

# SUSTAINABILITY THROUGHOUT THE GAS VALUE CHAIN

Claudia Beumer  
Sales Manager Processing Solutions

Japan Technical Seminar, Nov 2018



# Agenda

- Gas Value Strategy
- Market update
  - Regulations and Market Developments
  - Decarbonization
- Emission reduction strategy
  - Engine performance
  - The Use of Green fuels
- A sustainable future
  - Ship to Shore
  - Making Green Propulsion a Reality (cooperation WinGD/GTT/Wartsila)

# GAS VALUE STRATEGY



'At Wärtsilä our purpose is to enable sustainable societies through smart technology'







## Wärtsilä Gas Solutions (WGS)

- Innovative solutions for handling and processing of gaseous and cryogenic cargo
- Ship to shore facilities, small and mid scale terminals
- (Bio)gas upgrading and liquefaction onshore and in marine
- The complexity and the need for utmost reliability of these solutions make WGS a preferred supplier for ship owners, terminal operators and EPC companies.
- With WGS you have the experienced partner throughout the complete Gas Value Chain
- Integrated solutions for the shipbuilding industry, owners and operators

# WGS Product Offering





# MARKET UPDATE



# More stringent regulations force the Industry to reduce emissions



Source: UN.org

**Europe leads the global clean energy transition: Commission welcomes ambitious agreement on further renewable energy development in the EU**  
Strasbourg, 14 June 2018

Source: press release EC 14-06-18

**NO<sub>x</sub>**

Acid rains



Tier II (2011)  
Tier III (2021)

**SO<sub>x</sub>**

Acid rains



3.5% (2012)  
ECA 0.1% (2015)

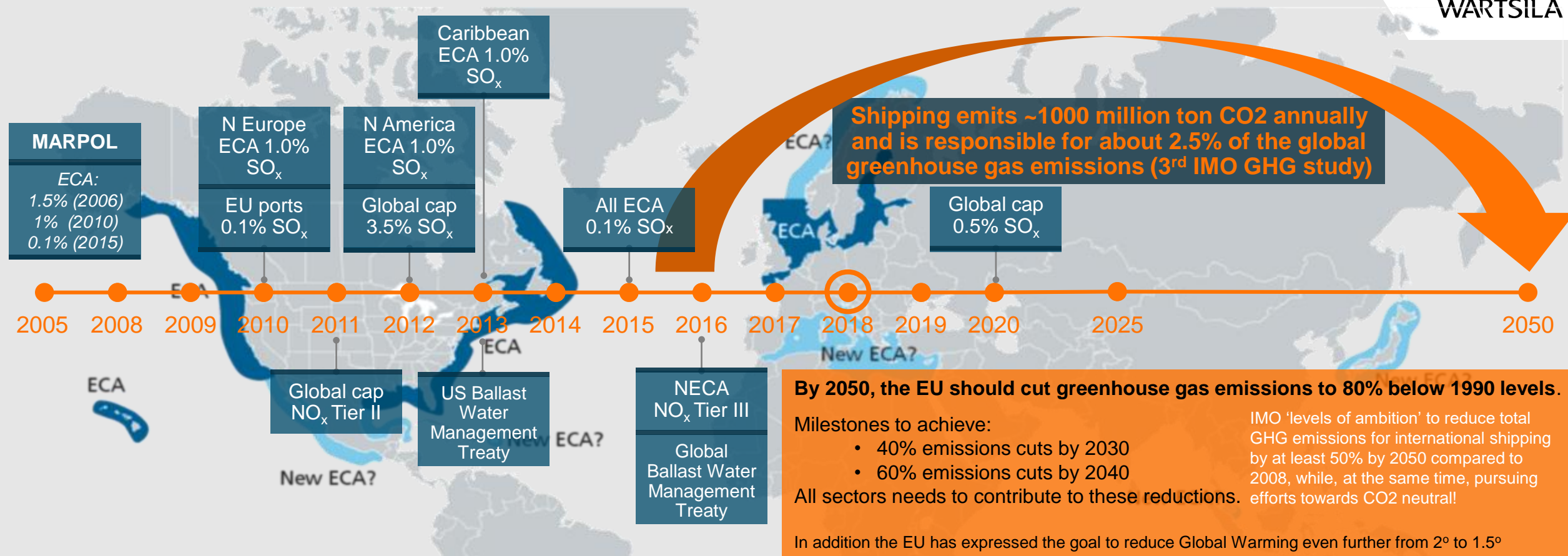
**CO<sub>2</sub>**

Greenhouse  
gas



Under evaluation  
by IMO





### SO<sub>x</sub> legislation:

- Sulphur free fuels
  - LNG
  - Methanol, LPG, bio-fuels
  - Distillates (MDO, MGO)
- Scrubbers in combination with HFO (~3 MEUR/15MW hybrid scrubber)

### NO<sub>x</sub> legislation:

- Tier II
- Engine internal methods
- Tier III
- Secondary methods (SCR, ~2-300 kEUR)
- LNG/NG with lean burning process (dual-fuel engines)

### Ballast Water Treatment:

- UV ballast water treatment system
- EC ballast water treatment system
- Minimised amount of ballast water through Ship Design

# Emission reduction; which strategy to follow

## Engine efficiency improvements,

1. Lower engine CO<sub>2</sub> emissions
2. Voyage planning



## Fuel de-carbonization, utilizing alternative fuels

1. LNG vs. diesel. Per unit of energy, LNG causes ~20% less CO<sub>2</sub> emission
2. Biofuels that have a negative CO<sub>2</sub> emission during their production;
3. Biofuels created from biowaste

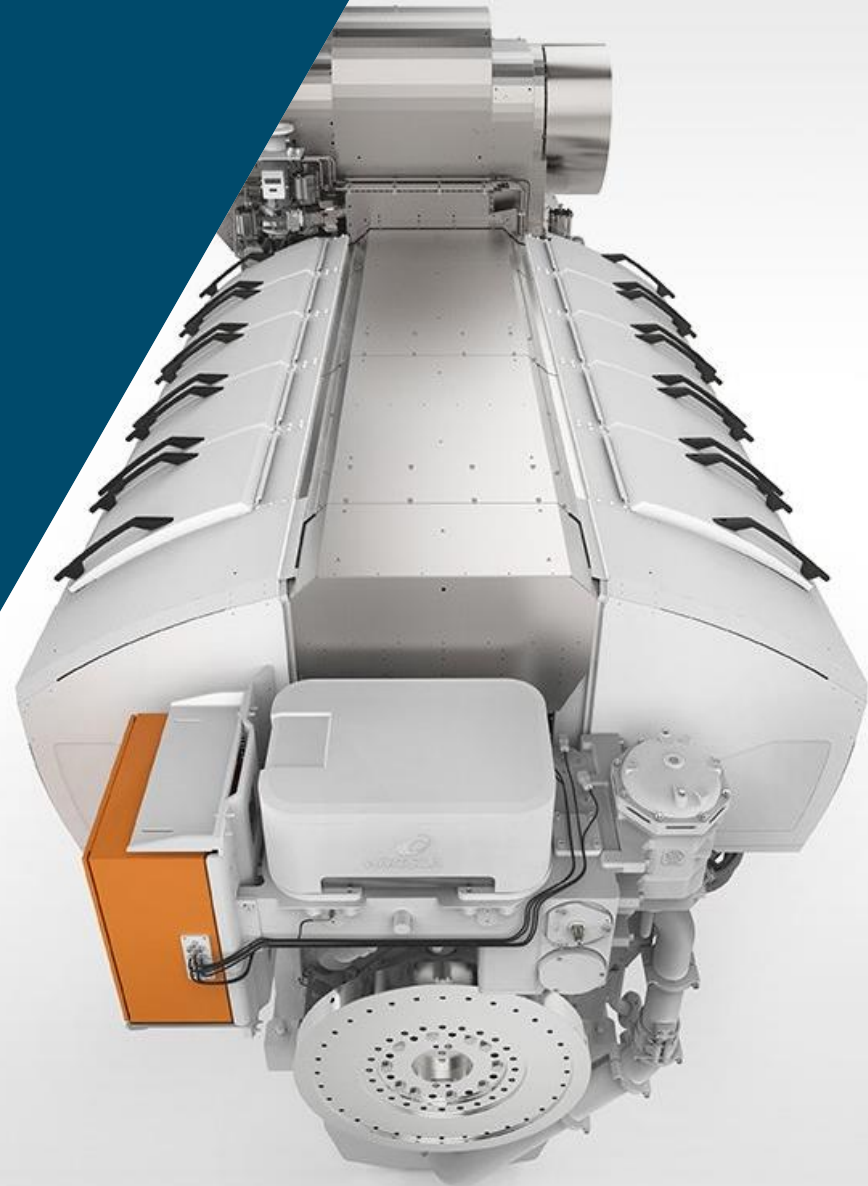
## Lowering non-CO<sub>2</sub> emissions. Prime example is CH<sub>4</sub> emitted from gas engines.

1. Scrubbers
2. SCR

Carbon Credits



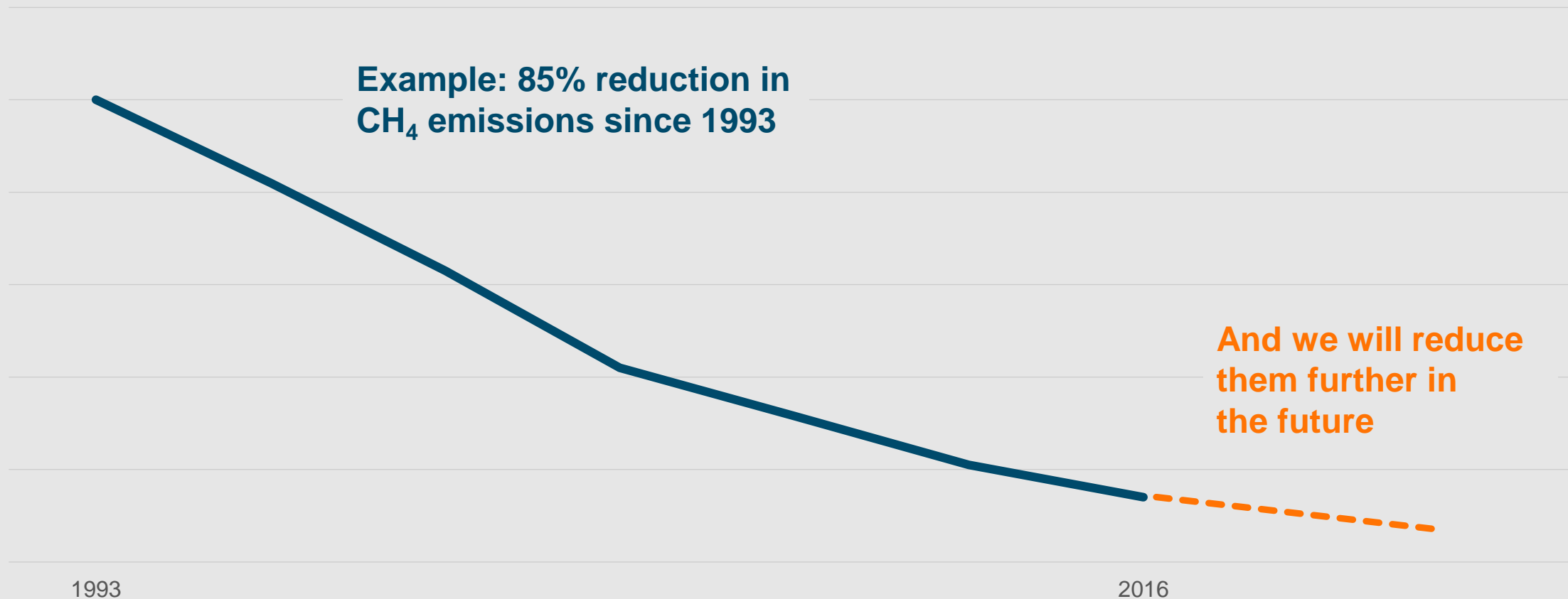
# PROPULSION AND POWER





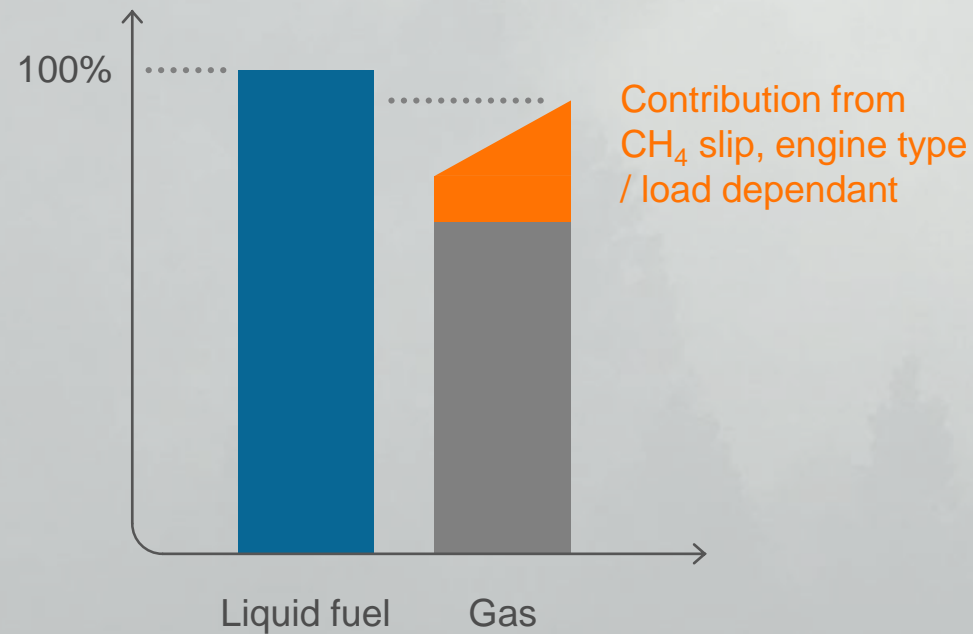
## GHG emissions from Wärtsilä engines have been decreasing for decades

Wärtsilä gas engines now outperform Wärtsilä diesel engines by 12-30%



## Diesel and gas engines produce greenhouse gases...

### Indexed GHG emissions as CO<sub>2</sub> equivalents



**...but gas engines compare favorably to diesel engines!**

# ALTERNATIVE FUELS



## Methanol

- Sulfur free
- Low NO<sub>x</sub>
- Ultra low particulates

SECA ✓  
NECA ?



In Service

## Bio-fuels

- Sulfur free
- Fuel specification and availability is a question mark

SECA ✓  
NECA ✗



In Service

## VOC

- Mix of different HC's and inert gas
- VOC from a shuttle tanker can cover 20% of energy demand

SECA ✓  
NECA ✓



In Service

## LPG

- Sulfur free
- Heavier than air
- 2% of global energy market

SECA ✓  
NECA ✓



Tested in the 90's

## Ethane

- C<sub>2</sub>H<sub>6</sub>
- Sulfur free
- Interesting when available as cargo

SECA ✓  
NECA ✓



In Service

## Gas as fuel

- LPG/LEG has a high energy density and burns clean, making it a desirable alternative fuel for the future
- LPG/LEG is non-toxic. In case of spills, it will not be as harmful to the environment as oil based fuels.
- The burning of LPG/LEG results in lower emissions compared to oil-based fuels
  - CO<sub>2</sub> : 20%
  - NO<sub>x</sub> : 10–20%
- Virtually no particles in the exhaust gas



# Biofuels

**The stone age did not end because we were running out of stones. The oil age will not end because we are running out of oil ...**

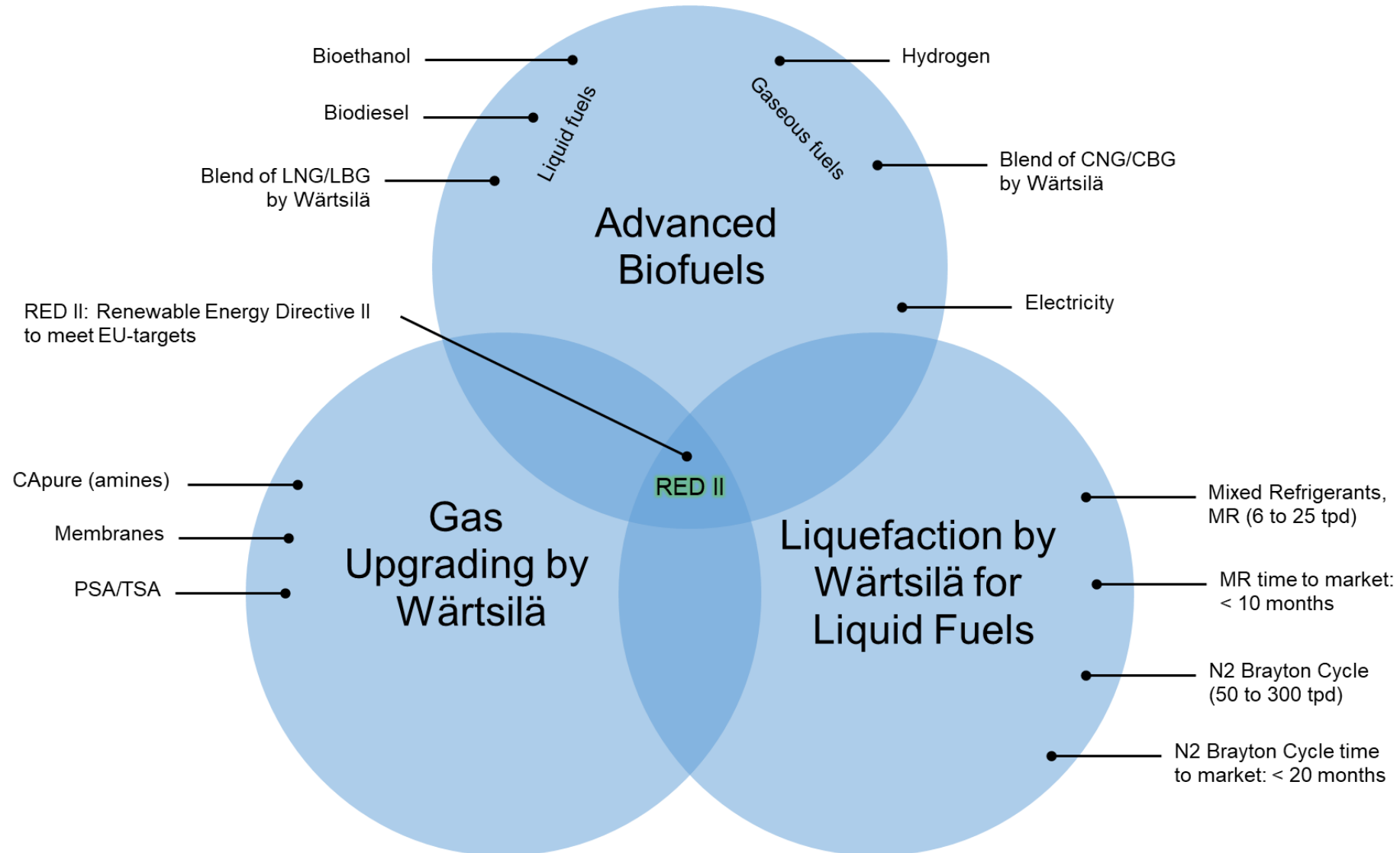
- 1 ton biowaste → 130 liter LBG or 65 kg LBG
- Biowaste of a midsize town like Oslo (60,000 tons biowaste per year):
  - 7.8 million liter LBG, or approx. 4,000 tons LBG per year
  - Fuel supply to approx. 135 busses in public transportation
  - More than 50% emission cuts in changing from diesel to LBG

## **Global low-carbon economy roadmap by 2050**

- By 2050, the EU should cut greenhouse gas emissions to 80% below 1990 levels
- Milestones are 40% emissions cuts by 2030 and 60% by 2040
- All sectors from power to transport need to contribute
- The low-carbon transition is feasible & affordable → fuel blends
- **Source:** [https://ec.europa.eu/clima/policies/strategies/2050\\_en](https://ec.europa.eu/clima/policies/strategies/2050_en)



Advanced Biofuel Provision and Wärtsilä Technology to meet RED II Requirements by 2021 to 2030

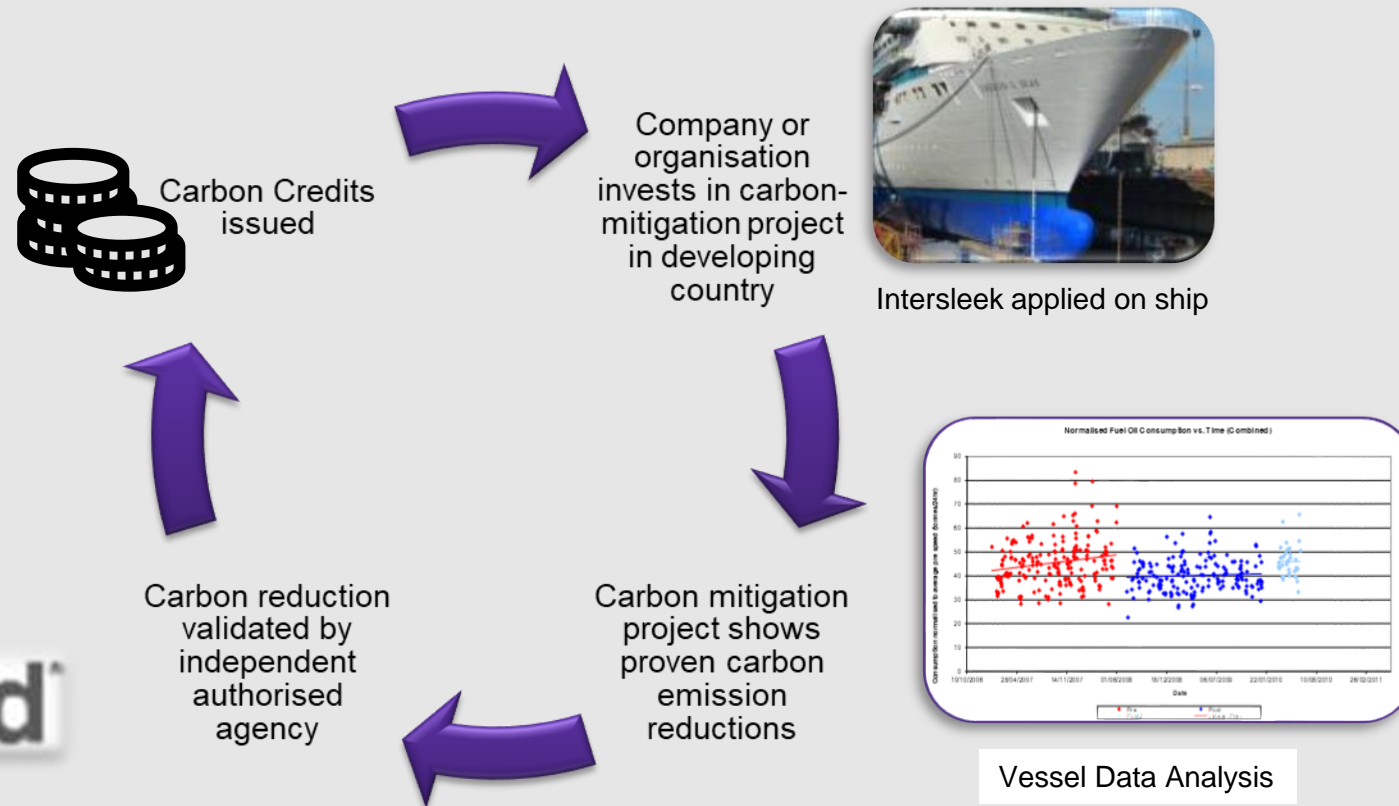


## Biowaste to fuel; Upgrade and Liquefaction

- With CAPure and biogas liquefaction, Wärtsilä is able to provide a complete turnkey solution
- Biomethane has a high caloric value
- Minimal CH<sub>4</sub> slip
- Helps achieve sustainability criteria
- Recovered CO<sub>2</sub> can be sold as side product
- No need for additional exhaust treatment



# CARBON CREDITS ARE A MEANS TO SUPPORT THE ENERGY TRANSITION IN SHIPPING





# 1 Carbon Credit = 1 Tonne CO<sub>2</sub> Saved

**Once generated, Carbon Credits can be**

- Sold to generate revenue
- Retired to offset emissions elsewhere
- Gifted to other parties



## Enable a smart marine eco system, “co-financed” by Carbon Credits (CC)

1 carbon credit	= 1/3 ton HFO saved
1/3 ton HFO saved	= apr. 100\$
1 carbon credit	= apr. 6-7 \$ (current carbon credit pricing), annual issuance
carbon credits	= 10 to 28 years potential income over additional CC Program

- *Fuel reduction remains the dominant business case driver.*
- *Carbon/ Fuel reduction gives a high credibility, being independently verified.*

# A SUSTAINABLE FUTURE





**Shared  
capacity**



**Big data  
analytics**



**Smart  
vessels**



**Automated  
ports**







# Maritime Analytics

## DATA

Data is continuously collected from vessels and external data sources

>

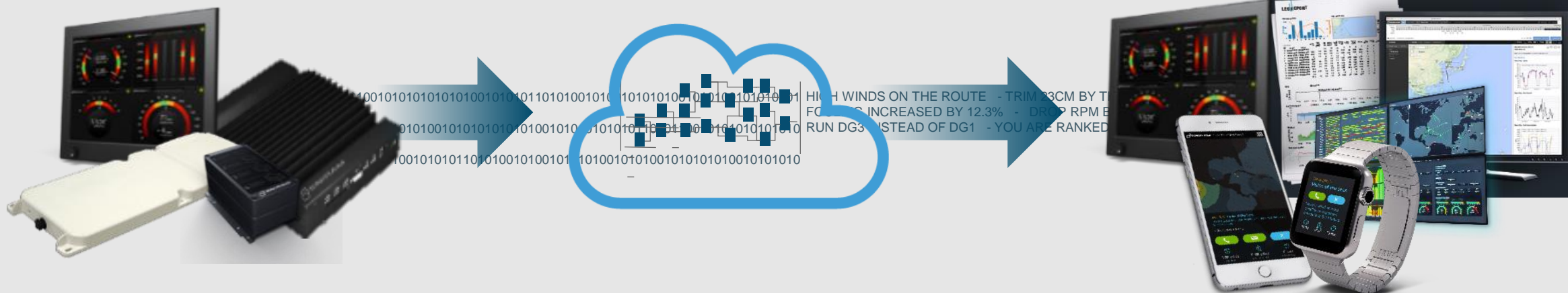
## INSIGHT

Data is automatically analyzed and enriched

>

## ACTIONS

Insight is transformed to actions by easy-to-use user interfaces



### Onboard:

- Existing systems
- Eniram sensors

### Onshore:

- Forecasts
- Knowledge bases

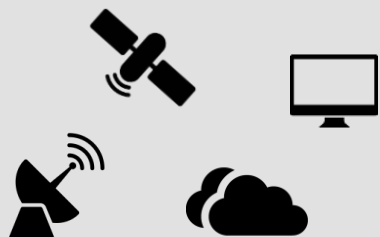
- Statistical modelling
- Machine learning
- Simulation
- Prediction
- Optimization
- Data enrichment

- Efficient crew operations
- Optimized asset lifecycle
- Minimized fuel use
- Reduced emissions
- Best commercial efficiency
- Proactively ensured safety

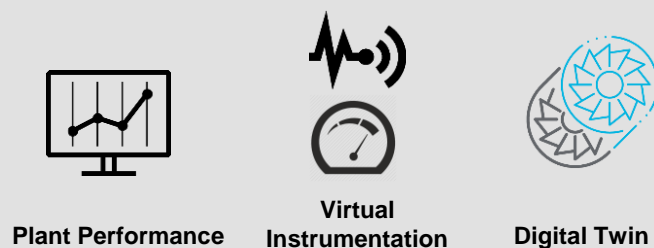
# OPERIM<sup>®</sup>

## Enabling Smart Operations

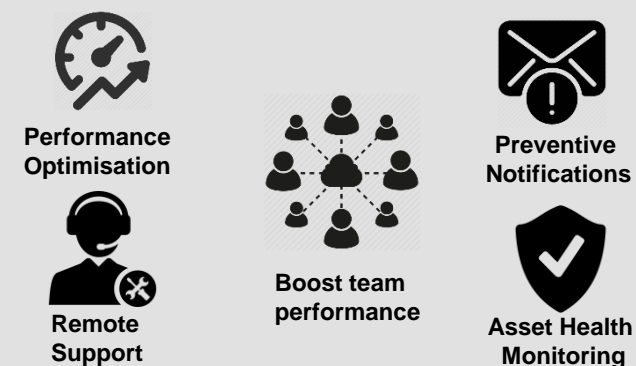
### Gather Data



### Generate Insights



### Deploy Solutions



### GAS SOLUTIONS



### FLOW SOLUTIONS



### WASTE & WATER

# Creating the Infrastructure; 3k LNG Bunkering Barge for European Inland Water Ways

<b>Owner</b>	LNG Shipping (Victrol and CFT)
<b>Type</b>	LNG Bunkering Barge
<b>Cargo</b>	LNG
<b>Financier</b>	Shell
<b>Ship Size</b>	3 000 CBM
<b>Shipyard</b>	
<b>Scope of supply</b>	<ul style="list-style-type: none"> <li>• Cargo Handling System</li> <li>• Cargo Tanks</li> <li>• LNG Metering system</li> </ul>
<b>Ship design</b>	INEC
<b>Class</b>	BV
<b>Ship dimensions (LxBxD)</b>	110 x 15 x 11 m
<b>Delivery</b>	2018





# Creating the Infrastructure; 4k LNG ATB Barge – Bunkering of cruise vessels

<b>Owner</b>	Q-LNG
<b>Type</b>	4k LNG ATB Barge w. cylindrical type C tanks
<b>Cargo</b>	LNG
<b>Ship Size</b>	4 000 cmb
<b>Shipyard</b>	VT Halter
<b>Scope of supply</b>	<ul style="list-style-type: none"> <li>• Complete Wärtsilä integrated solution</li> <li>• Cargo tanks, cargo handling system, pumps, STS, SSL, control system, thrusters, E&amp;A, Communications, DP</li> </ul>
<b>Barge design</b>	VT Halter
<b>Class</b>	ABS/USCG



# WARTSILA-WINGD-GTT

Norway - All rights reserved



# Smart Solutions driving “LNG as Fuel”



A new platform for future shipping by  
collaboration of three technology providers

Barcelona, Gastech – September 2018

## Quotes of the partners:

WinGD, Rolf Stiefel: *“The simplicity of our 2-stroke dual fuel engine design is the key to success and the base for a smart and fuel efficient solution”.*

GTT, Julien Bec: *“It’s time to accelerate LNG innovations by merging high-end technologies in order to meet the environmental targets”.*

Wärtsilä, Frank Harteveld: *“The next leap on our roadmap to a cleaner horizon can only be realized by extensive collaboration”.*

# External influences driving “LNG as Fuel”

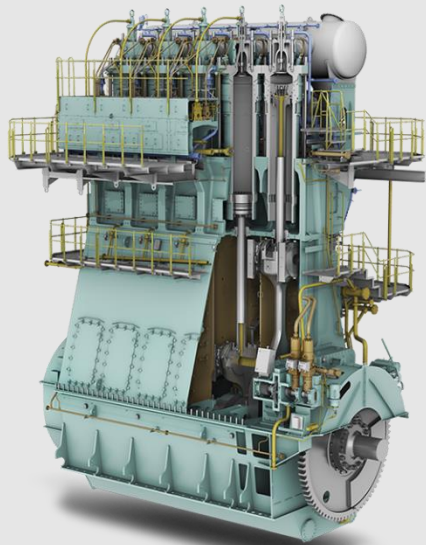


Driving LNG by the industry, there is need for:

- Close collaboration by technology providers;
- Legislation needs to be in place;
- Make sure that LNG is available at all strategic locations and port hubs;
- Understanding Total Cost of Ownership.



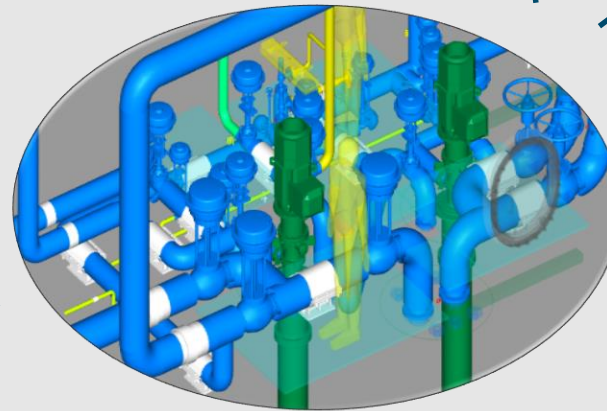
# Wärtsilä LNGPac™



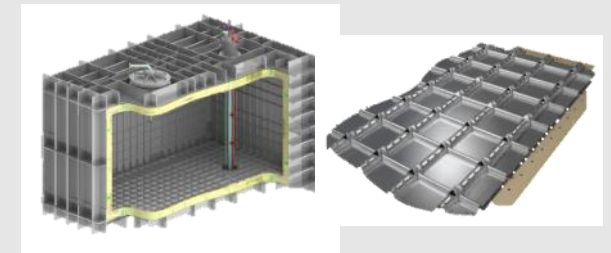
12X92DF



W34DF



LNG Fuel Gas Supply System



18600m<sup>3</sup>