INTERNATIONAL CONFERENCE

PORTS
MARITIME TRANSPORT
& INSULARITY

MILOS 21-22 APRIL 2017

FME POWERED BY DUTCH TECHNOLOGY

Leo van der Burg, business development manager at FME

Innovations to support the LNG uptake

April 21 – 22, 2017

Growth starts at the roots

From the **five pillars of our membership,** we provide value to our members.

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FME IS THE NETHERLANDS' LARGEST BUSINESS ORGANISATION IN THE TECHNOLOGY INDUSTRY

FME key figures

2.200
MEMBER COMPANIES

220.000
EMPLOYEES

€39
MILJARD EXPORTS

€21
MILJARD ADDED VALUE

75
BILLION EURO TOTAL TURNOVER

60
ASSOCIATED TRADE ORGANISATIONS

DID YOU KNOW THAT FME MEMBERS ARE RESPONSIBLE FOR ONE SIXTH OF THE TOTAL DUTCH EXPORT EARNINGS?

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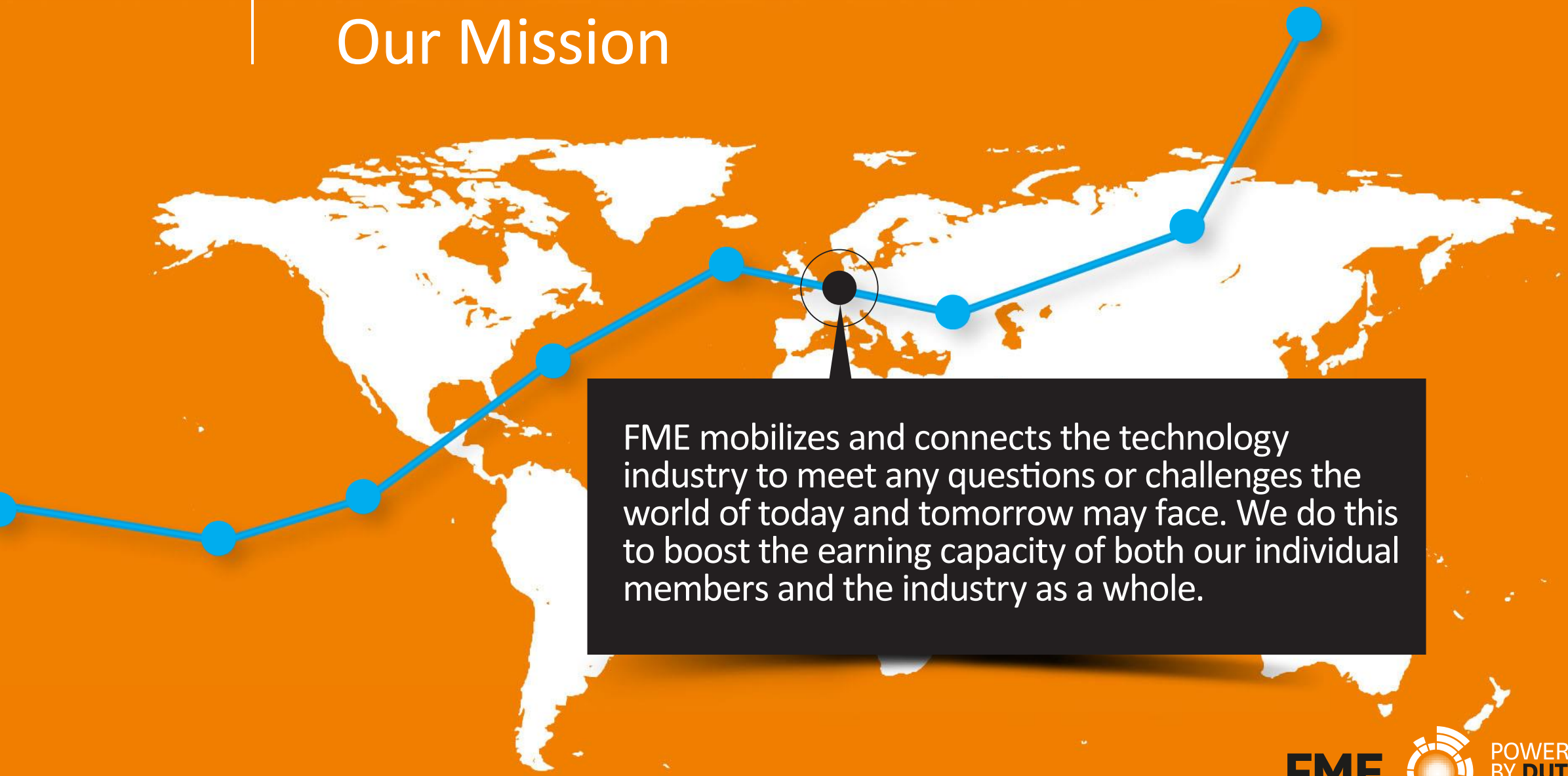
Our Mission



FME mobilizes and connects the technology industry to meet any questions or challenges the world of today and tomorrow may face. We do this to boost the earning capacity of both our individual members and the industry as a whole.

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Presentation overview

Content of the presentation:

- Status at 2017/type of ships
- Nowadays LNG bunkering situations
- Regulations
- Innovations to support the LNG uptake:
  1. Carbon capture and storage on ships
  2. Low Pressure LNG tank and Bunker Storage Solutions (LPTSolutions)
  3. Plug and Play Energy Pack for Inland and Shortsea Shipping
  4. Standard modular LNG system for ‘Small Scale LNG’ vessels
  5. Methane catalyst for LNG engines
  6. Training technologies for the use of LNG

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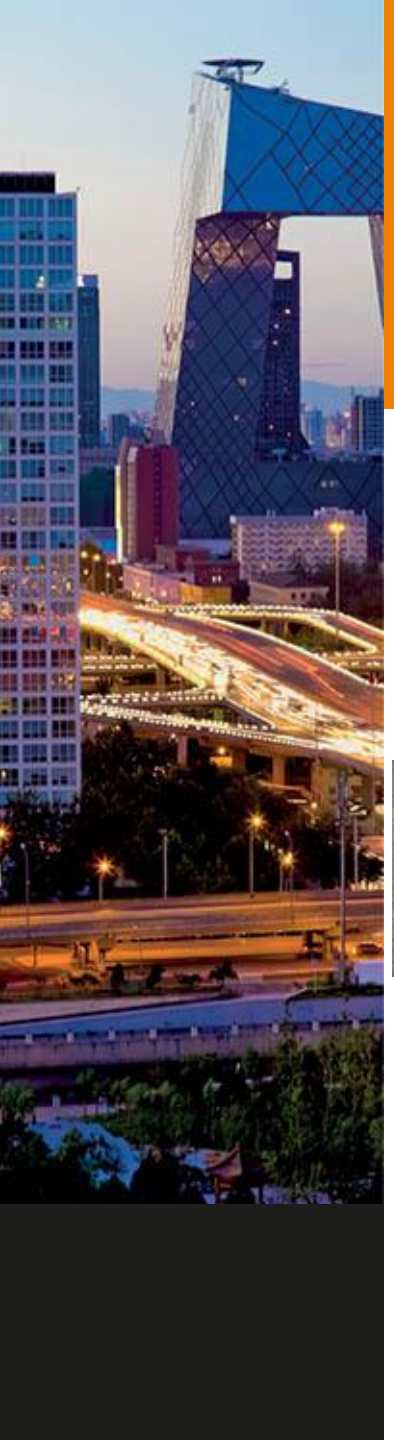

INNOVATIONS TO SUPPORT THE LNG UPTAKE

LNG ships/inland an seagoing

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INNOVATIONS TO SUPPORT THE LNG UPTAKE

Nowadays LNG bunkering situations

Type Bunkering	Volume	Minimal investment	Maximum investment
-Truck incl. Trailer -Truck/Trailer (ISO Container (40 ft))	-20 ton -22 ton (55 m^3)	€ 130.000,- € 180.000,-	
-Smallscale Station (Trailer+tanks) -Smallscale Station (Trailer+tanks -….+ extra tank	-150-200 m^3 -500 m^3 -500 m^3	€ 1.500.000,- € 4.000.000,- € 700.000,-	€ 2.000.000,- € 5.000.000,- € 800.000,-
-Bunkership seegoing (crew: 10/12 pers. Fee Terminal € 75.000,- -Bunkership inland (crew 2 pers) Fee € 75.000,-	-5.100 m^3 -6.500 m^3 -7.500 m^3 -1.000 m^3/2.000 m^3	€ 40.000.000,- € 50.000.000,- € 60.000.000,- € 15.000.000,-	€ 50.000.000,- € 60.000.000,- € 70.000.000,- € 20.000.000,-

Regulations at sea /-The IMO emission standards as Tier I...III standards.

	Date	NOx Limit, g/kWh		
		n < 130	130 ≤ n < 2000	n ≥ 2000
	2000	17.0	$45 \cdot n^{-0.2}$	9.8
	2011	14.4	$44 \cdot n^{-0.23}$	7.7
	2016†	3.4	$9 \cdot n^{-0.2}$	1.96

ssion Control Areas (Tier II standards apply outside ECAs).

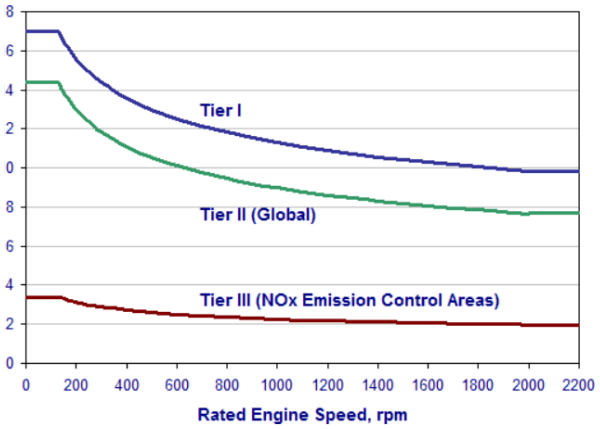

Figure 1. MARPOL Annex VI NOx Emission Limits

Date	Sulfur Limit in Fuel (% m/m)	
	SOx ECA	Global
2000	1.5%	4.5%
2010.07	1.0%	
2012		3.5%
2015	0.1%	
2020		0.5%

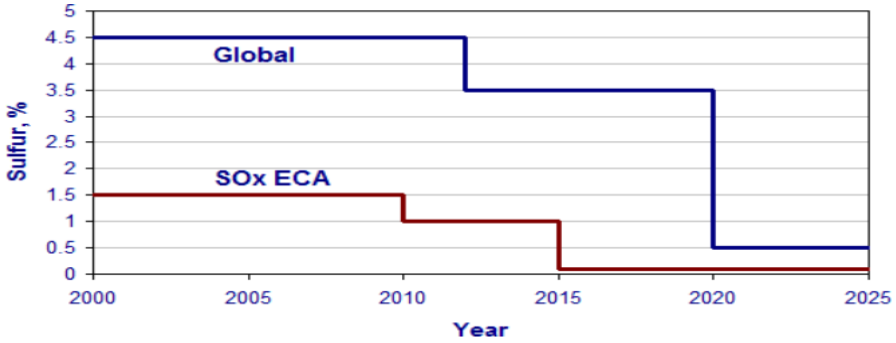

Figure 2. MARPOL Annex VI Fuel Sulfur Limits

Existing Emission Control Areas include:

- Baltic Sea (SOx: adopted 1997 / entered into force 2005; NOx: 2016/2021)
- North Sea (SOx: 2005/2006; NOx: 2016/2021)
- North American ECA, including most of US and Canadian coast (NOx & SOx: 2010/2012).
- US Caribbean ECA, including Puerto Rico and the US Virgin Islands (NOx & SOx: 2011/2014).

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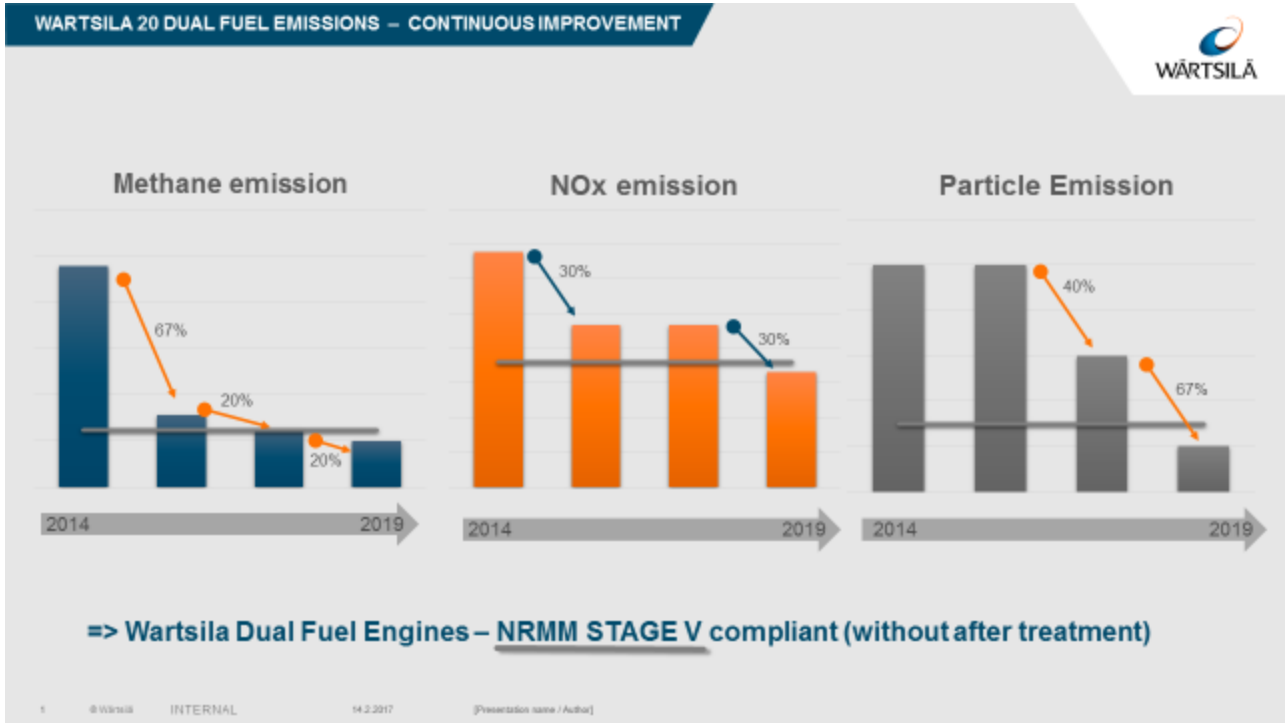
Regulations inland waterways (NRMM/Stage V)

Stage V emission standards for engines in inland waterway vessels (IWP & IWA)

Category	Net Power	Date	CO	HC[a]	NOx	PM	PN
	kW		*g/kWh*				*1/kWh*
IWP/IWA-v/c-1	19 ≤ P < 75	2019	5.00	4.70[b]		0.30	-
IWP/IWA-v/c-2	75 ≤ P < 130	2019	5.00	5.40[b]		0.14	-
IWP/IWA-v/c-3	130 ≤ P < 300	2019	3.50	1.00	2.10	0.10	-
IWP/IWA-v/c-4	P ≥ 300	2020	3.50	0.19	1.80	0.015	1×10^{12}

[a] A = 6.00 for gas engines
[b] HC + NOx



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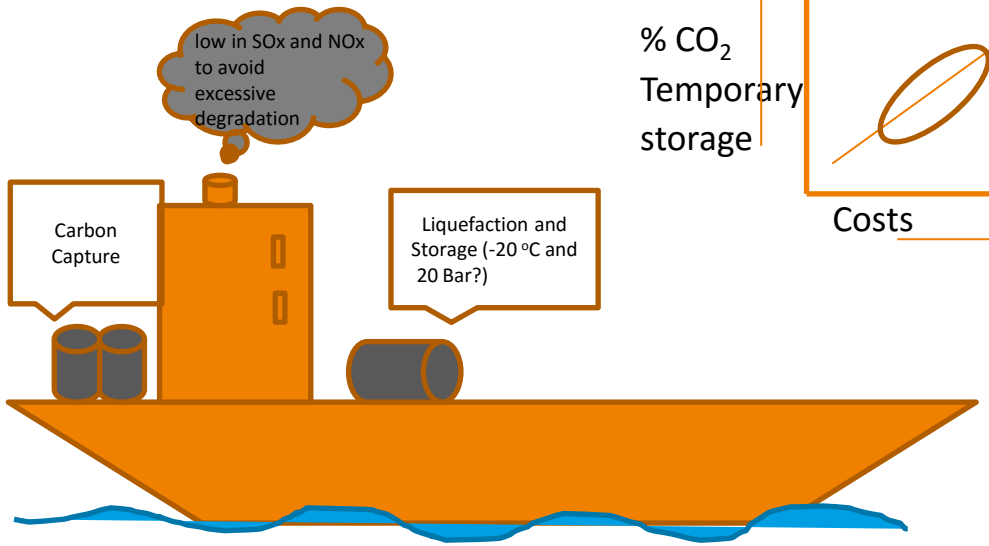
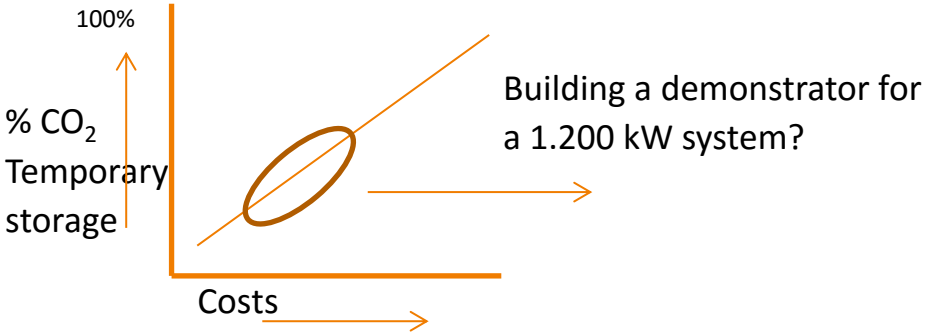
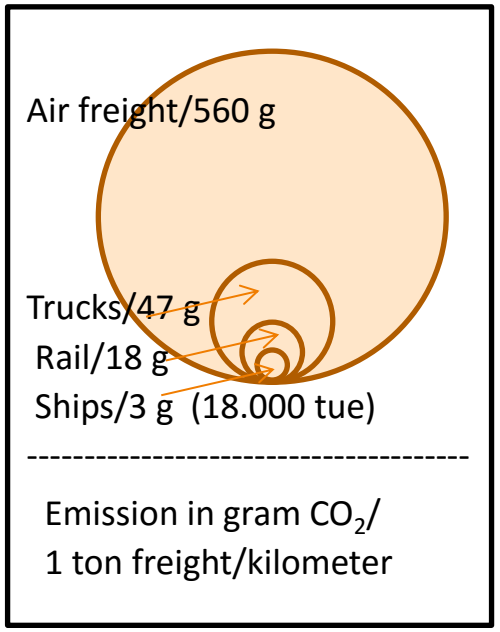
INNOVATIONS TO SUPPORT THE LNG UPTAKE

Carbon capture and storage on ships

- To combust 1 kg diesel (42.700 kJ/kg) >> CO_2 = 3,15 kg
- To combust 1 kg LNG (49.620 kJ/kg) >> CO_2 = 2,7 kg







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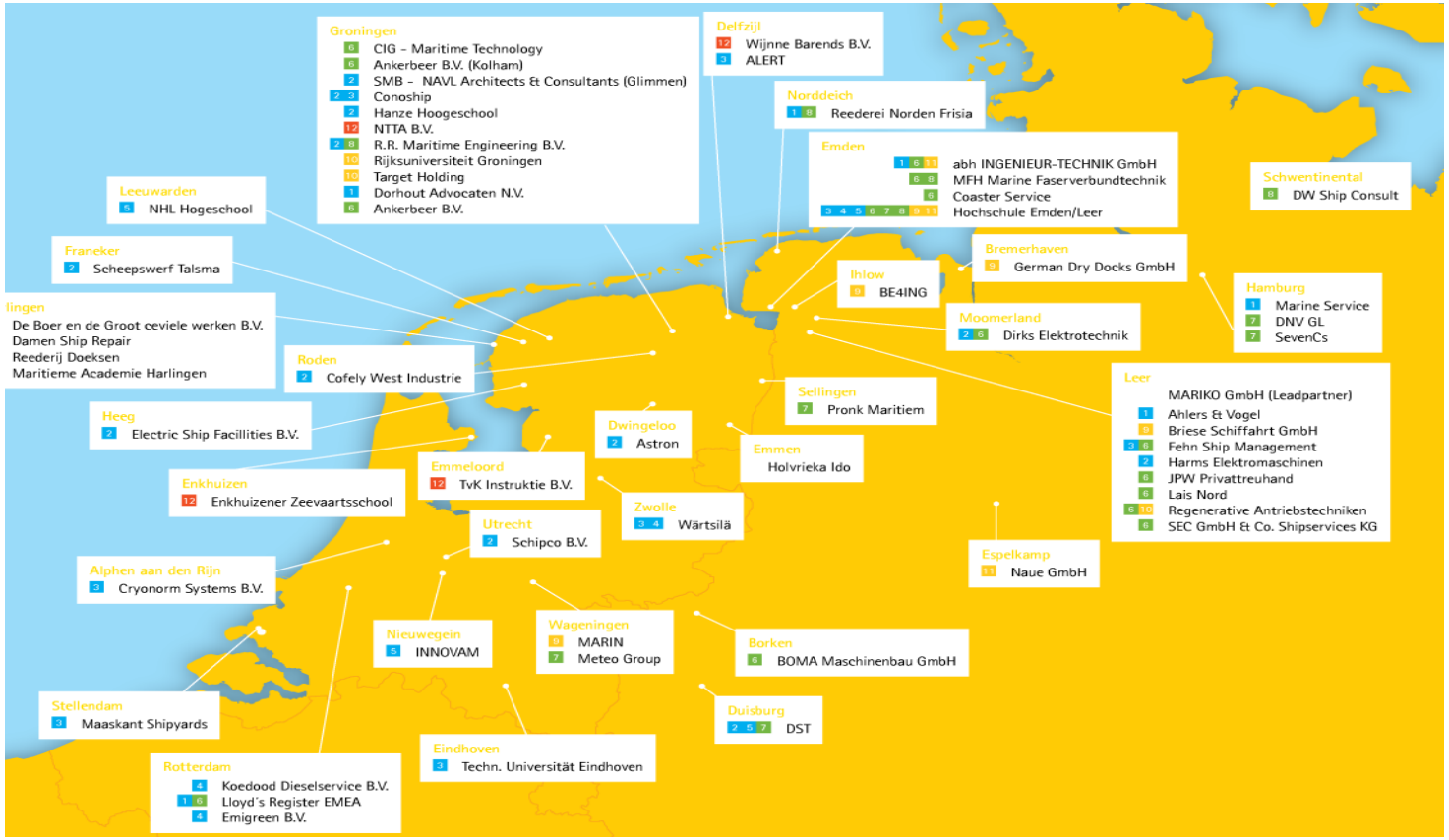
LNG Market Uptake

- Low Pressure LNG Tank and Bunker Storage Solutions (LPTSolutions)
- Plug and Play Energypack for Inland and Shortsea Shipping
- Standard modular LNG system for ‘Small Scale LNG‘ vessels
- Methane catalyst for LNG engines
- Training technologies for the use of LNG



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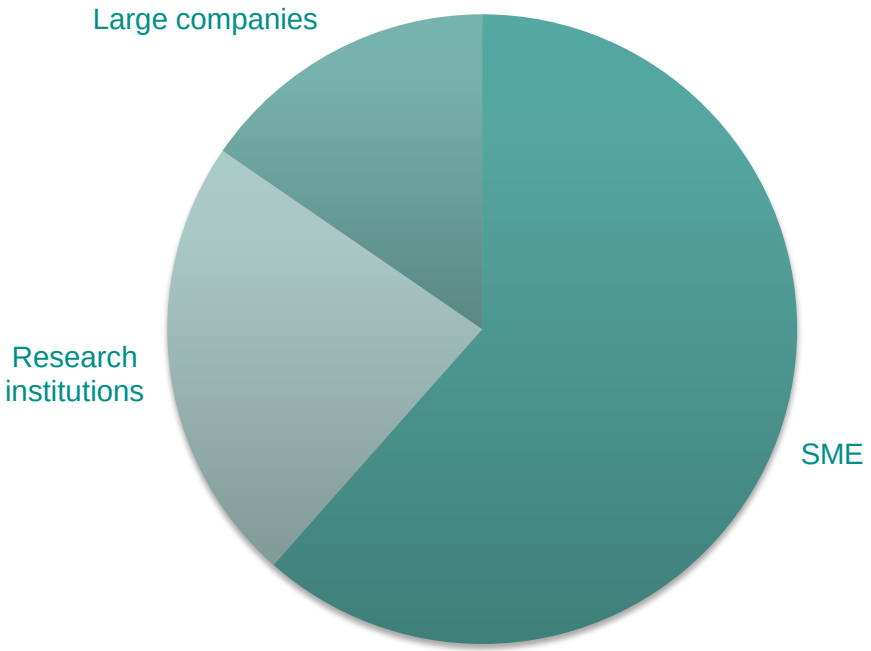
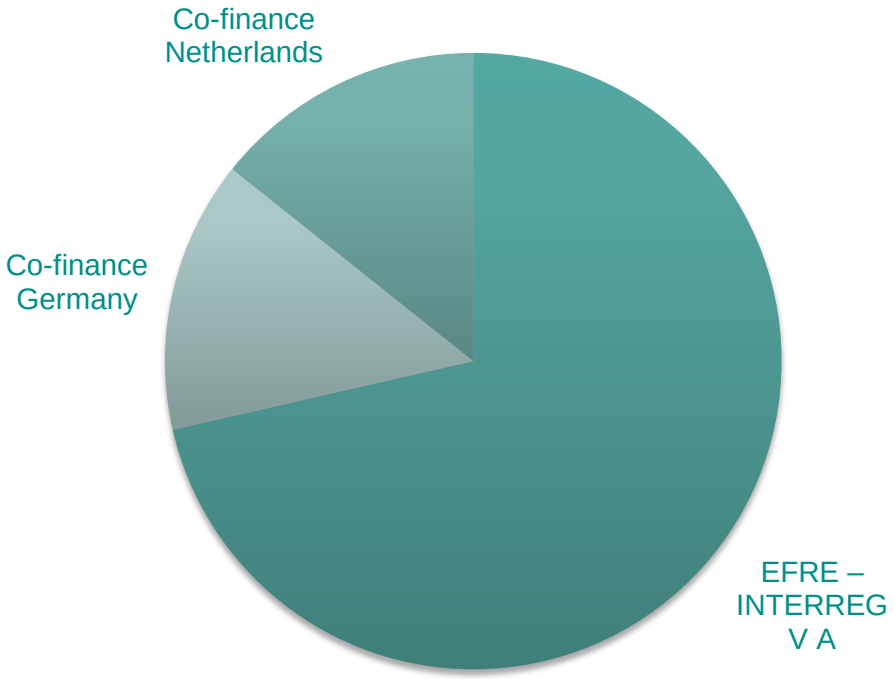
Finance of the project

Total amount: 9,9 M €

Own recources (30%)



Subsidies (70%)



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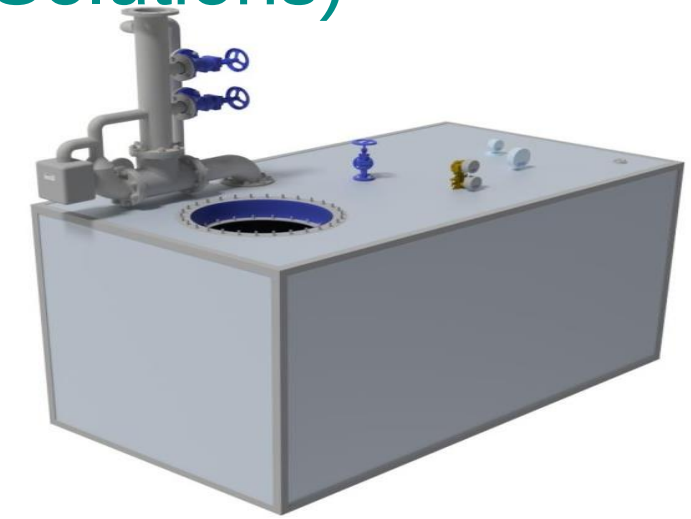
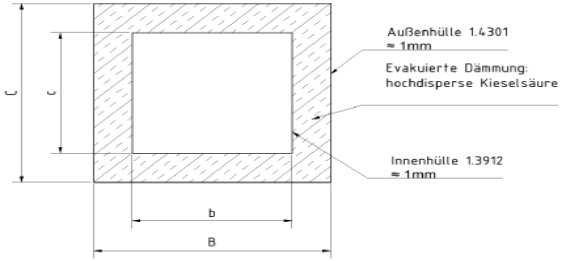
Low Pressure LNG Tank and Bunker Storage Solutions (LPTSolutions)





Shipping company
Frisia and Doeksen

- Prismatic Low Pressure Tank LPT)
- Vacuum insulated
- Box in box principle
- High variance in tank shape
- Max. utilisation of given space for LNG-storage

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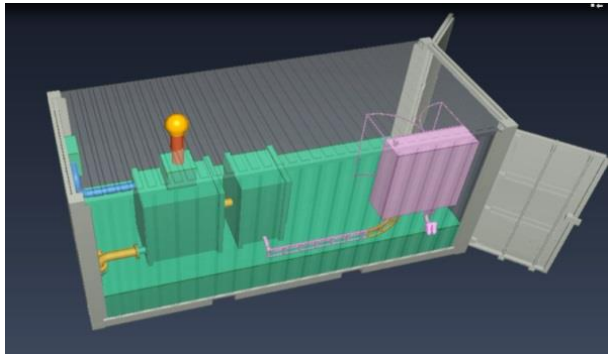
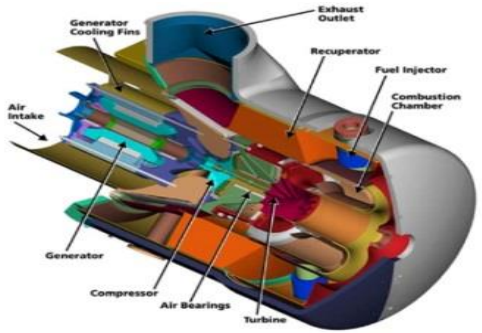
Plug and Play Energypack for Inland and Shortsea Shipping



- Small scale LNG solution through LNG-turbine technology (truck industry) to cover the demand of electricity for inland- and short sea vessels
- Power generator together with fuel tank in one box
- Direct LNG injection
- (No) methane slip → good emission profile, stageV!
- Test on MV “Emeli”, training ship of Maritime Academie Harlingen
- Cost price <300 kE/total efficiency 40-45% for a 300 kW system



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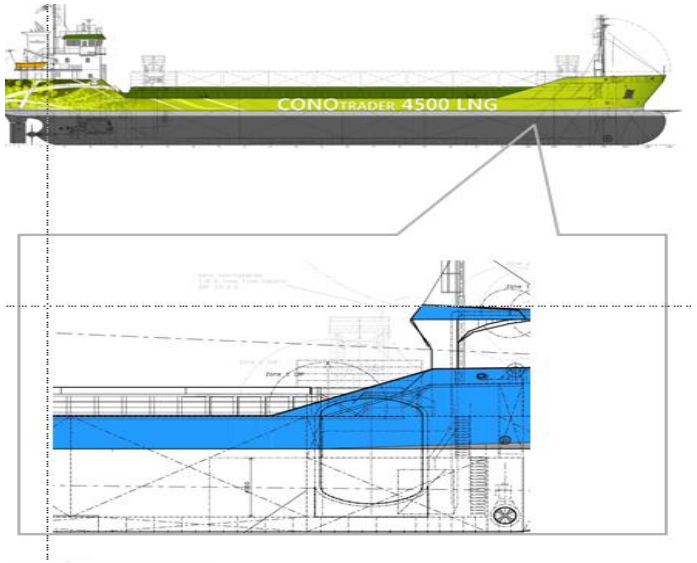
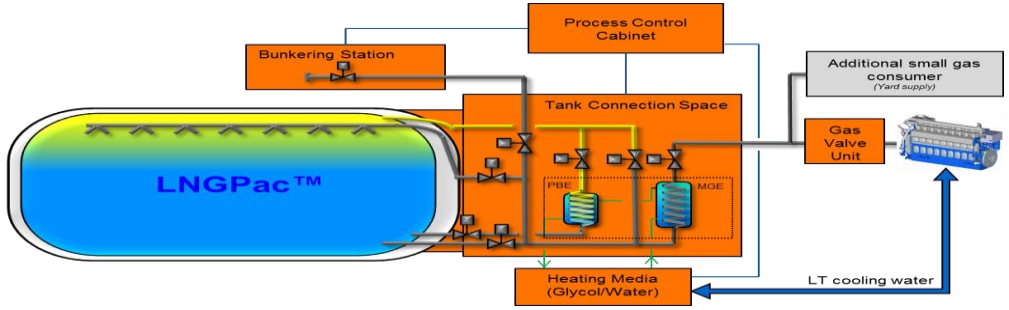
Standard modular LNG system for „Small Scale LNG“ vessels



- Standarization of modules regarding smal scale LNG systems
- 30% cost reduction through standardization in order to smooth the way for Fishing and Shortsea Vessels



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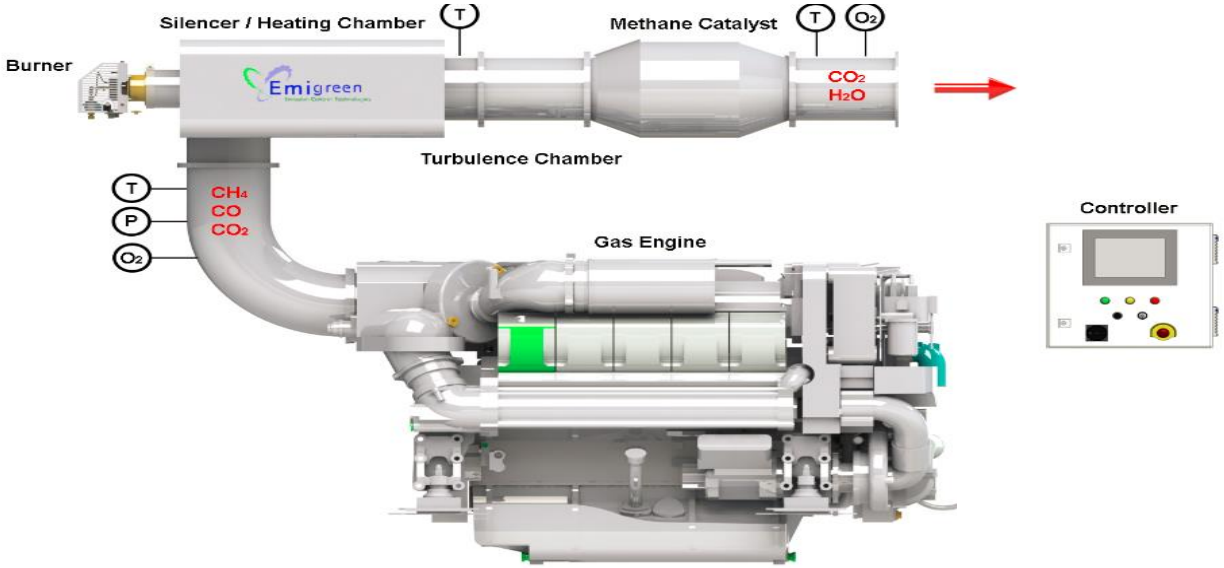
Methane catalyst for LNG engines



Exhaust gas flow 200 kg/h

Exhaust gas temperature 400 °C

- Methane slip is a common issue regarding LNG propulsion
- Methane has a global warming potential which is 25 times higher in comparison to CO_2
- No methane reduction installation available yet
- Development of a methane catalyst in order to avoid methane slip (split CH4 to CO_2 and H_2O)

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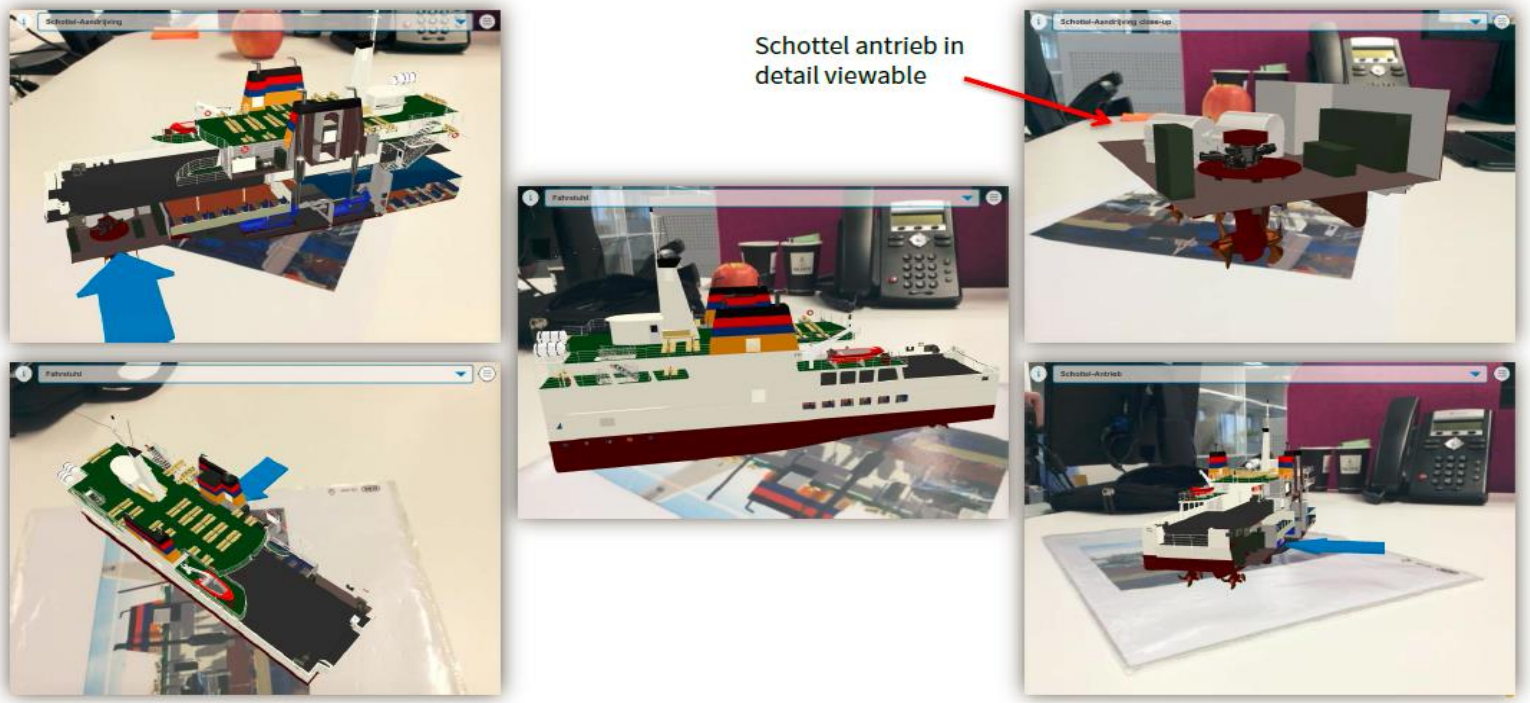
Training technologies for the use of LNG



Development of additional material for the LNG basic training course based on blended learning technologies such as augmented reality and virtual reality.

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Das Projekt MariGreen wird im Rahmen des INTERREG V A Programms Deutschland-Nederland mit Mitteln des Europäischen Fonds für Regionale Entwicklung (EFRE) und des niederländischen Wirtschaftsministeriums (Ministerie van Economische Zaken), des Landes Niedersachsen (Niedersächsische Staatskanzlei) sowie des nordrhein-westfälischen Ministeriums für Wirtschaft, Energie, Industrie, Mittelstand und Handwerk und der Provinzen Drenthe, Flevoland, Friesland, Gelderland, Groningen, Noord-Brabant und Overijssel kofinanziert. Es wird begleitet durch das Programm-Management INTERREG bei der Ems Dollart Region (EDR).

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Thanks for your attention

Leo van der Burg, business development manager at FME

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