presence:** 35 Yards

**The Damen Standard:** Stock hulls > 150

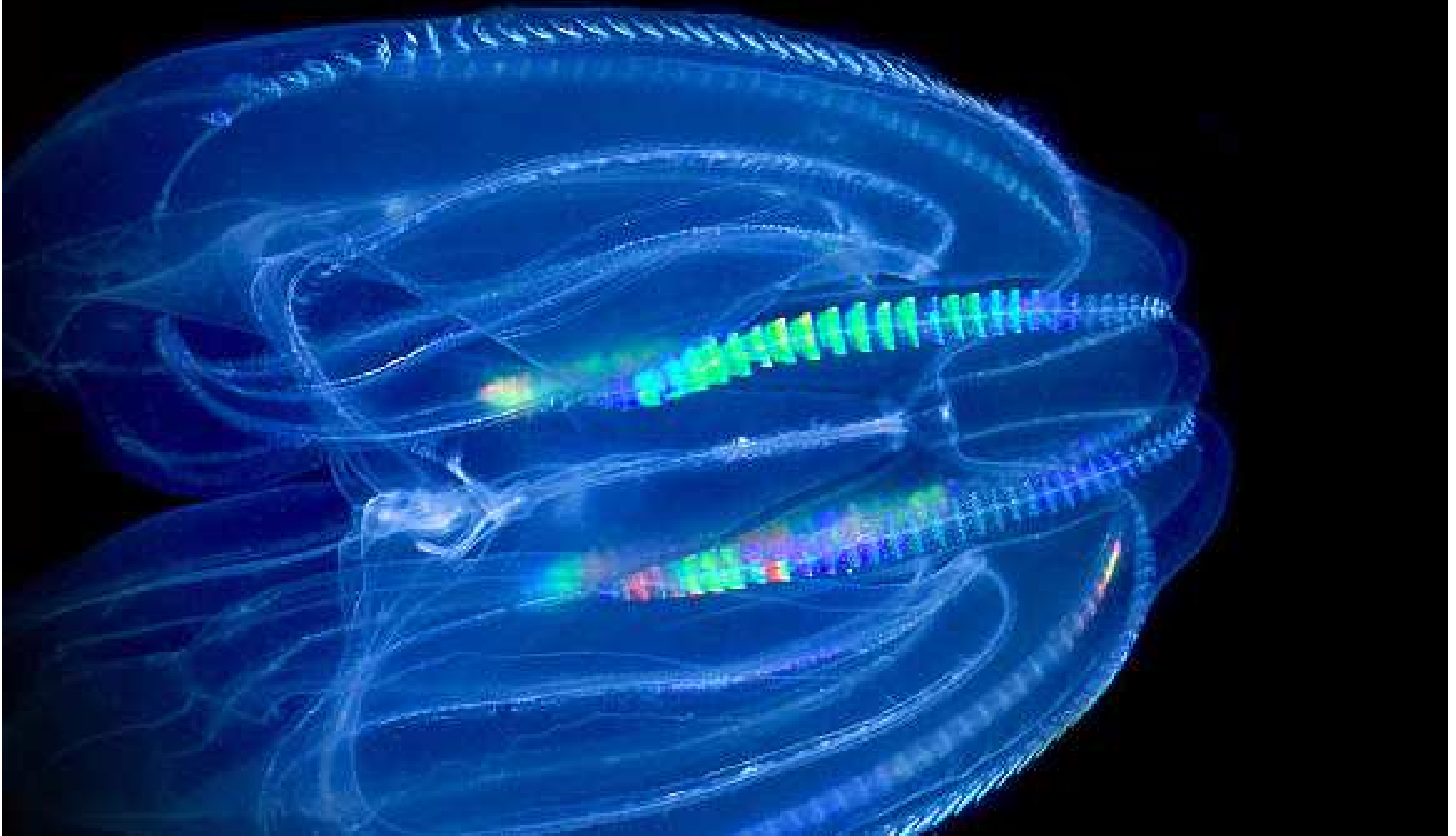
**Vessels delivered since 1969:** > 5,500

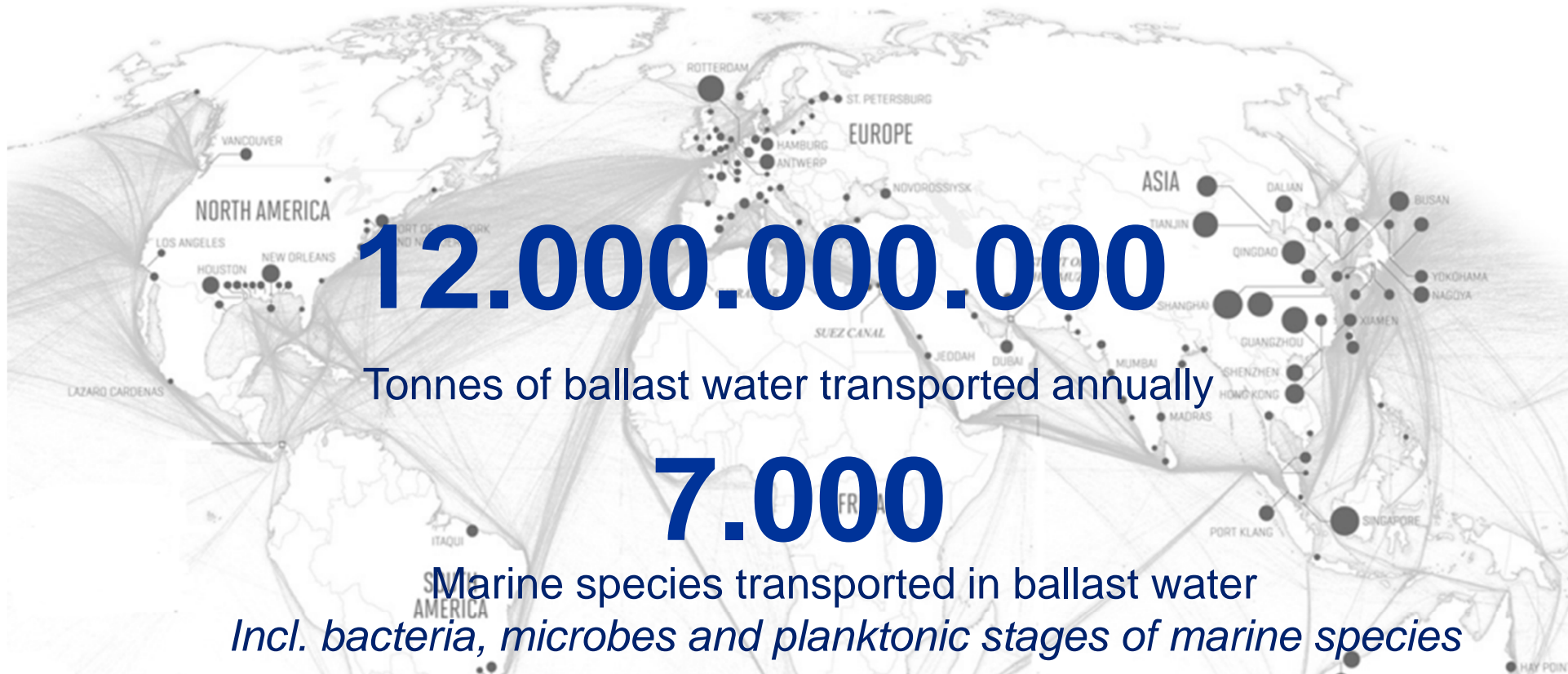


**By now most of us know what aliens  
look like.....**

This alien doesn't need a **space ship** to travel.....

it uses **your ships**





Selection of most unwanted invaders



Cholera



Zebra Mussel



Comb Jellyfish



Japanese Seastar



Cladoceran water flea



Asian kelp



Ballast Water Management Convention  
*To be ratified 2014 ???*



United States Ballast Water Regulations  
*Enforced*

Many vessels  
need to comply  
short term



## How to comply ?

- Management Plan & Record Book
- Survey & Certificate
- Manage ballast water by either Exchange or...
- ..by Treatment using a type approved system
- After implementation dates only treatment will be allowed.





**Most will comply by installing or retrofitting a Ballast Water Treatment System on board**



The background of the slide is a photograph of a ship's deck. The deck is covered with various pieces of equipment, including large white cylindrical tanks and complex piping. The ship is moving through the water, as evidenced by the wake and spray. The sky is a clear, pale blue.

**70.000**

**Vessels will need to comply with BWM regulations**

**40.000.000.000**

**Estimated total cost USD to equip the world fleet with a BWTU**

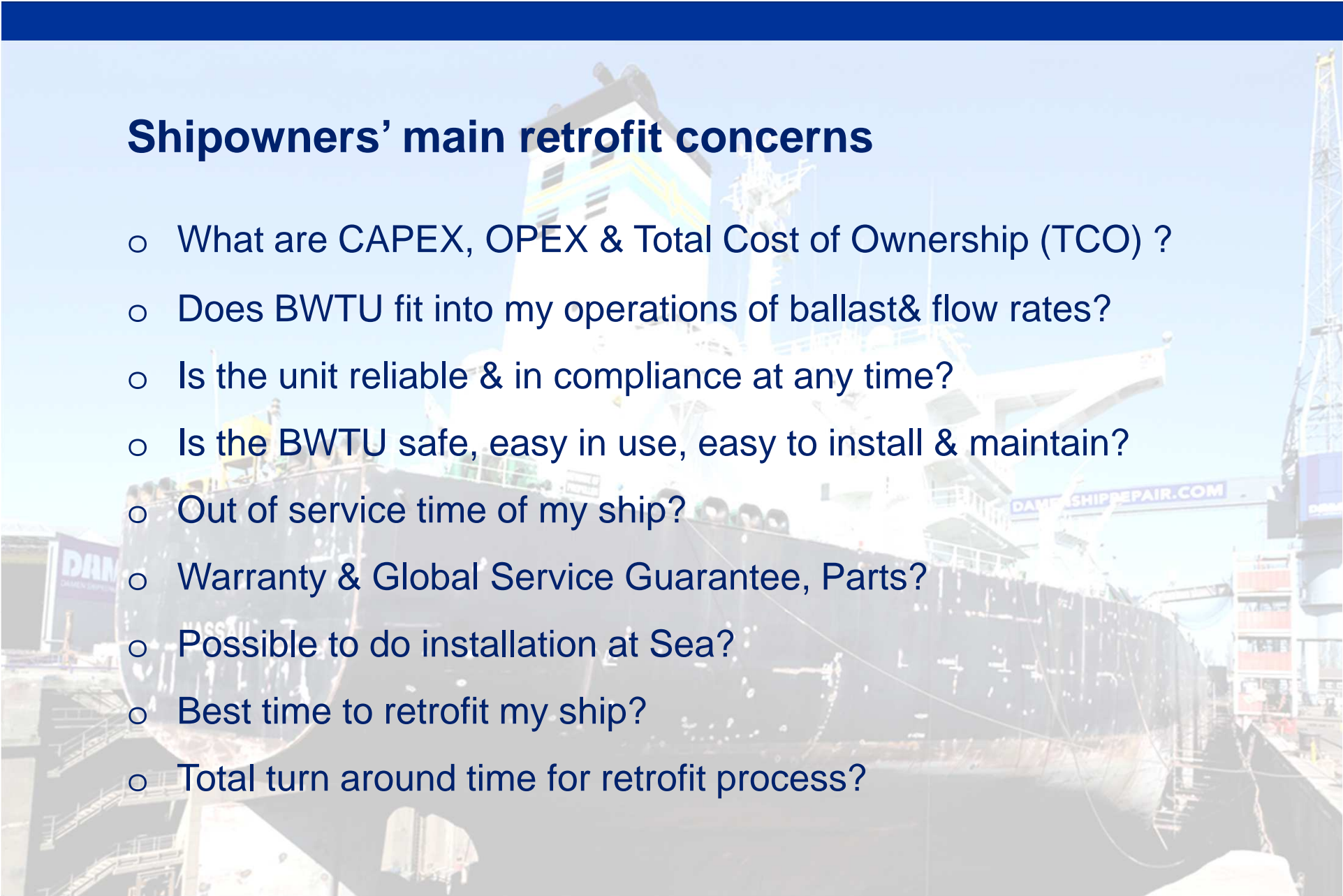


The capsizing of Cougar Ace in 2006 has been blamed on BW exchange leading to instability

## The Challenge

- All shipowners will be faced with BWM requirements sooner or later
- Estimated 25 retrofits/day in average (peak year 2018 40/day)
- Shipowners will face practical challenges:
  - equipment supply
  - engineering capacity
  - installation capacity
  - Availability of facilities/yards
- This may lead to shortage and higher cost

## Shipowners' main retrofit concerns

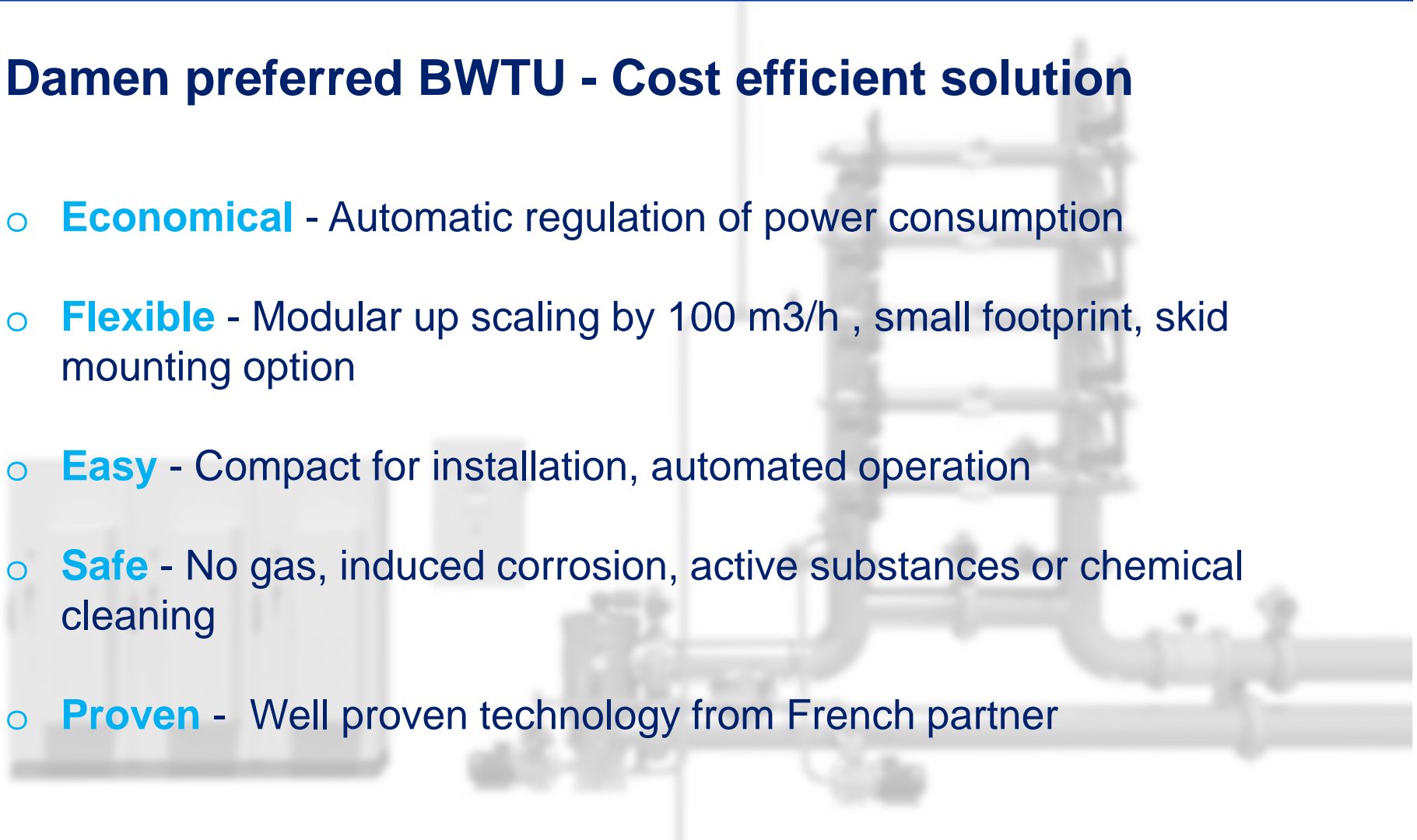
- What are CAPEX, OPEX & Total Cost of Ownership (TCO) ?
  - Does BWTU fit into my operations of ballast & flow rates?
  - Is the unit reliable & in compliance at any time?
  - Is the BWTU safe, easy in use, easy to install & maintain?
  - Out of service time of my ship?
  - Warranty & Global Service Guarantee, Parts?
  - Possible to do installation at Sea?
  - Best time to retrofit my ship?
  - Total turn around time for retrofit process?
- 
- The background of the slide is a photograph of a large ship, likely a tanker, at a dry dock. The ship is dark-colored and has "DAMEN SHIPREPAIR.COM" written on its side. The ship is surrounded by industrial structures, including cranes and scaffolding. The sky is clear and blue.

## We developed a one-stop-shop Retrofit Service Worldwide



**Total package:** Selection, Survey & 3D scan, Engineering, Procurement, Installation, Management Plan and Service

## Damen preferred BWTU - Cost efficient solution

- **Economical** - Automatic regulation of power consumption
  - **Flexible** - Modular up scaling by 100 m<sup>3</sup>/h , small footprint, skid mounting option
  - **Easy** - Compact for installation, automated operation
  - **Safe** - No gas, induced corrosion, active substances or chemical cleaning
  - **Proven** - Well proven technology from French partner
- 



# THE SOLUTION

## Damen Shiprepair & Conversion



### Your One-Stop-Shop partner for BWT Retrofit



REPAIR



REFIT



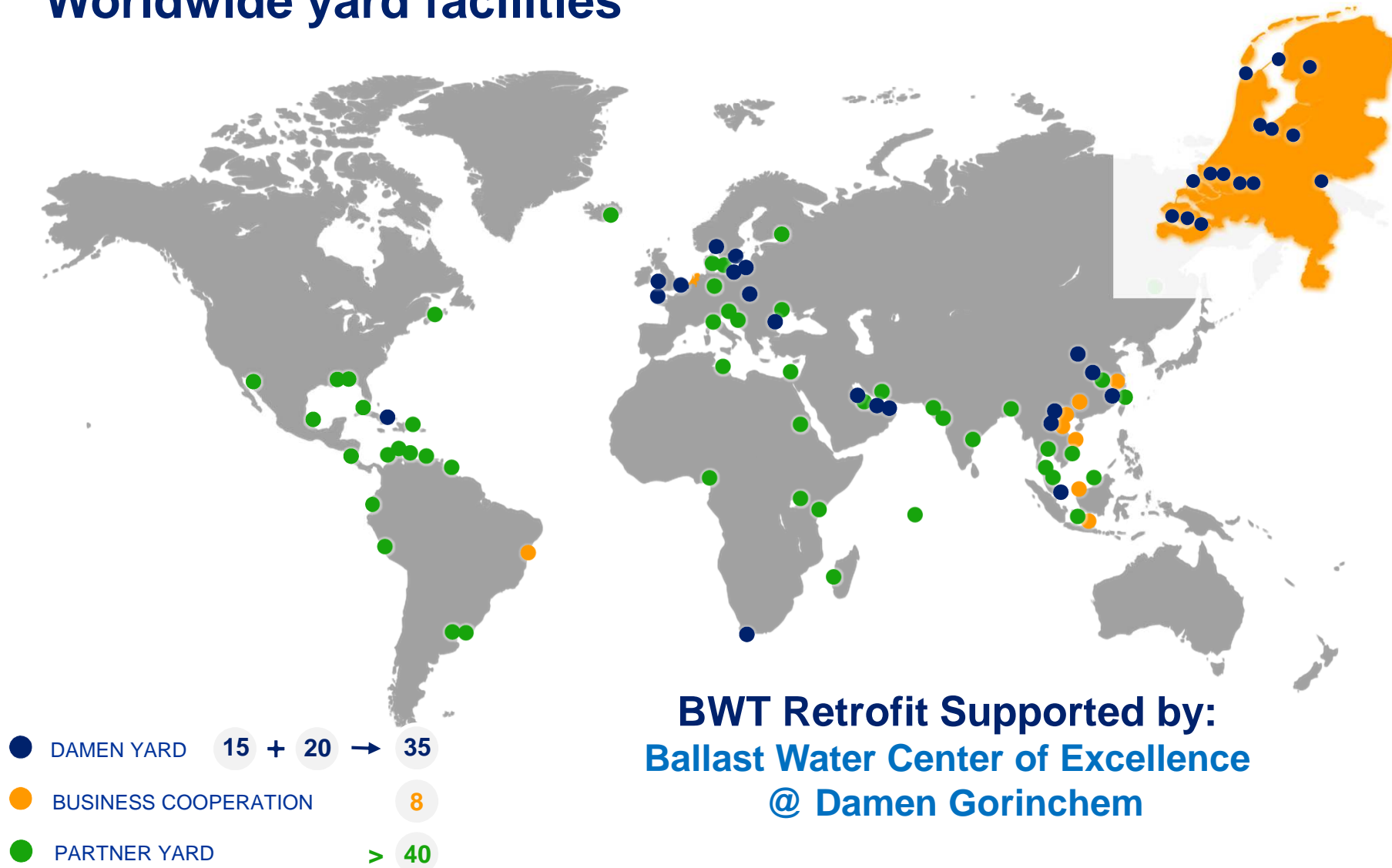
CONVERSION



MAINTENANCE

### Worldwide yard facilities

THE NETHERLANDS

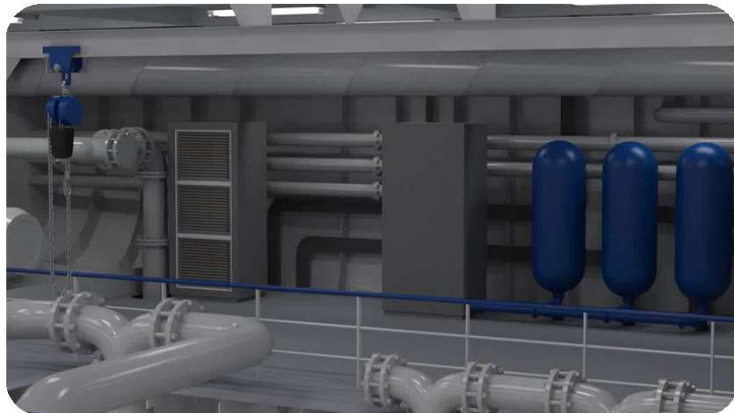


## We provide turn-key installation of Ballast Water Treatment Systems

### Options:

- BWT Technology
  - Damen preferred unit
  - Customers' preferred unit
- Installation
  - Damen yard
  - Non-Damen repair yard
  - Afloat by our mobile squad

## Typical steps to retrofit (8 - 10 months)



1. Selection system+pre budget  
1-2 Month

2. Onboard survey + 3d scan & pre-  
engineering 2 Months

3. Design integration plan + detailed design  
2 Months

4. Purchasing + pre fabrication, planning  
3-4 Months

5. Installation and commissioning  
2 Weeks

6. Warranty & after service



**Thank You**

**Contact us at:**

**[Green@damen.com](mailto:Green@damen.com)**



# We drive profitable compliance

"Teaming up in the retrofit market"  
Harderwijk - 27/3/2014

PureSO<sub>x</sub>  
P. Brands

# Installation of PureSO<sub>x</sub>



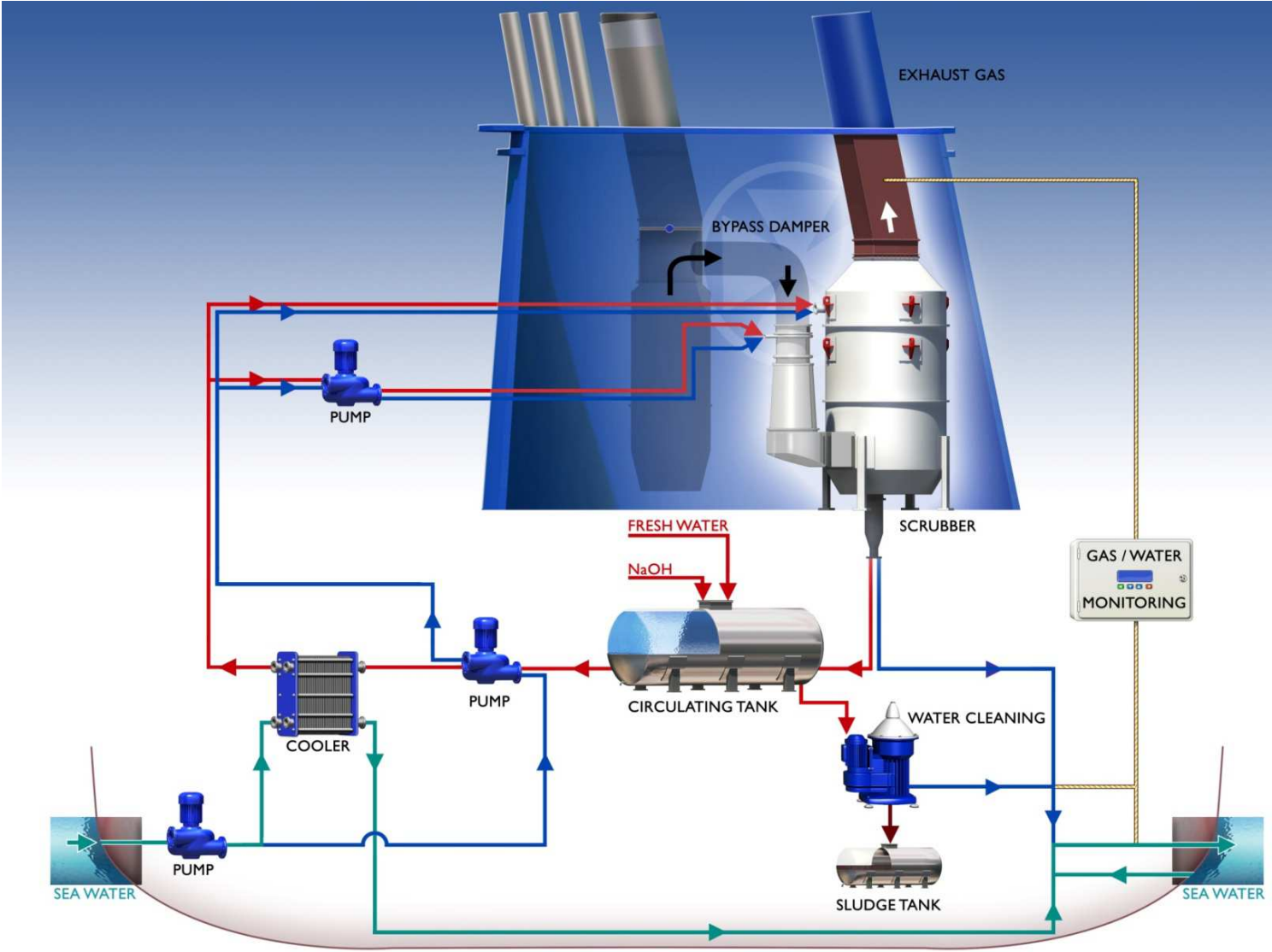
# History of PureSO<sub>x</sub>

- >4000 Inert Gas Systems systems sold with scrubber section from Nijmegen, The Netherlands
- First pilot tested on 1 MW MAN diesel engine in 2008/2009
- Engineering, Procurement and System Development from Business Center Nijmegen





# Hybrid system



# Benefits PureSO<sub>x</sub> Hybrid

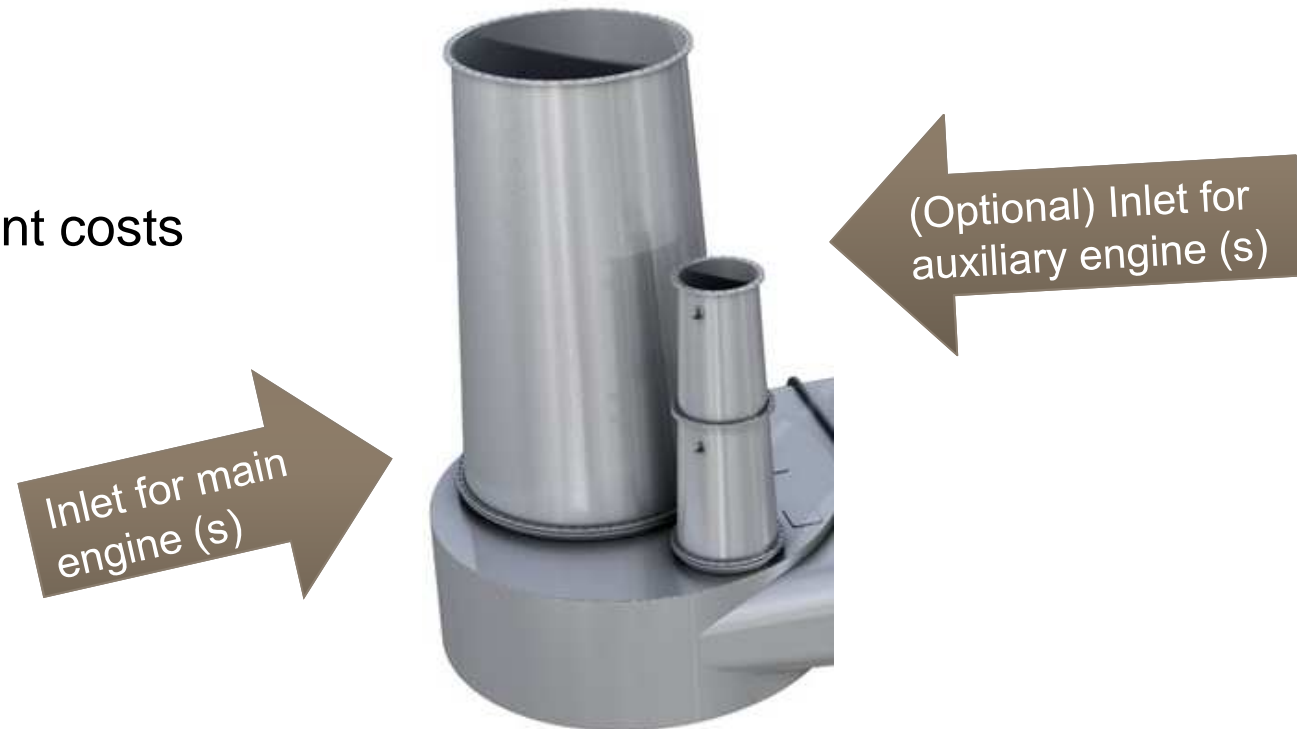


- Running in Sea Water mode whenever possible
- Zero discharge whenever required
- Ability to cope with low alkalinity waters
- Lowest possible NaOH consumption
- No switching between MGO/HFO
- Most proven and reliable system

# Multiple inlet systems

Combine several engines in one scrubber

- Less space required
- Less weight
- Lower investment costs



# PureSO<sub>x</sub> Water Cleaning



- MEPC wash water criteria are met
- Alfa Laval core technology
- Global service by Alfa Laval
- No chemicals needed



# References

Retrofit project:

# Ficaria Seaways (DFDS)



## Technical data

- Year built 2006
- Length 230 meters
- Width 27 meters
- Speed 22,5 knots
- Cargo capacity 3,831 lane meters
- MAN B&W type 9L60 MC-C (21MW)
- Classification LRS

# PureSOx for Ficaria Seaways

## Single inlet system



### Technical data:

- System type Hybrid
- Ship owner DFDS Seaways
- Engine 1 ME
- Total Power output 21 MW
- Height 10.5 Meters
- Length 8.2 Meters
- Diameter 4.6 Meters
- Weight empty 24T
- Weight with water 32T
- Exhaust gas 192,000 Kg/h
- Material SS alloys
- In operation 13,000 hours

# Single inlet system – DFDS



- ① Jet scrubber
- ② Absorber
- ③ Circulation tank
- ④ Circulation pump
- ⑤ Plate heat exchanger
- ⑥ Caustic soda tank
- ⑦ Water cleaning unit
- ⑧ Sludge tank



Retrofit project:

# Plyca (Spliethoff)



## Technical data

- Year built 2009
- Length 205 meters
- Width 26 meters
- Gross tonnage 28300 mt
- Deadweight 18250 mt
- 2x ME Wärtsilä 12V46C (12.6 MW)
- 2x AE Wärtsilä 8L20 (1.36 MW)
- Classification LRS

# PureSOx for Plyca : Multiple inlet system



## Technical data:

- System type Hybrid
- Ship owner Spliethoff
- Innovation 2 ME + 2 AE and EGC fan
- Total Power output 28 MW
- Height 9.3 Meters
- Length 8.5 Meters
- Diameter 4.7 Meters
- Exhaust gas 216,000 Kg/h
- Weight 154 tons (complete system)
- Material SS alloys
- In operation 9,000 hours

# Multiple inlet system – Spliethoff



Retrofit project:

# 3 Ro-Ro vessels (DFDS)



## Technical data

- Retrofit installation: July 2013
- Ship names: Petunia Seaways / Magnolia Seaways / Selandia Seaways
- Engines: 1 x MAN 9L60 MC-C/ 1 x MAN 9L60 MC-C / 2 x GMT Sulzer 9 ZA 50S
- Total output: 21 MW / 21 MW / 21.6 MW
- No of scrubbers: 1 / 1 / 2
- System type: Hybrid, single inlet

# Retrofitting of the Selandia Seaways



Circulation tanks



GRE piping



Scrubber installation at Remontowa Shiprepair yard

# References

- 37 vessels
  - 35 Retrofit projects
  - 2 Newbuilds
- 42 PureSO<sub>x</sub> systems
  - 38 Hybrid systems
  - 4 Fresh water only systems



Thank you!

# RETROFIT

- Opportunities
- Way of working
- Capabilities
- References

## Selection of Wartsila retrofit offering

- Automatic HFO / LFO fuel switch systems
- IMO Tier 2 engine conversions
- Gas / Dual Fuel engine conversions
- HFO -> LFO Engines and boilers conversions
- Re-engining
- Scrubbers and SCRs
- Ballast Water Management Systems
- S&B: Stern Tube Conversions oil to water
- Stern tube upgrade to biodegradable oils
- Propulsion upgrades & redesign
- Electrical & Automation upgrades

*Seminar "Teaming up in the retrofit market"*

*27 maart Harderwijk*

*Henk de Jong*



# Retrofit market drivers

Environmental requirements are an important element of the retrofit market but there are more reasons why the retrofit market is important in the marine industry.

- New legislation
- Technical developments (Hydrodynamic design)
- Obsolescence management (Hardware and software support)
- Changed business requirement (Vessel conversions)

The speed of changes has increased due to rapid technical developments. Focus on all environmental emissions will continue due to the growing global population and consequential environmental impact.

## Retrofit market will continue to grow

# Wartsila Retrofit solutions / activity

Retrofit projects are in general unique and complex delivery obligations, tailor made, outside standards, requiring engineering and/or design changes.

Retrofit projects require multi- discipline project teams with dedicated project management covering total scope of supply.

Risks management is an crucial element for retrofit projects to ensure budget control, timely execution and proper system integration

## Retrofit project is more than equipment supply



# How does Wärtsilä approach retrofit projects?

## Service/Retrofit Projects – Centres of Competence

Project Centre	Type of Project	Project Centre GM
France	Nuclear / railway	Bassam Yaacoub
Finland	Power Plants/Plant efficiency/ Fuel conversions (Power & Marine)	Tero Karjalainen
Netherlands	Marine / Vessel efficiency	Marcel Koper
India	Relocations / Rehabilitations	PV Kini

**Specialized project centre:**  
**Project management**  
**Engineering**  
**System integration**  
**Naval architects**

**Each project centre has special focus area so they are managing similar projects again and again**

# Retrofit projects Main Focus Areas

## Power Plants installations

Relocations

Rehabilitations

Extensions

Engine breakdowns



Gas Conversions

Liquid Fuel Conversions

Modernisations & Upgrades

Heat Recovery



## Marine installations

Salvage Services

Disaster Recovery

Re-engining projects

System modifications



Vessel Efficiency Optimisation

Propulsion upgrades

Marine LNG Conversions

Liquid Fuel Conversions



# Wärtsilä Retrofit offering

**Modular offering:** from equipment only to a "turn – key" delivery depending on customer needs

## CORE COMPETENCES

- Product knowledge
- Regulatory and class requirement expertise
- Skilled engineering resources / multi – discipline (own naval architects / marine engineers + network of sub-contractors)
- Project management
- Procurement
- Site management and supervision
- Commissioning
- Crew training

# Wärtsilä partnership program

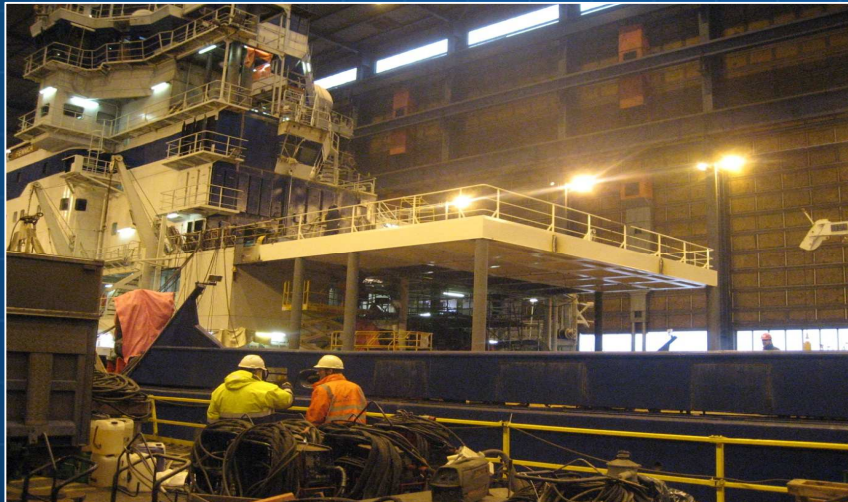
## adding value to the customers business

- ▶ **technology choice** to suit the ship type and operational profile
- ▶ **modular design** for ease of new build or retrofit installation
- ▶ **flexible turnkey** installation capability
- ▶ **strong brand** & credible supplier to the marine & offshore sector
- ▶ **proven global life cycle support** capability



# Nordica/ Fennica SCR Retrofit

## Turn – key reference



- Customer and background
  - Artcia Offshore (Finland)
  - Two sister ships: Nordica / Fennica
  - Oil exploration operations in the Arctic Ocean's
  - Very tight emission standards: NOx, PM, CO, VOC
- Scope of supply
  - Wärtsilä NOx Reducer
  - Oxidation Catalyst
  - Crankcase ventilation system
  - CEMS\*
- “Turn – key” project responsibility
  - Engineering, procurement, construction
  - Complete installation: deck extension, new funnel casing, relocation of equipment, piping work, modification to fuel oil system, electrical and automation integration, etc...
- Very tight schedule (contract in Sept 2011, docking in Dec – Jan, operations during summer 2012)



# Tarbit LNG Conversion

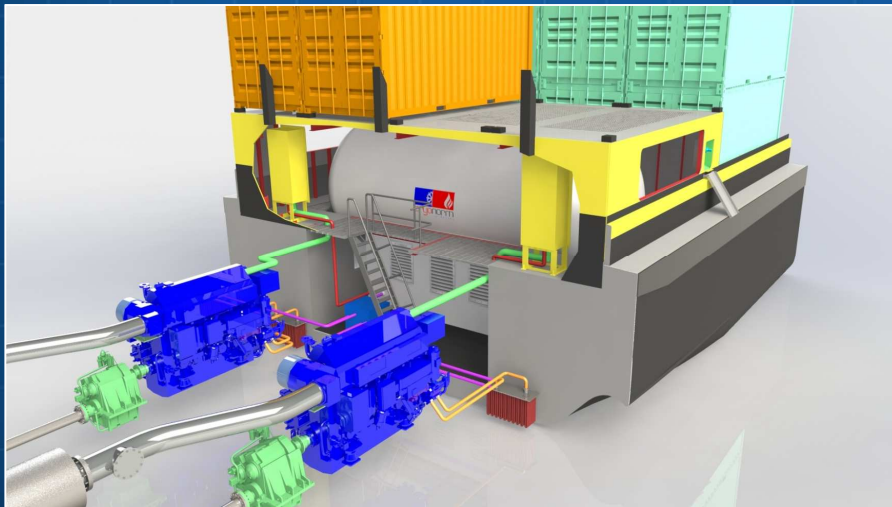
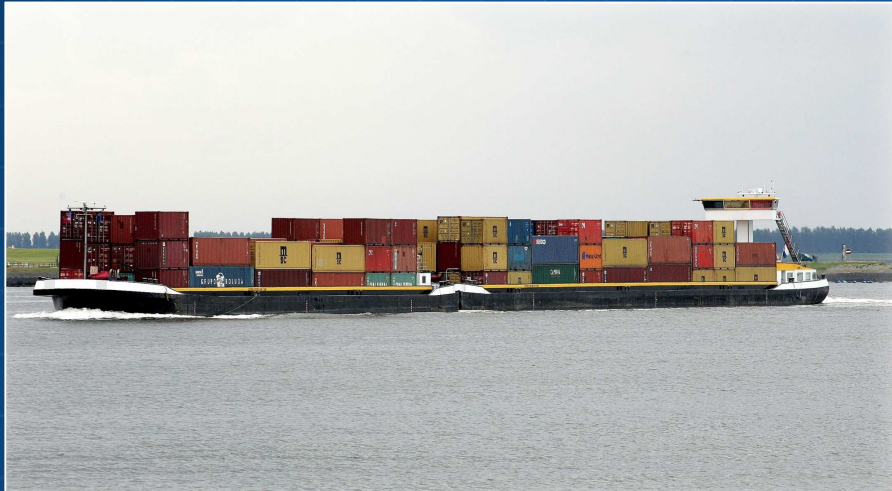
## Turn – key reference



- Customer and background
  - Tarbit
  - Chemical Tanker (Bit Viking)
  - First LNG conversion ever done
  - First LNGPac and GUV delivery
- Scope of supply
  - DF conversion of 2xW6L46
  - Complete LNG system (tanks, piping, gas valve units, inerting system)
  - Automation upgrade
  - Fire fighting system upgrade
- “Turn – key” project responsibility
  - Engineering, procurement, construction
  - Complete installation: engine conversions, reinforcement of deck, tank installation, piping work, electrical and automation integration, etc...
- Ship successfully sailing since summer 2011

# "Eiger" LNG Conversion

## Turn – key reference



- Customer and background
  - Danser Group
  - Inland Container Vessel (koppverband)
  - First LNG conversion ever done in Inland Shipping
  - First Wartsila 20 Dual Fuel Engine driving FPP
- Scope of supply
  - 2 x W20DF Engines c/w GUV's and Controls
  - System Integration know-how
  - Interface Engine/ Propeller
  - Pay-back analysis
- “Turn – key” approach by/ in combination with Wartsila dealer: Koedood Diesel Service B.V. Project responsibility:
  - Engineering, procurement, construction
  - Complete installation: engine installation, tank room , tank installation, piping work, electrical and automation integration, etc...
- Start Refit in April 2014. Restart operations in June 2014

# "Oleander" Propulsion retrofit

## Success story Oleander



- Replacing open CPP main propulsion by ducted CPP propeller in HR nozzle
- Providing vessel conversion drawings using capabilities of Wärtsilä Ship Design
- Replacing CPP and TT controls by today state of the art equipment
- On very last moment replacing CPP shaft with coupling for new

Vessel type:	<b>Roro Container vessel</b>
Name:	<b>Oleander</b>
Owner:	<b>Bermuda Container Lines</b>
Country:	<b>Netherlands</b>
Delivered:	<b>2011</b>

# Saipem propulsion retrofit



## Success STORY CONVERSION SAIPEM 7000

- New design CP propellers on non-Wärtsilä shaft line
- Calculated efficiency increase confirmed by measurements
- Comfort level similar before and after conversion



Vessel type: **Semi-submersible crane vessel**  
Name: **Saipem 7000**  
Owner: **Saipem ENI**  
Control type: **De Hoop/Groenpol → Lipstronic**  
Delivered: **2010/11**

**THANK YOU!**

# Wetering Rotterdam



[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

# Wetering Rotterdam

- Founded in 1880
- Activities:
  - maintenance
  - repair
  - aftersales services
  - trading




[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

# Makers we represent

**DAIHATSU** DAIHATSU DIESEL

**HYUNDAI**  
HEAVY INDUSTRIES CO.,LTD.

**stx** Engine

 HANSHIN DIESEL

 **HIMSEN**

**S M S**  
MARINE SYSTEM

 naniwa pump  
Manufacturing Co., Ltd.

 **Kawasaki**

 **Fiber Glass  
Systems**

 **TANABE  
COMPRESSORS**

 **TECHCROSS**

[www.weteringrotterdam.com](http://www.weteringrotterdam.com)



# Focus on the future

- Ballast Water Treatment System (BWTS)
- Glass Fiber Reinforced Epoxy (GRE)  
Piping Systems for Scrubber Installations

[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

# BWTS

Total Order Book : **546** Ships  
ECS Delivered : **299** Ships



Container  
ship



Bulk Carrier



Tanker



LNGC/  
LPCC

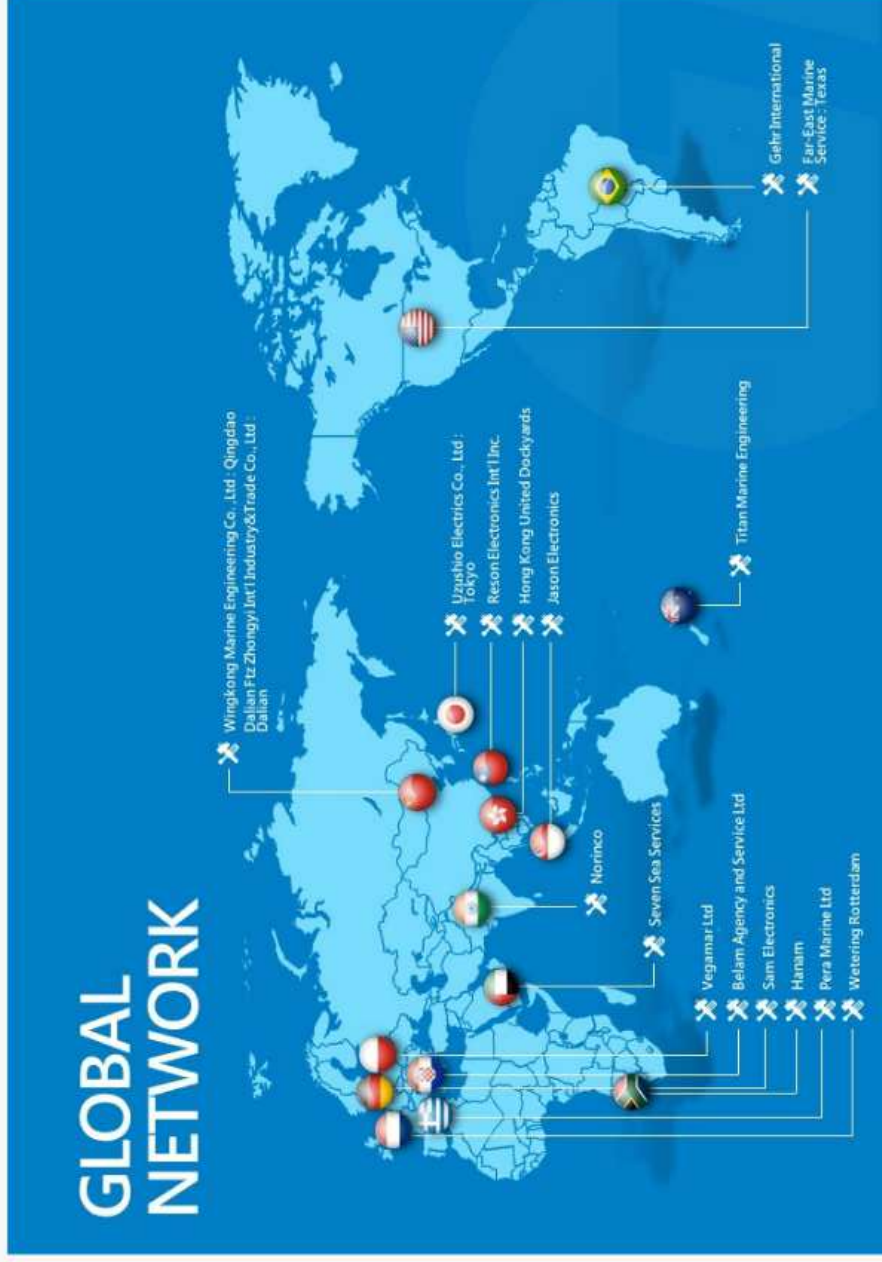


Special Ship



[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

# Global network



[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

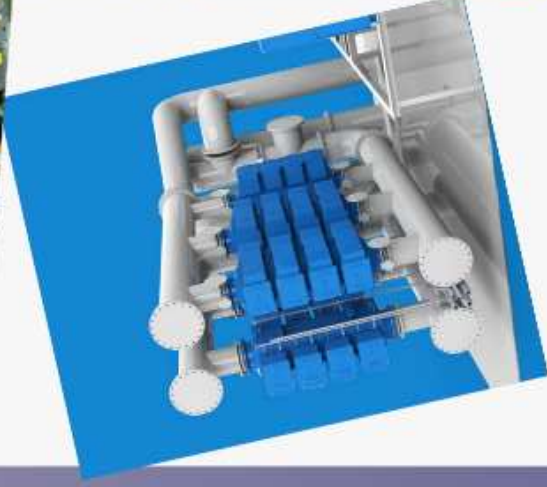
# Scope of supply

BWTS

- 3D scanning
- detailed engineering incl. ISO metric drawings for the piping systems
- prefabrication
- project management
- commissioning of the system

[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

# Techcross retrofit



[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

# Scrubber installation

NOV Bondstrand Glass Fiber Reinforced Epoxy Pipes

- 1/7 weight of steel
- Resistance against chemicals and acids like sulphur
- standard fittings
- class approved

[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

# Scope of supply

## scrubber piping

- detailed engineering included ISO metric
- drawings for the piping systems
- prefabrication
- project management

[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

# NOV-EGS

## Bondstrand



[www.weteringrotterdam.com](http://www.weteringrotterdam.com)



Thank you for your attention!



[www.weteringrotterdam.com](http://www.weteringrotterdam.com)

# **AXCES EMISSIONS VISION**

## **INTRODUCTION:**

**BERRY VAN PEER AXCES INDUSTRIAL EXHAUST SYSTEMS  
KJELT REMMEN AXCES EMISION TECHNOLOGY**

**AXCES IS ESTABB: 2001 BY MARCO GOOSSENS  
ANDRE BASSANT AXCES INDUSTRIAL STACKS**

# SUBJECTS

- Silencers
- Regulated Emissions
- Emission standards
- Approach
- SCR Catalyst
- Combination

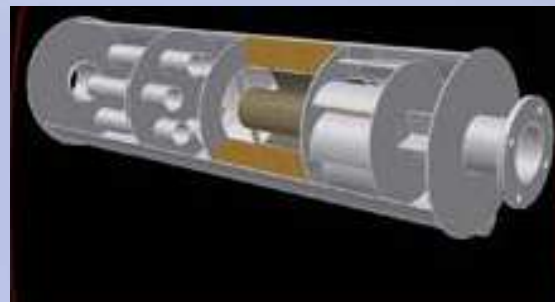
# DEMPERS

- **Silencers**
  - Emissions
  - Emission standards
  - Approach
  - SCR Catalyst
  - Combined
- Axces
  - Changing R&D
  - New Compact Silencer Types DNV, LR Spark arrestor
  - Retrofit Silencer/SCR catalyst
  - Newbuild Silencer/ SCR Catalyst

## Silencers

### *Main topics R&D*

- ➔ Design and sound reduction
- ➔ on demand of application
- ➔ minimalisation back pressure



# EMISSIONS

- Silencers
  - **Emissions**
  - Emission limits
  - Approach
  - SCR Catalyst
  - Combi
- regulated combustion engine Emissions
  - Sound (pressure dBa)
  - CO en HC (colemonoxide en hydro carbons)
  - Soot or/and PM
  - Nitrogene oxides Nox
  - Sulpher

# EMISSIONS !!

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi



# EMISSIONS?

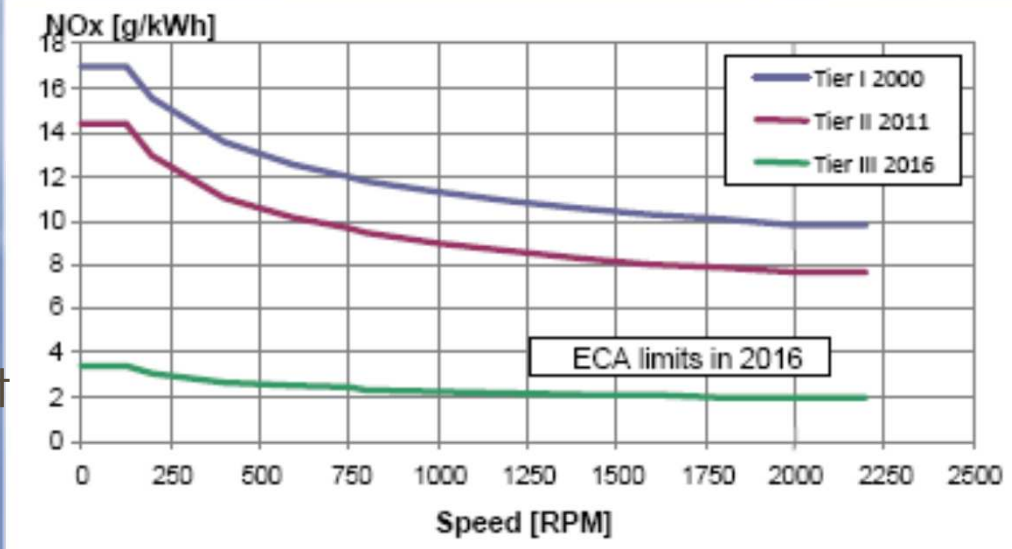
- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi





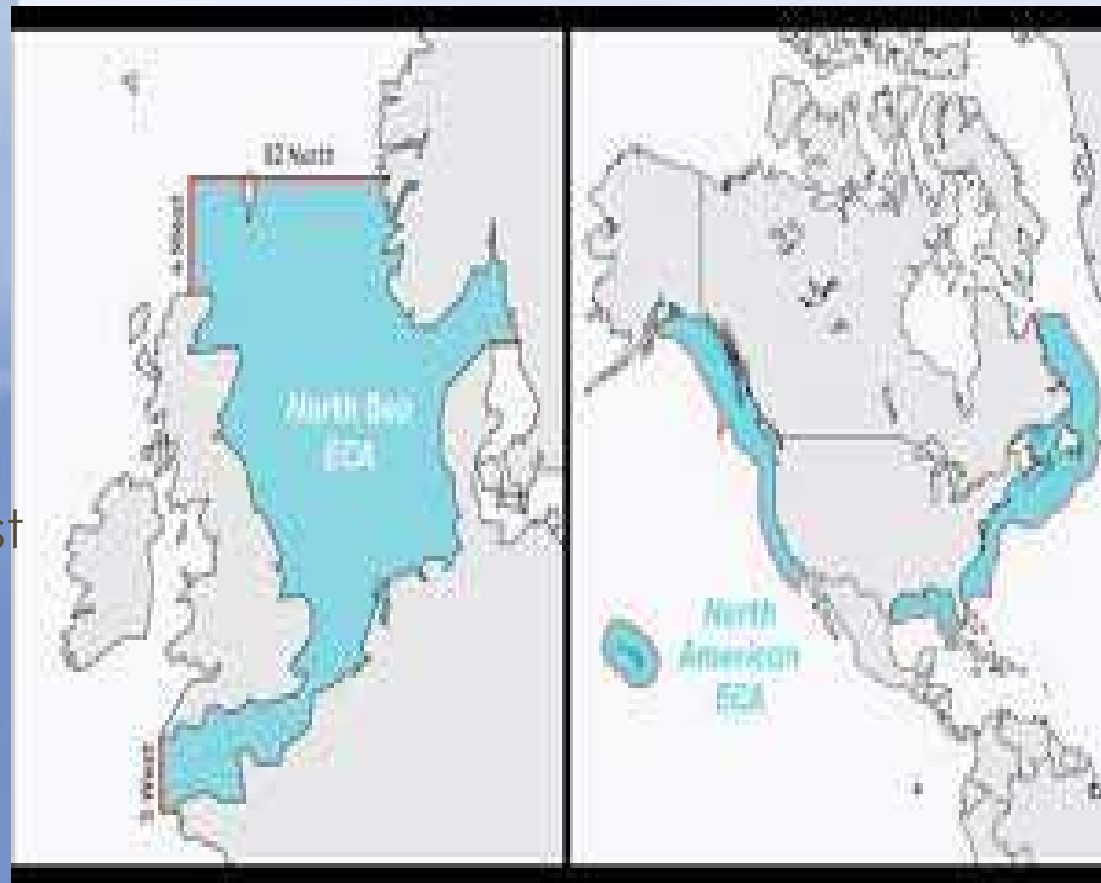
# EMISSION STANDARDS MARINE

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi



# EMISSION STANDARDS

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi



# APPROACH

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi

New(er) Engines

Rebuild/ refurbished with new technology

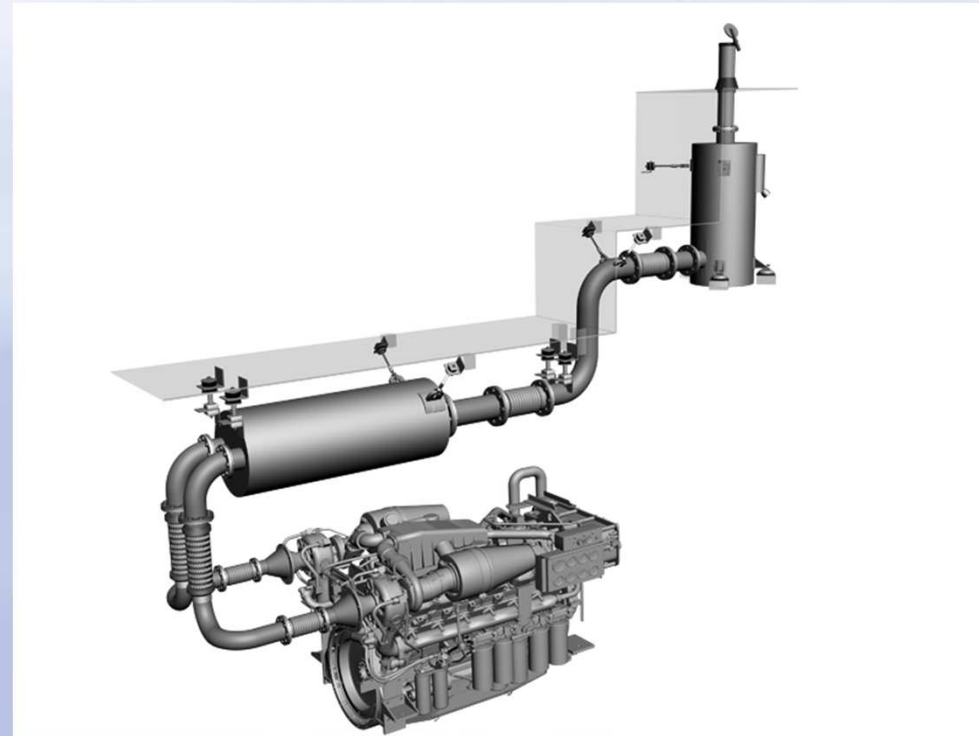
Exhaust gas after treatment

Fuel quality improvement

Fuel choice (MGO, LNG ?)

# APPROACH

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi

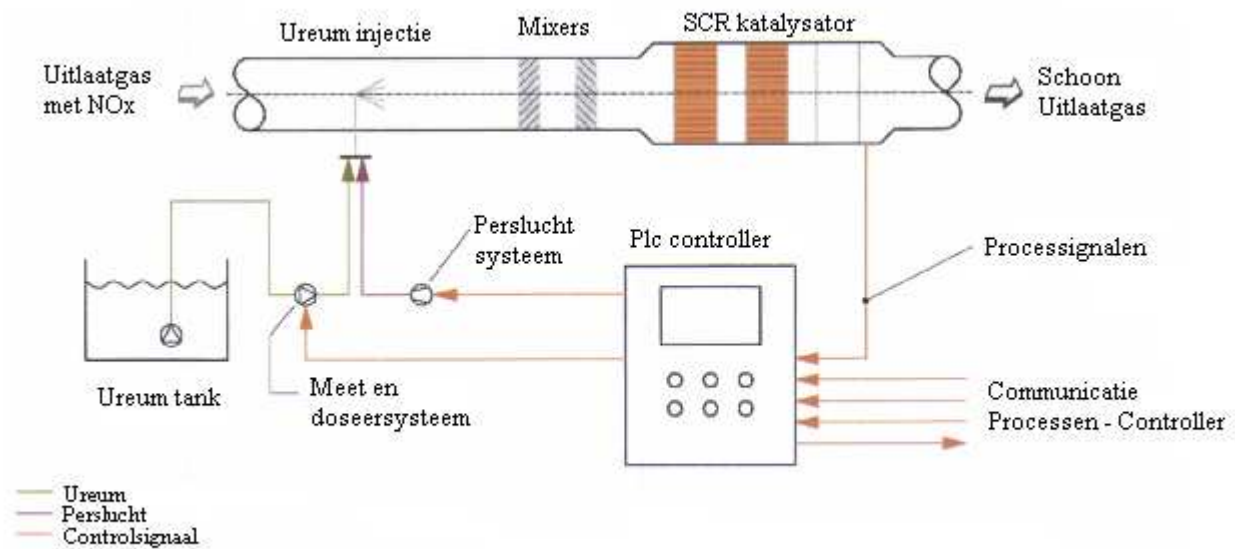


# SCR CATALYST

- Silencers
  - **Emissions**
  - Emission limits
  - Approach
  - SCR Catalyst
  - Combi
- NOx Emission to low required level
  - 32,5 and 40 % Ureum /Ad Bleu choise
  - Short mix trajet, compact construction
  - Reduction to 0,1 gr/Kw/Hr
  - Minimal Amonia slib (max 25 PPM)
  - Airless systems
  - Low backpressure and long running hours/ lifetime

# SCR CATALYST

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi





- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi





- Inleiding
- Dempers
- Emissies
- Emissie eisen
- Aanpak
- **SCR Kat**
- Combinatie

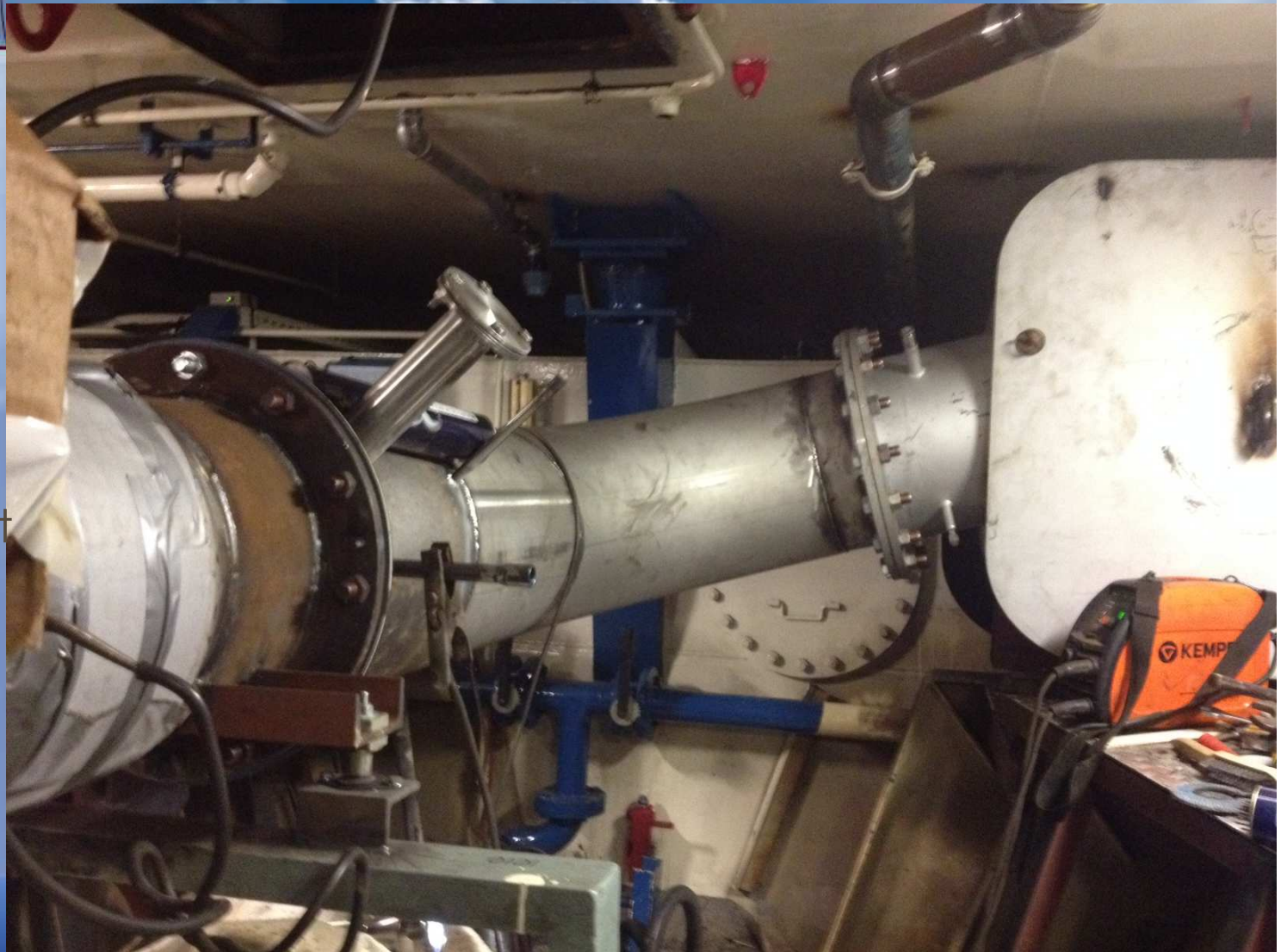




# SCR KATALYSATOR

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi

1-4-2014



# SCR KATALYSATOR

- Silencers
  - **Emissions**
  - Emission limits
  - Approach
  - SCR Catalyst
  - Combi
- IDENOX SCR Catalyst system: silencer included
  - € 26-35 each kW in de range from 1500 kW en hoger . Sootblower € 2000.Mwh
  - € 35-65 smaller engines.
  - Costs for smaller engines relatively higher
  - Retrofit costs (labour, material Yard are often the same as system costs.
  - prepared ship, install costs are avv.20 % of SCR system costs.

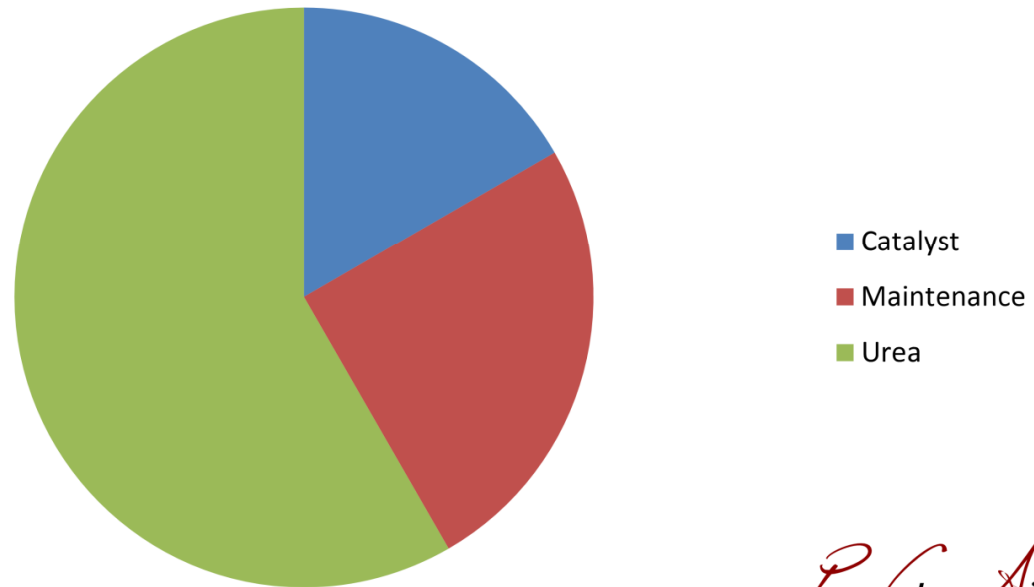
# SCR KATALYSATOR

- Silencers
  - **Emissions**
  - Emission limits
  - Approach
  - SCR Catalyst
  - Combi
- NOx/ Sound Emission reduction to required level.
  - 32,5 and 40 % (Ad Bleu/ Urea) choice
  - short mix traject, compact design
  - Reduktin to 0,3 gr/Kw/Hr
  - Ammonia slib (max 25 PPM)
  - Low backpressure en long lifetime of catalyst elements (16000-23000 running hours avar.)

# SCR CATALYST

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi

O & M Cost 4 - 7 €/MWh  
(Operational and Maintenance cost)



Doc 3118

*Pure Clean Air*

# SCR CATALYST

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi



Av. consumption:  
10 litre/ Mwh

Urea/Ad Bleu Costs:  
€ 0,24 - € 0,45 / liter

# COMBINATION

- Silencers
- **Emissions**
- Emission limits
- Approach
- SCR Catalyst
- Combi





AXCES COMBINES CUSTOMER  
DEMANDS WITH KNOW HOW AND IS  
READY FOR THE FUTURE.

[KR@AXCES.COM](mailto:KR@AXCES.COM)