

# Scrubbers bridging the gap to zero emissions

6 April 2021 • 09:00-09:45 BST

Premier partner



Knowledge grows

Supporting association



## Panellist documents

Page 2: Aleksander Askeland, Yara Marine Technologies

Page 9: Fabian Kock, DNV

Page 17: Elizabeth Lindstad, SINTEF Ocean, Maritime

Page 24: Aslak Suopanki, Wärtsilä - Exhaust Treatment Division

Part of  
**Marine Propulsion**  
Webinar Week

6-9 April 2021

**marine  
propulsion**  
& auxiliary machinery



# Bridging the gap to zero

Aleksander Askeland CSO

**10** years of experience

Over

**400+**

Scrubbers

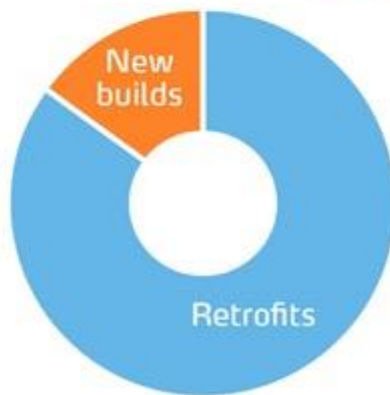
Yara Marine  
Training  
Academy



Typical installation

**2** weeks  
dry-dock

After-Sales  
service -  
spare parts



**500+**

crew members trained

Over 2 million  
operating  
hours



**3** international  
patents for marine  
applications

Extended  
Guarantee



# SO<sub>x</sub>

Scrub down beyond compliance

# CO<sub>2</sub>

Less than VLSFO



*“From well-to-wake the continued use of heavy fuel oil with a scrubber is the most environmentally beneficial means of meeting GHG emissions targets”*

Chief Scientist Dr. Elizabeth Lindstad, 2019



# New climate targets - and regulations coming



40% CO<sub>2</sub> reduction by 2030

70% CO<sub>2</sub> reduction by 2050

Shipping enter EU climate quota system (ETS)

EU ban on CO<sub>2</sub> emissions at berth



# With new regulation come distinct new opportunities!

Now is the time to OPTIMIZE ...

Energy consumption



Operational performance



Fleet coverage



Cost reduction



... tomorrow is the time to REVOLUTIONIZE!

Scrub new fuels!



Scrub and store CO2



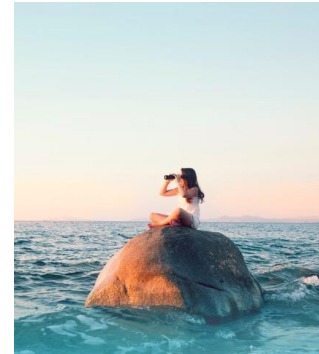
Interconnect with other tech



... at last ELIMINATE the scrubber!

Keep scrubbers relevant for regulators and ship owners alike!

In line with YMT's Ambition and Purpose



**Our Ambition**

A healthy planet for future generations

**Our Purpose**

We provide technology to enable a greener maritime industry

# At Yara Marine Technologies, we have started our revolution ...

## OUTSET

Focused scrubber supplier  
No diversification to  
compensate for market swings  
Difficult capacity adaptation

## FUTURE STATE OPTIONS

### PRODUCT DRIVEN

Focused scrubber  
supplier



### PURPOSE DRIVEN

Broad technology  
provider to enable a  
greener maritime industry



## CHOSEN PATH

- Continued challenges
- Smaller market
- Balancing on one leg
- Internal innovation pipeline
- M&A/Partnerships
- Yara Marine X



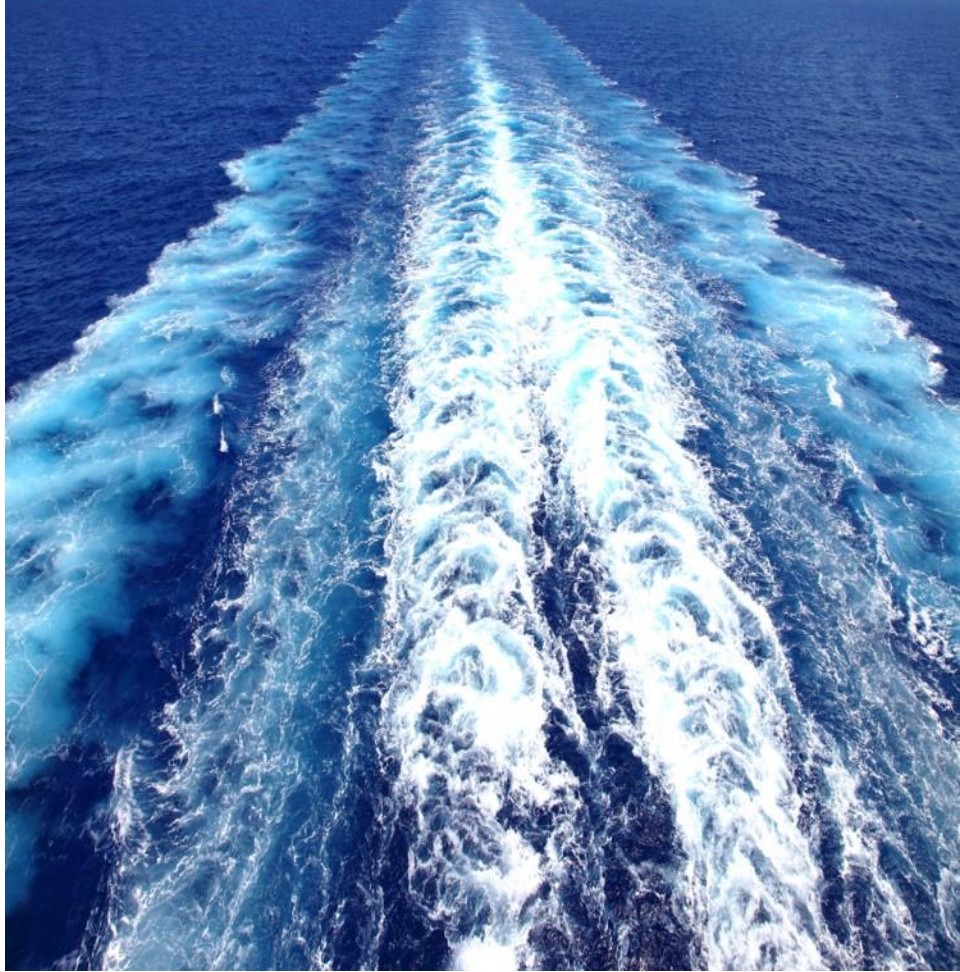


**Purpose:**

*We provide technologies to enable a greener maritime industry.*

**Ambition:**

*A healthy planet for future generations*





# Scrubbers: Safer, smarter greener

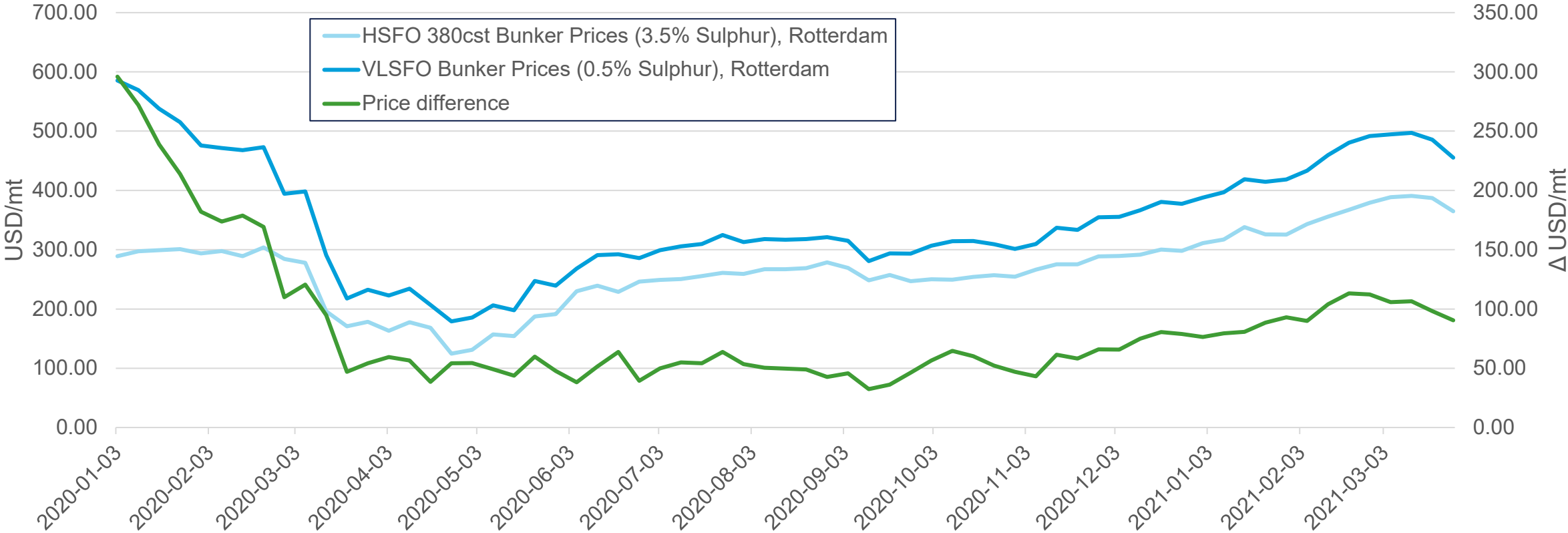
Scrubbers bridging the gap to zero emissions?

Dr. Fabian Kock

06 April 2021

# Bunker prices

## Bunker prices Rotterdam

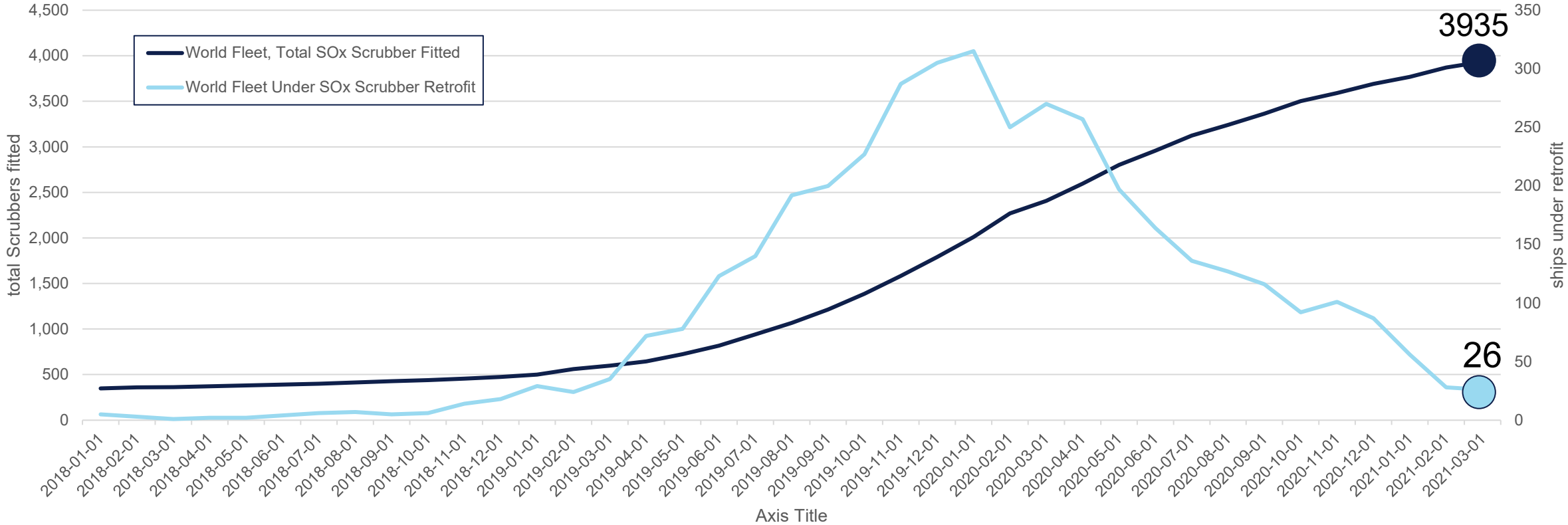


Source: © Clarkson Research



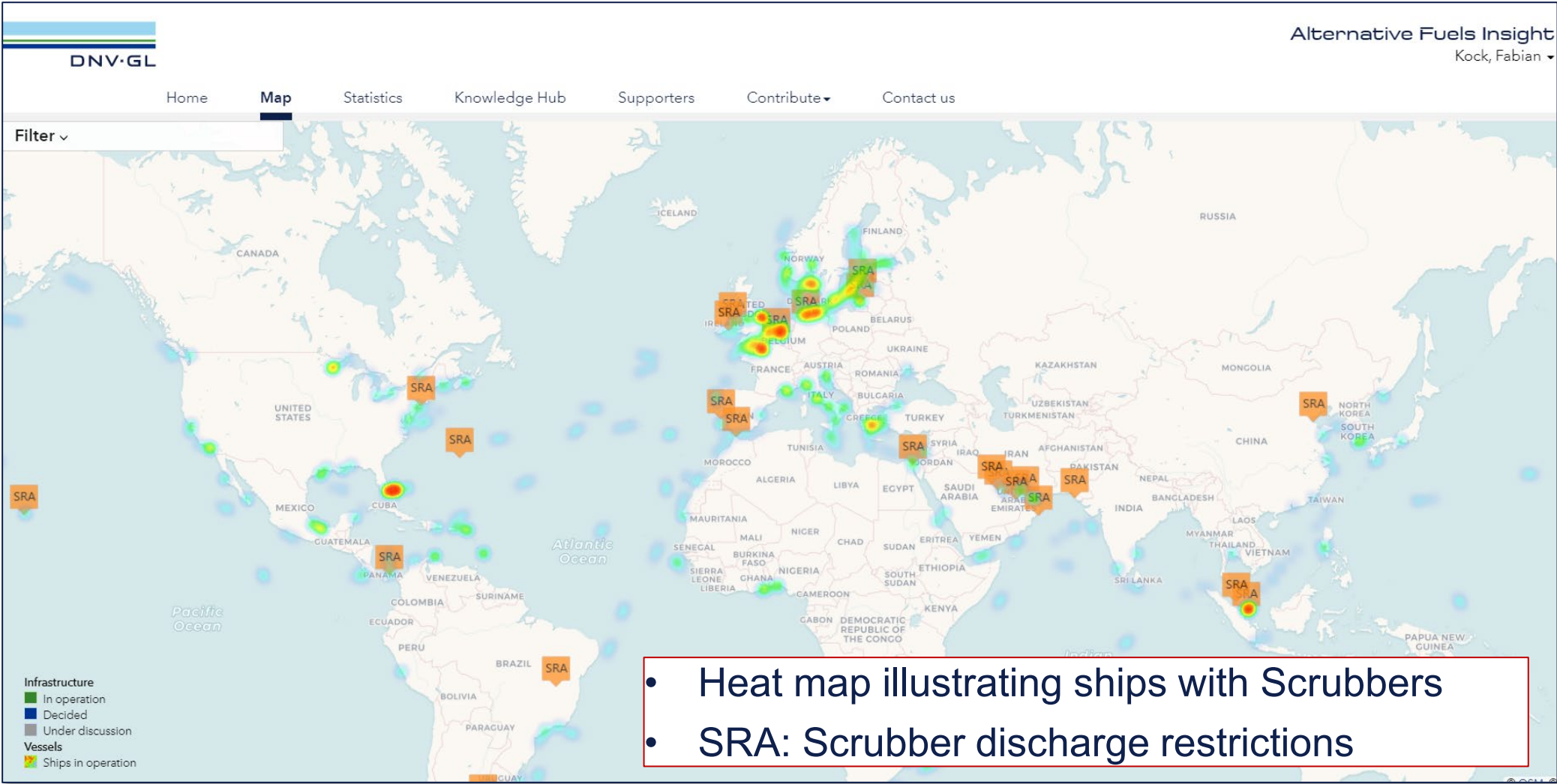
# Scrubbers fitted / under retrofit

Scrubbers fitted / under retrofit



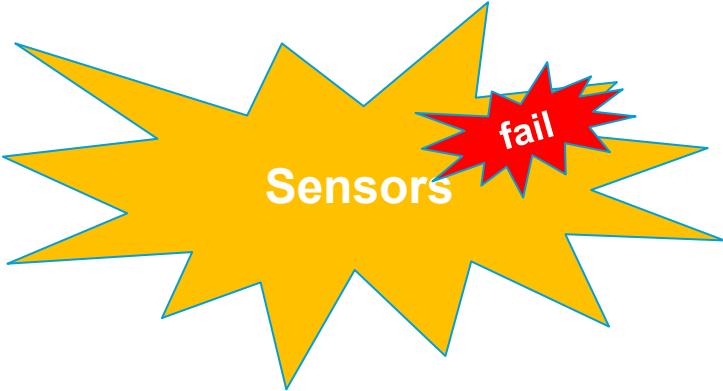
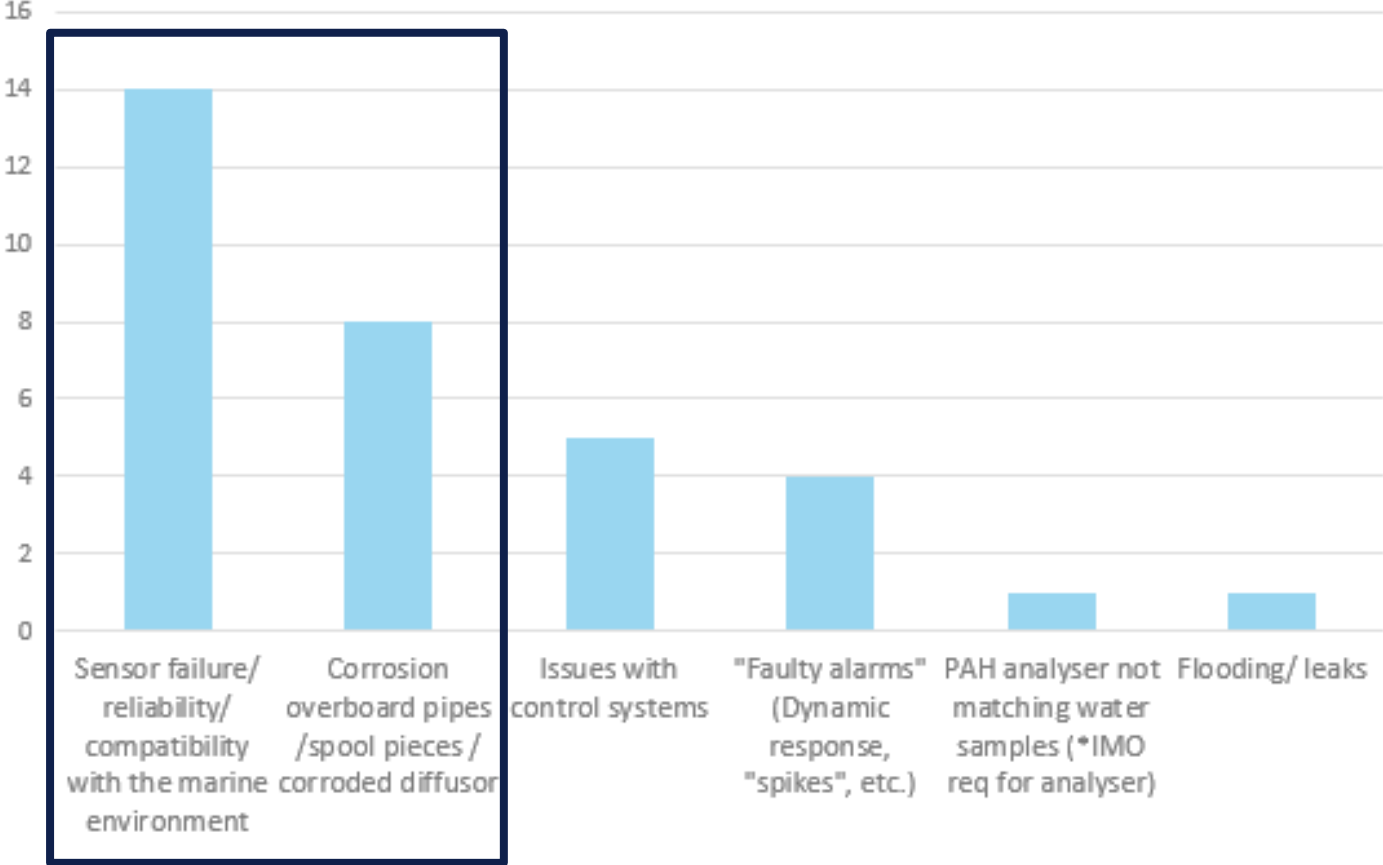
Source: © Clarkson Research

# Open loop: Local restrictions

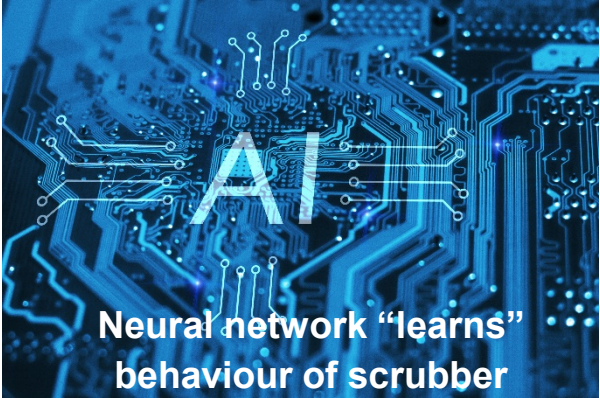
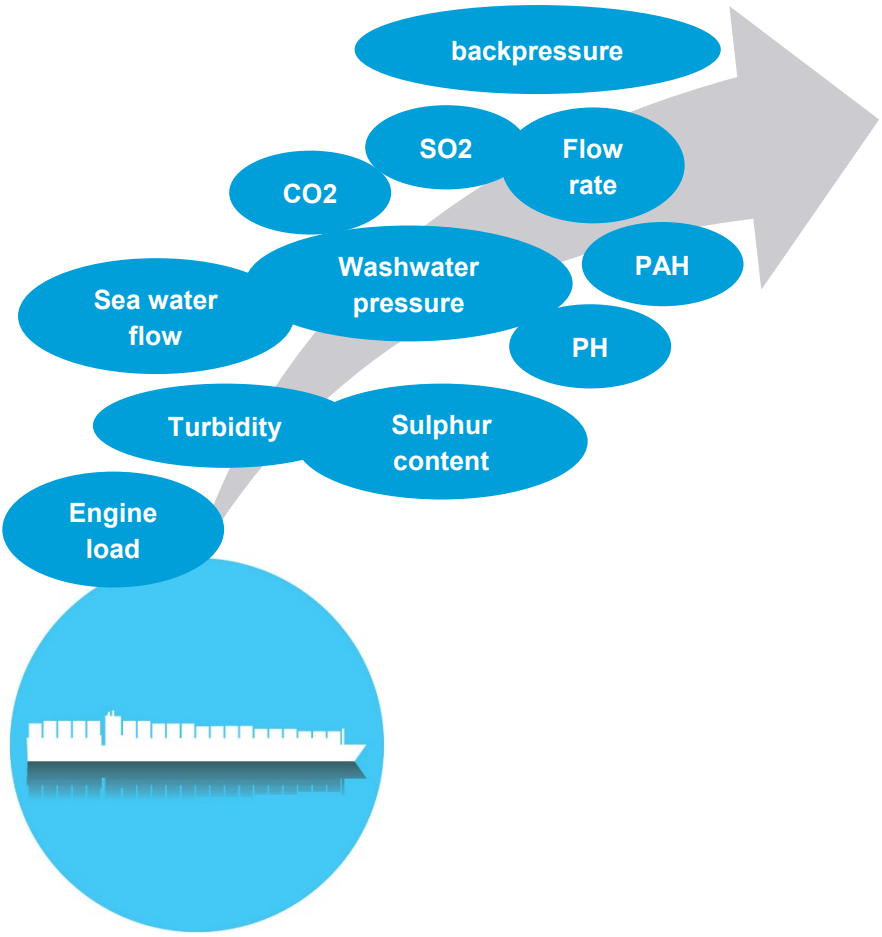


# Current challenges

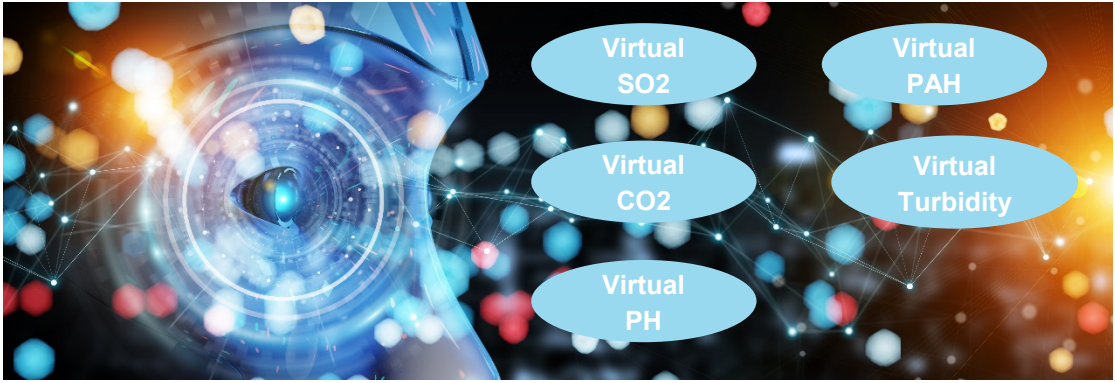
What parts of the scrubber system are most prone to failure and need to be replaced most frequently?



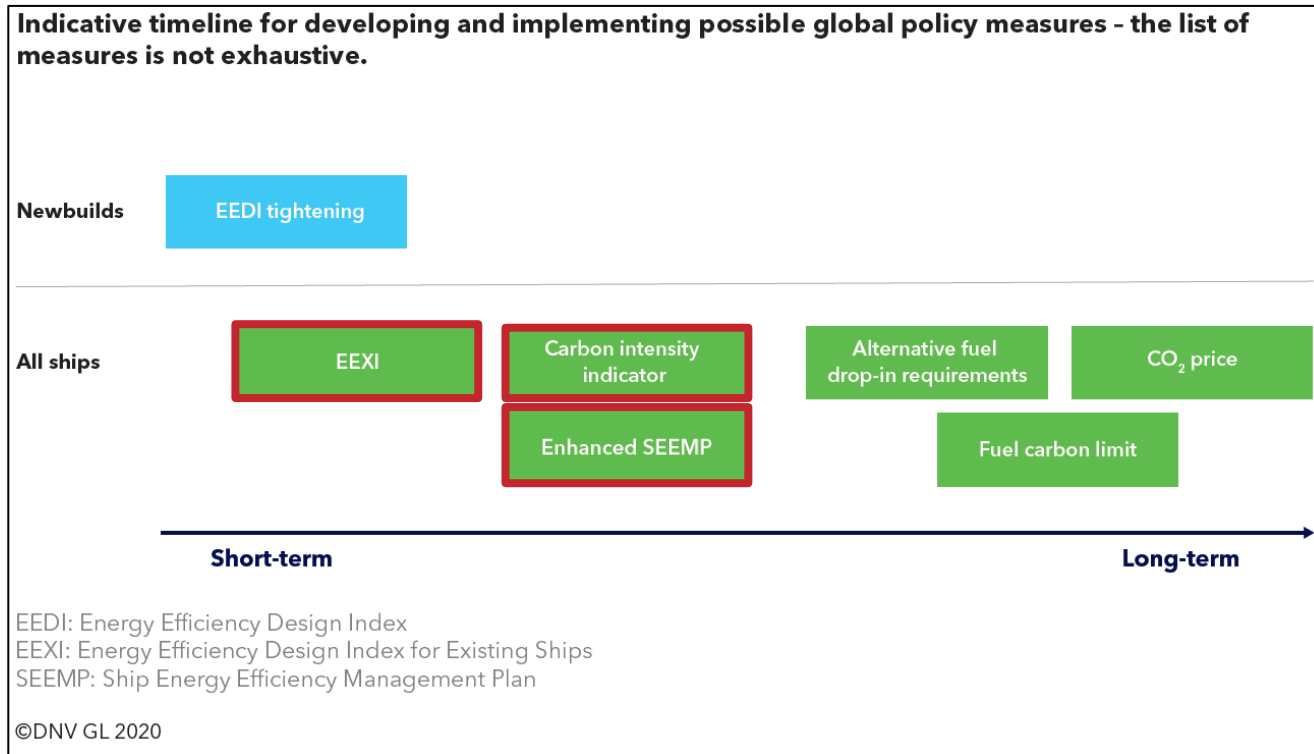
# Intelligent backup via “virtual” sensors



How about if we let machines do the job of learning how Scrubbers react?



# Scrubbers in the framework of GHG reduction



- Scrubbers and usage of HFO does not give benefits for EEXI.
- Carbon-Capture-Storage (CCS) with Scrubbers?
- Life-Cycle-Analysis (LCA) needs to be implemented by IMO.

# The broader view on emissions



Fabian.kock@dnv.com

+49 1724044585

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





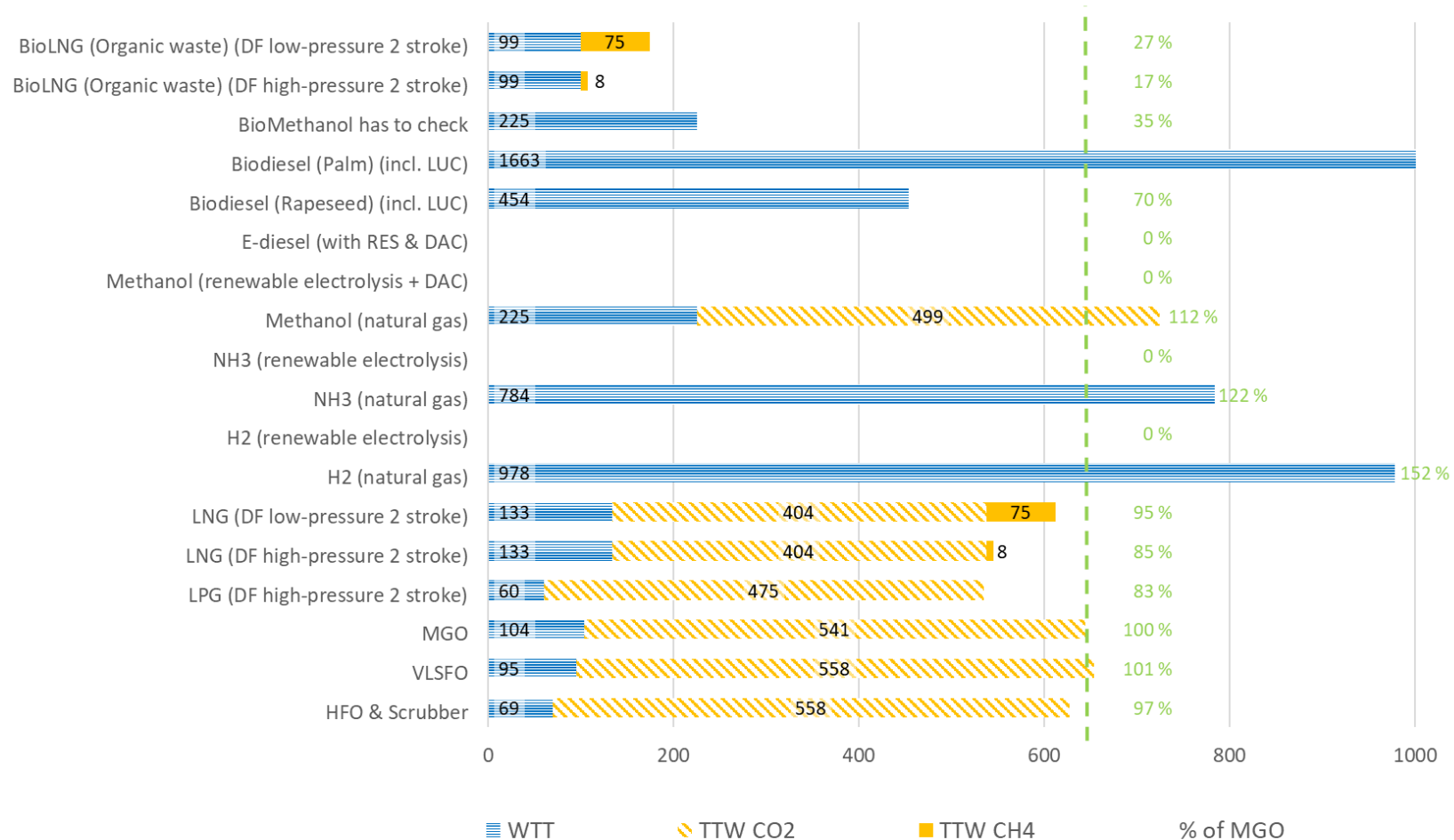
# Scrubbers and conventional fuels versus " E-fuels and Synthetic E-fuels"

**Dr. Elizabeth Lindstad - Chief Scientist  
SINTEF Ocean AS**

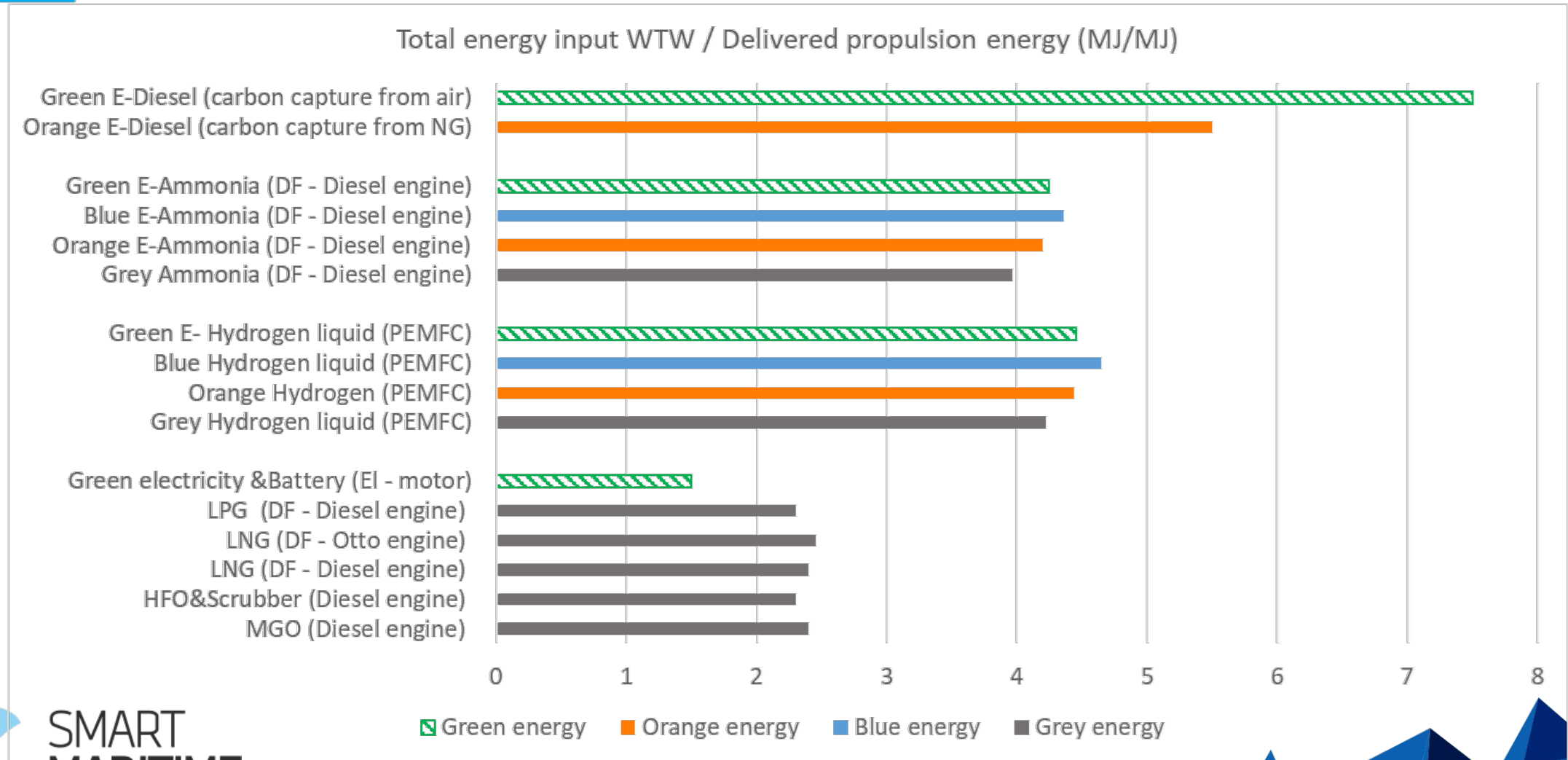


# It's the source of raw material (Well-to-tank) which decides the carbon footprint of Bio and E-fuels

Well-to-Wake Emissions in Gram CO<sub>2</sub>eq. per kWh - GWP100

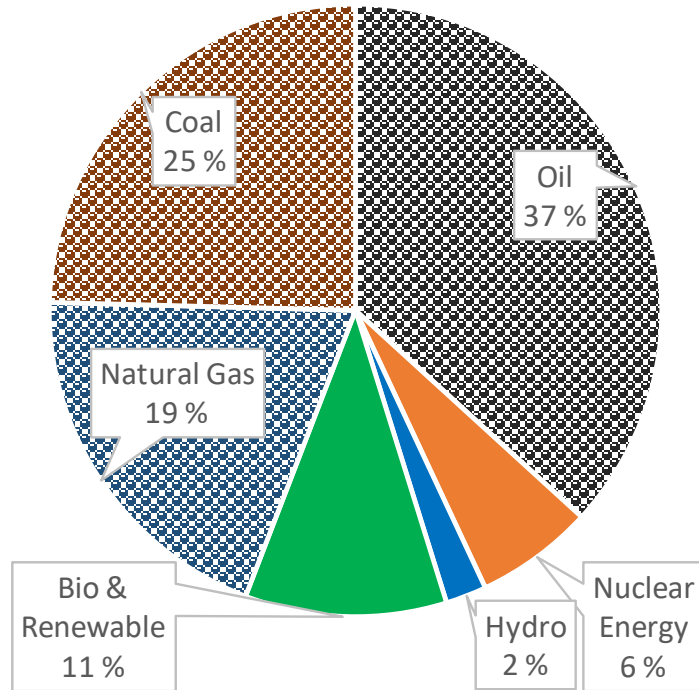


# E-fuels and Synthetic E- fuels roughly doubles and triples energy consumption compared to conventional fuels

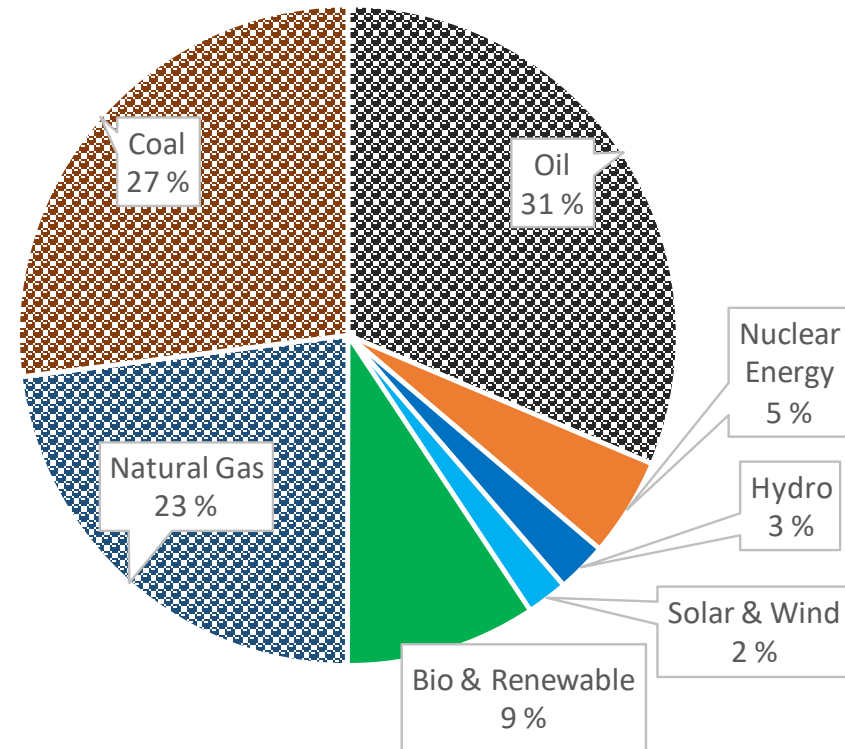


# E-fuels require large amount of Renewable Electricity – will these quantities become available? and if they do, are we better off by replacing coal in the electricity generation?

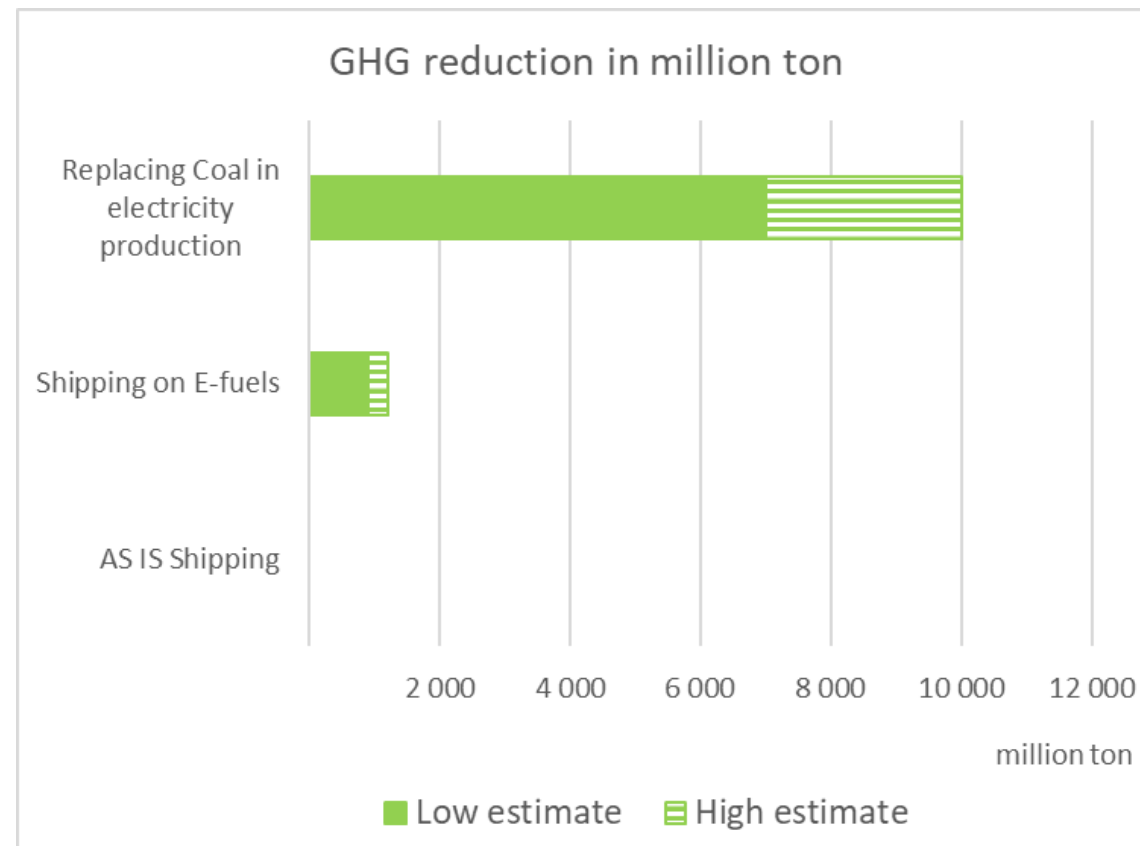
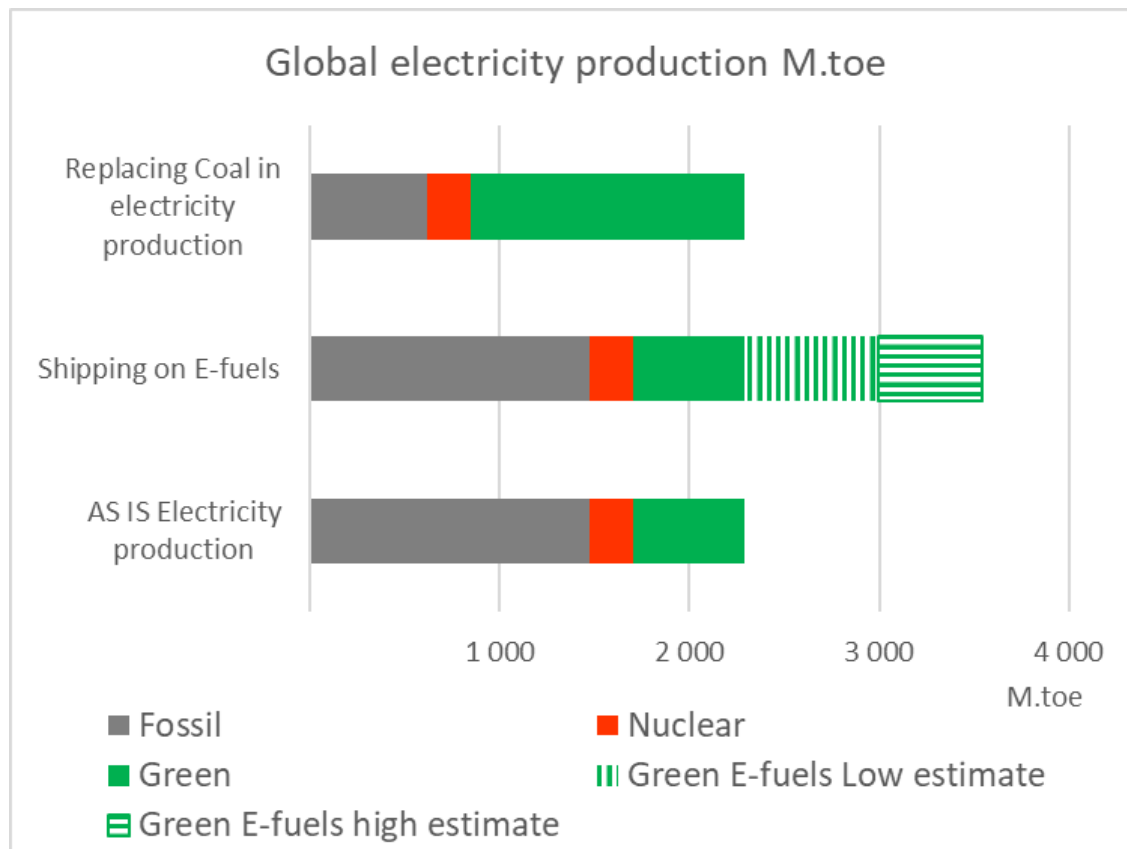
1990 - Production 8 790 M.toe



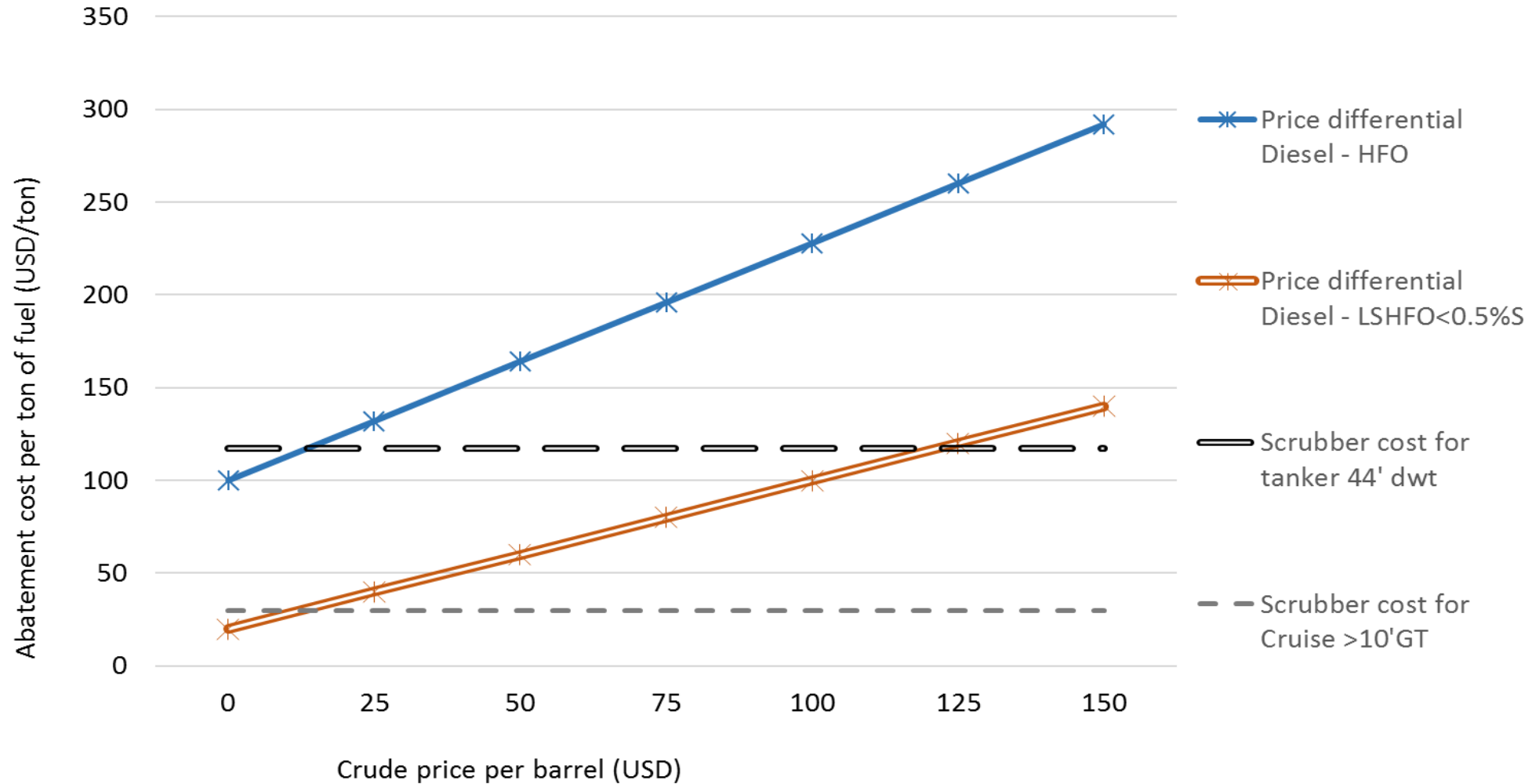
2018 - Production 14 207 M.toe



# Why use renewable electricity to produce E-fuels for shipping, when global GHG emissions can be reduced 5 – 10 more times per kWh by instead replacing coal fired power plants



# Abatement cost with scrubber versus VLSFO and Diesel as a function of crude oil price (source: Lindstad et al 2017)



# Scrubbers versus conventional compliant fuels

- Scrubber is most cost efficient for large consumers and at high fuel prices for nearly all vessels
- With a low price differential between VLSFO and HFO, VLSFO is a competitive options for low and medium sized consumers
- Diesel is only an alternative for the smallest consumers of HFO today



# NEXT GENERATION SCRUBBING – WHAT ENHANCEMENTS ARE SET TO COME

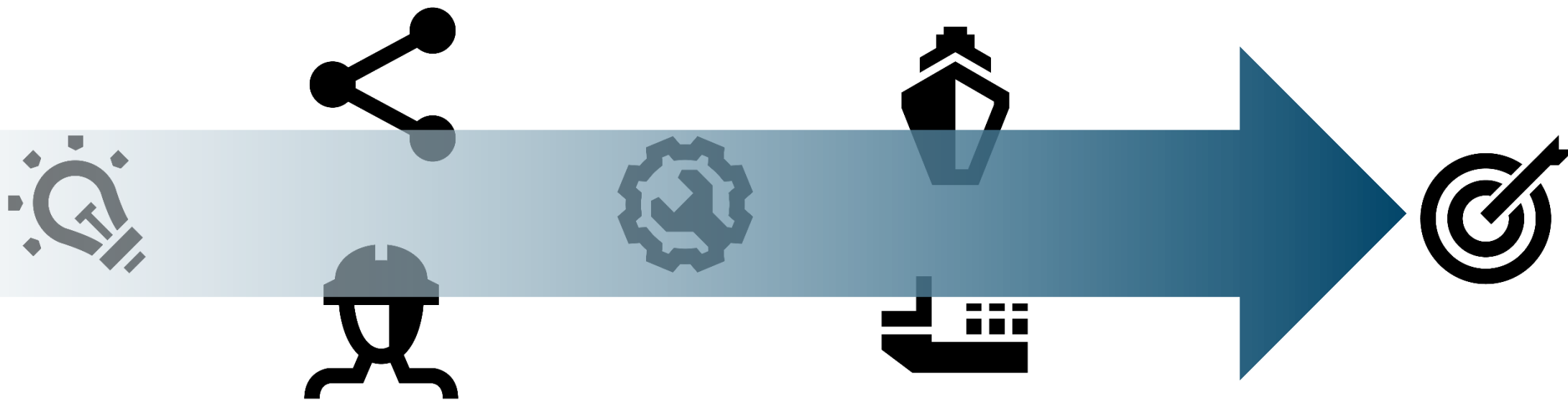
SCRUBBERS BRIDGING THE GAP TO ZERO EMISSIONS  
APRIL 6<sup>TH</sup> 2021

ASLAK SUOPANKI, WÄRTSILÄ





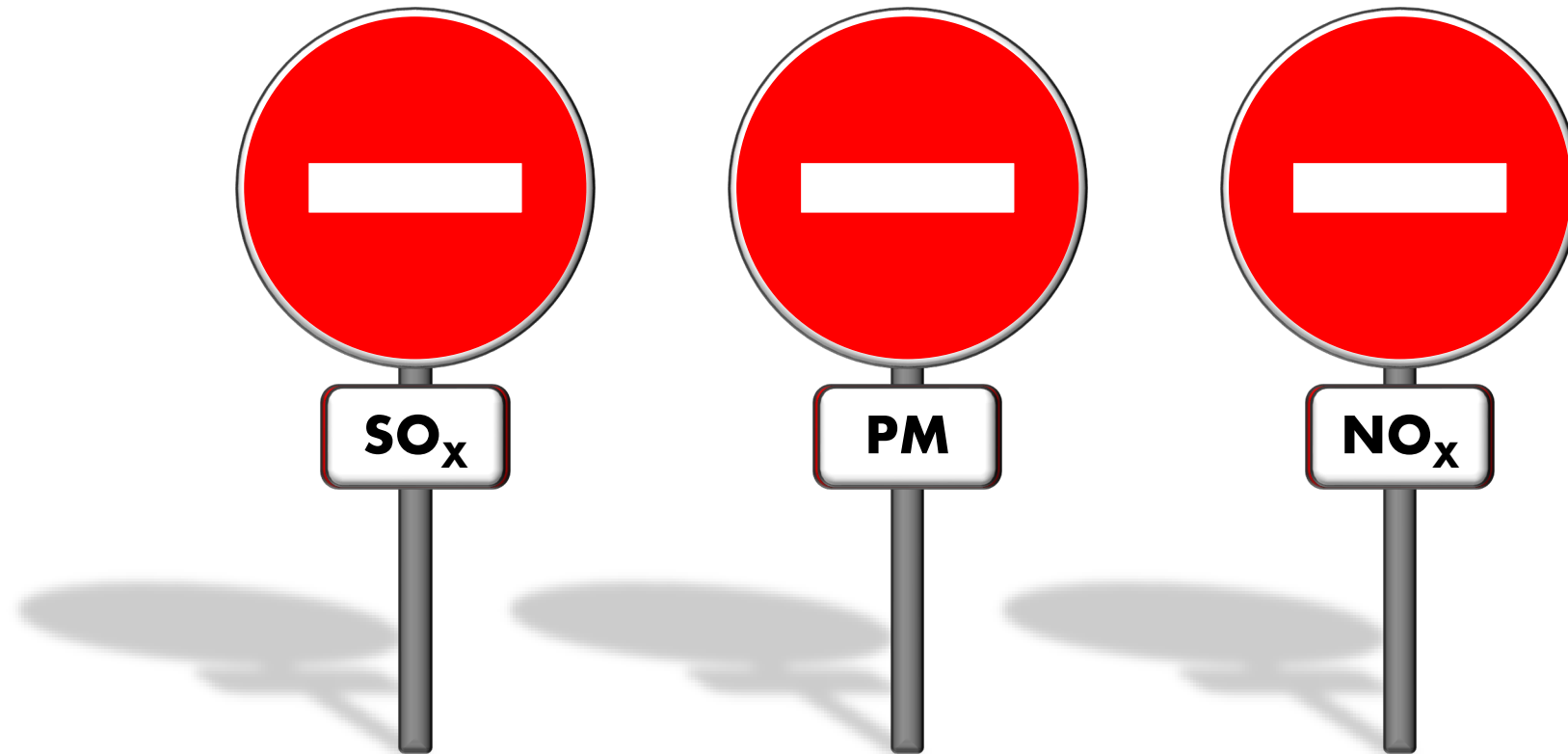
# FROM IDEAS TO REALITY...



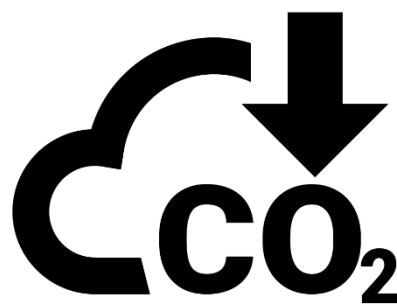
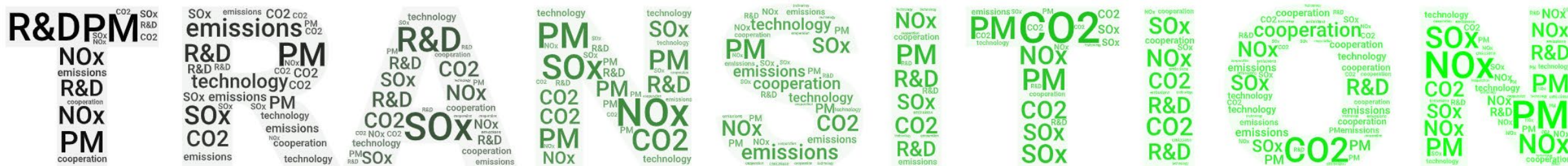
# CREATING LEADING TECHNOLOGIES...



# ADDRESSING BOTH TODAY'S AND TOMORROW'S EMISSION CHALLENGES...



## AND ENABLING THE ZERO-EMISSIONS TRANSITION





**WÄRTSILÄ**