

ACCELERATING THE TRANSITION TO NET ZERO

Jason Miles – Chief Executive Officer

quadrisefuels.com

BioMSAR™ MSAR®

2ND AMERICAN GREENTECH AND DECARBONIZING SHIPPING FORUM

October 11 Miami

AGENDA

1

THE ROLE OF FUEL TECHNOLOGY TO DECARBONIZE SHIPS

2

RAPID SOLUTIONS FOR AFFORDABLE DEPLOYMENT TODAY

3

ASSISTING REGULATORY COMPLIANCE



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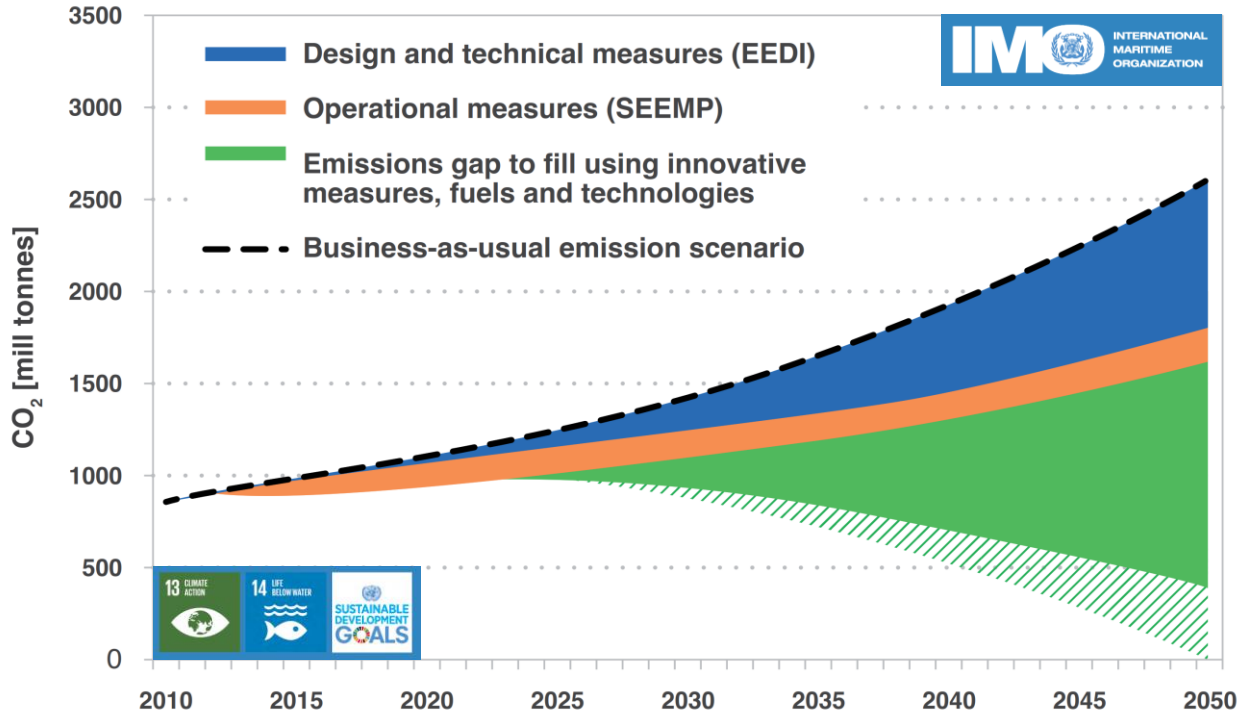
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REDUCING MARINE GHG EMISSIONS HAS BECOME AN IMPERATIVE

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New pressure to accelerate decarbonization in the maritime sector



COURTESY OF THE INTERNATIONAL MARITIME ORGANISATION : IMO ACTION TO REDUCE GREENHOUSE GAS EMISSIONS FROM INTERNATIONAL SHIPPING

New global IMO regulations are looming large:

1. **SEEMP & CII**
2. **EEDI and EEXI**

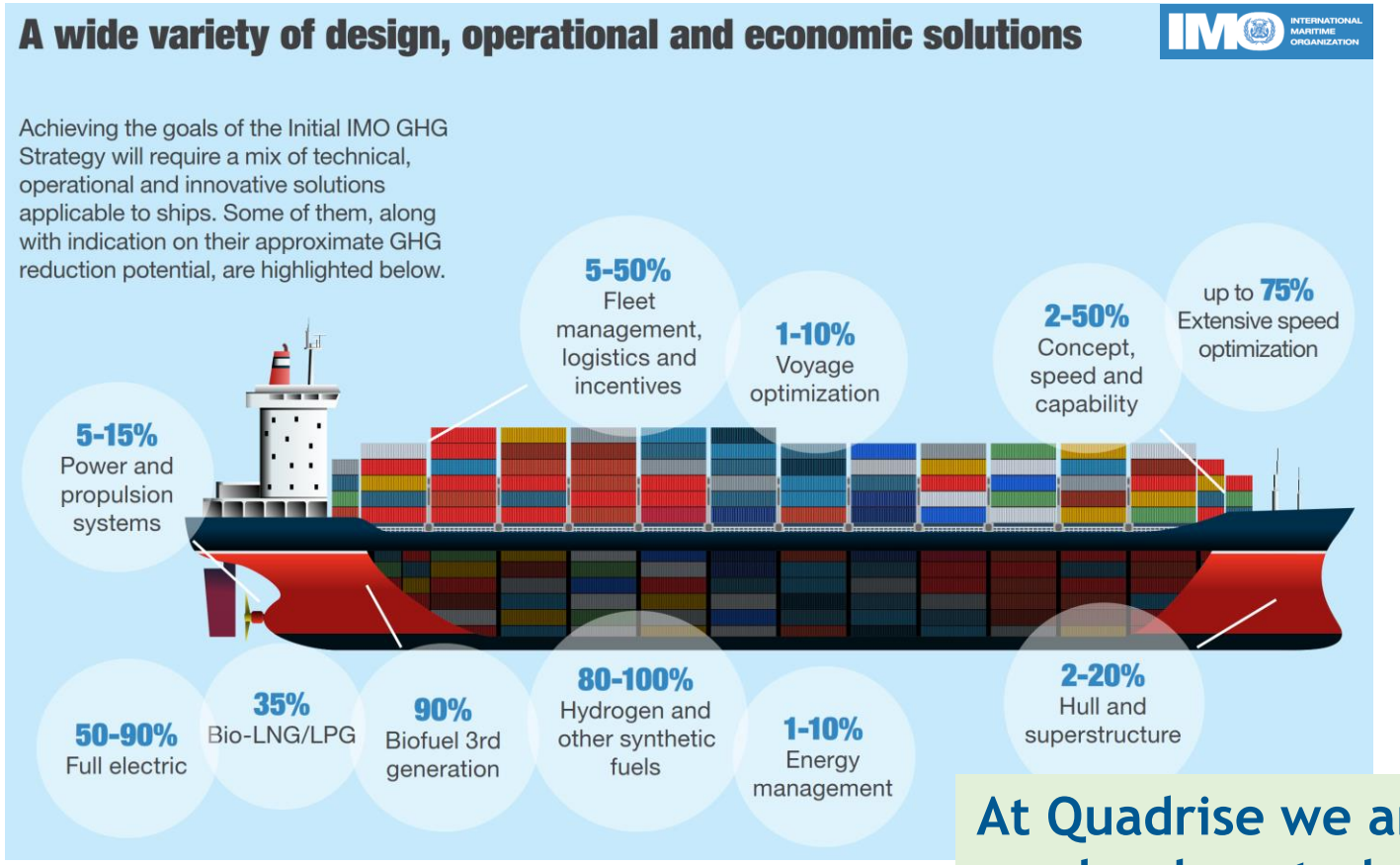
Coupled with new regional rules, such as EU Fit for 55

With particular implications for existing vessels over 10 years old…

TECHNOLOGY SOLUTIONS AVAILABLE, ALBEIT THEY NEED $-$$$ INVESTMENT

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Decarbonization solutions – there are many!



COURTESY OF THE INTERNATIONAL MARITIME ORGANISATION : IMO ACTION TO REDUCE GREENHOUSE GAS EMISSIONS FROM INTERNATIONAL SHIPPING

At Quadrise we are focusing on what can be done today for our clients to:

1. **Improve energy efficiency / SFOC**
2. **Lower emissions of CO_2 NO_x PM**

Using disruptive fuel technology that lower costs. Rapid ROI and deployment.

EMULSIONS, HOW CAN THEY HELP THE MARINE SECTOR?

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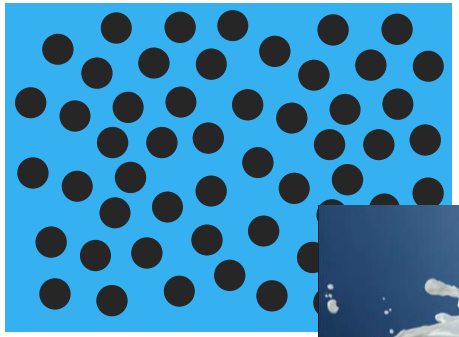
Water-in-Oil Emulsions



Oil viscosity is unchanged



Oil-in-Water Emulsions



Oil viscosity is reduced



In fuels, water addition can enhance performance & reduce emissions

5 LITRES OF WATER FOR 500 HORSES.

8% greater performance. 8% less consumption.



Most experience in the marine sector has focused on Water-in-Oil emulsions.

These systems reduce NOx emissions but have limitations as increasing water addition increases fuel use and GHGs.

Quadrise are Oil-in-Water fuel specialists.

ADVANCING FUEL & BIOFUEL BLENDING



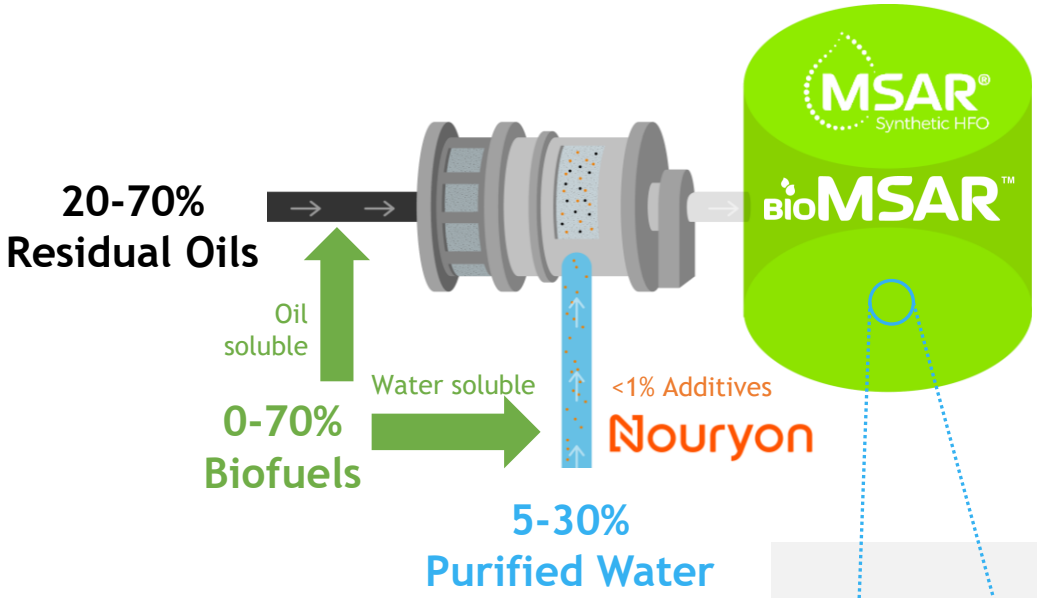
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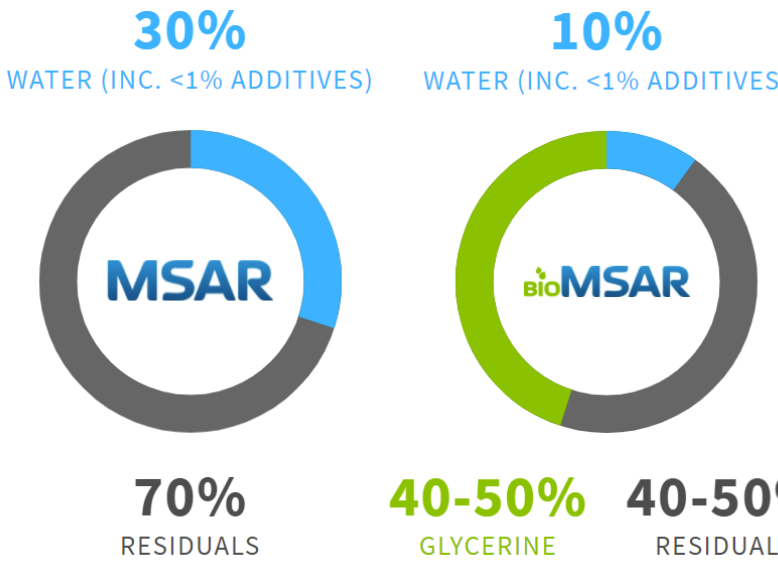
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OUR TECHNOLOGY

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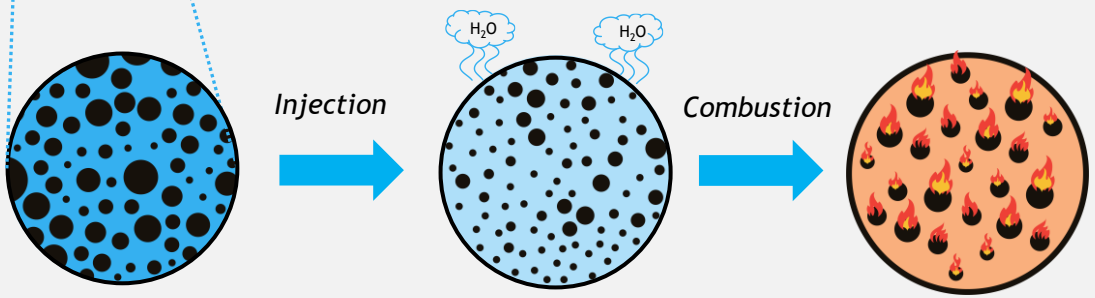
Advanced Emulsion Fuel Technology





Proven commercial technology is used to blend a range of conventional fuels and biofuels, both oil and water-based, into ultra-stable emulsion fuels/biofuels.

Combustion of MSAR® and bioMSAR™



*The water phase carries the tiny (5-10 microns) **atomized oil droplets***

*The **water evaporates** dispersing the oil droplets to sub-micron sizes*

*Nano droplets combust completely, providing **perfect energy conversion***

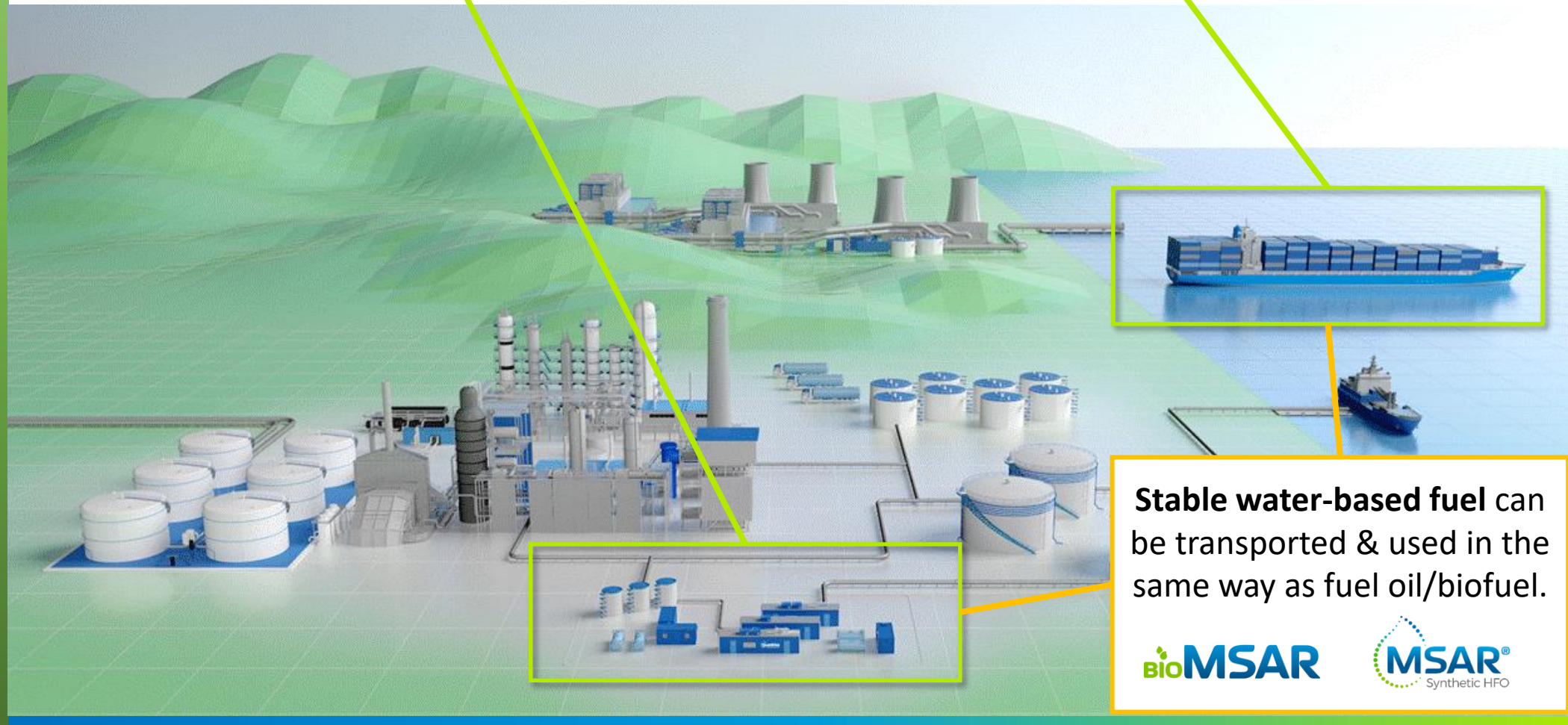
SYSTEM APPLICATIONS

Refinery/terminal blending technology

blends conventional heavy fuels, residuals and biofuels inline with water and additives to reduce costs and emissions.

Blend-on-board technology

blends conventional marine fuels and biofuels inline with water and additives to reduce costs and emissions.



Stable water-based fuel can be transported & used in the same way as fuel oil/biofuel.

BioMSAR MSAR® Synthetic HFO

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BENEFITS

MSAR® Synthetic HFO

BioMSAR™

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Quadrise Fuels International plc

Benefits For The Marine Sector



✓ CLEANER

- 25% less NOx, no Black Soot
- More efficient, lower CO_2



✓ CHEAPER

- Lower energy cost vs marine fuels & biofuels



✓ SAFER

- No impact to crewing
- Less hazardous



✓ SCALEABLE, TODAY

- Simple vessel conversion
- 10-15 large vessels/module

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DIESEL ENGINE EXPERIENCE

- Quadrise has >60 million tons of emulsion experience
- 150,000 reliable running hours on 4-stroke Wartsila engines (32 & 46) for base-load power generation
- Comprehensive 2-stroke marine MSAR® programme with Maersk, on MAN and Wärtsilä engines, resulting in:
  - Trials on MAN D&T, Mitsui & Wärtsilä test engines
  - Proof of concept tests at sea on Maersk Bogor and Seago Istanbul vessels
  - Operational trial on Seago Istanbul (~1500 hours)
  - Interim LONO obtained on Wärtsilä Flex 96 (69MW)
- **2023 vessel trials planned with MSC Shipmanagement**











Maersk Bogor 43,000 DWT (MAN B&W 7K80ME-C9)





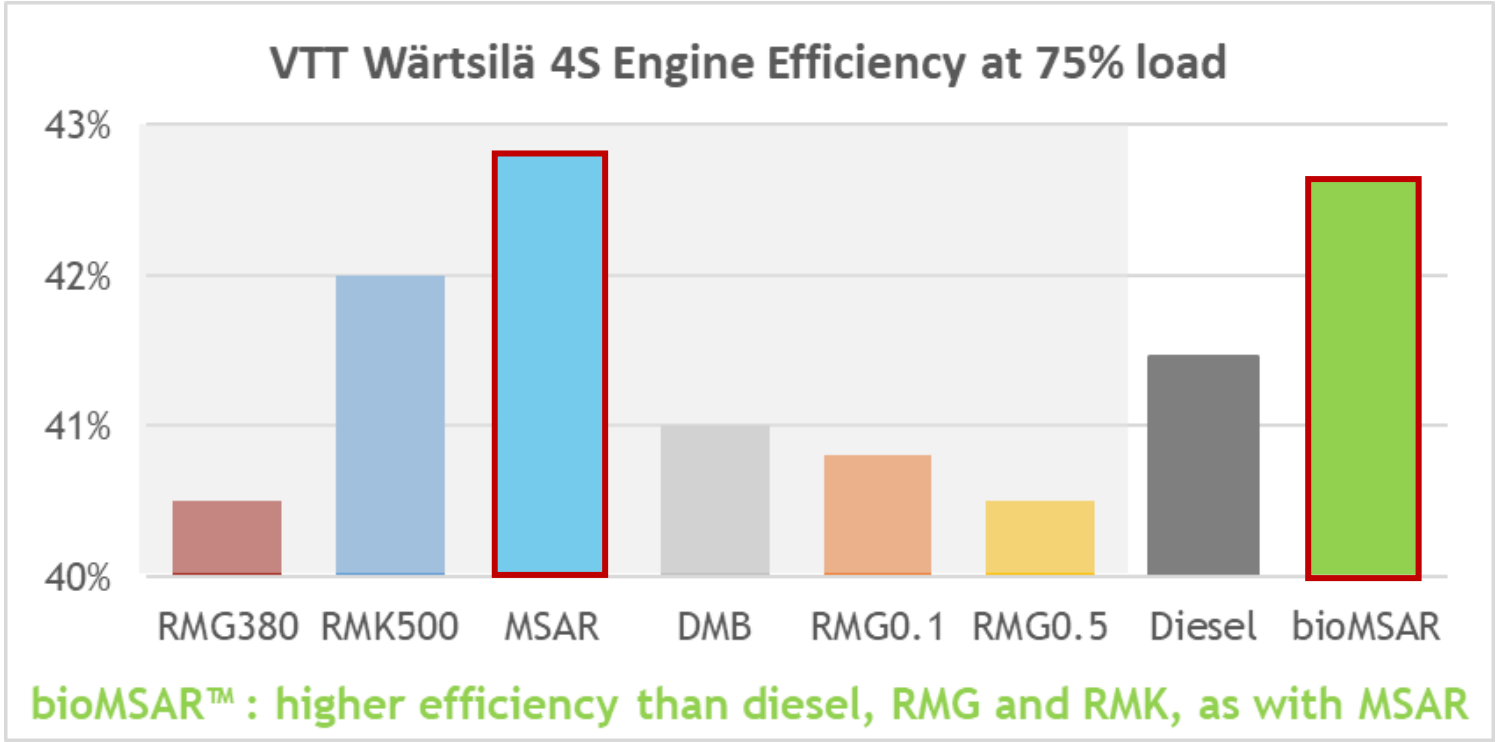
Seago Istanbul 54,000 DWT (Wärtsilä 12 RT-Flex 96 C-B)

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4S DIESEL ENGINE EFFICIENCY

Higher engine efficiency versus LFO/RMG on 4-Stroke Wartsila

- Emulsion fuels consistently more efficient than diesel and RMG, up to 7% better at engine loads of 50-90%.
- Higher efficiency results in lower energy consumption & lower GHG emissions.
- The bioMSAR™ results are consistent with prior testing on MSAR®.

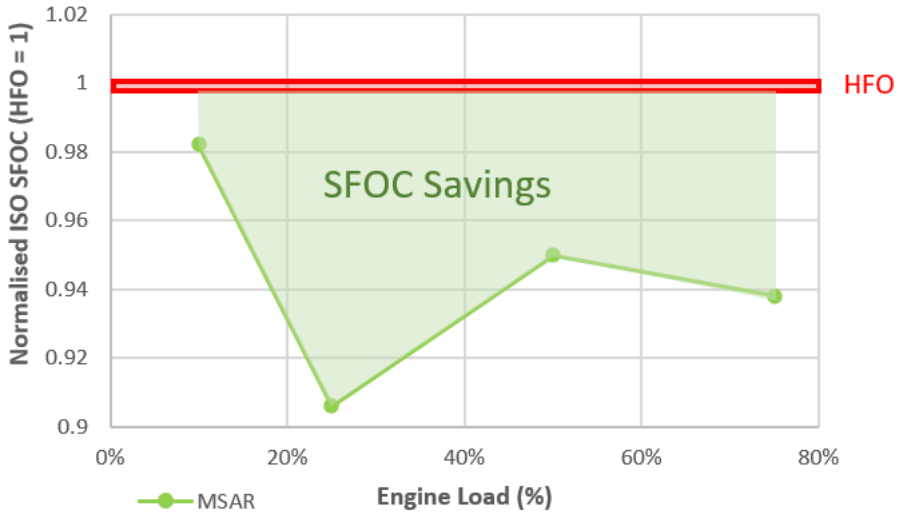


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2S DIESEL ENGINE EFFICIENCY

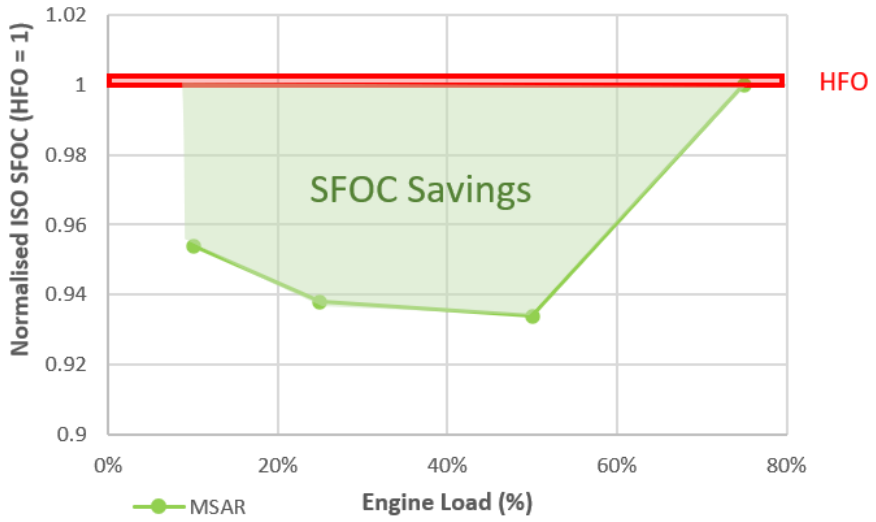
Up to 9% fuel consumption savings

Stationary Engine Test



Wartsila Winterthur (Flex 4RT 60C)

Seaborne Commercial Vessel



Seago Istanbul (12RT Flex 96C-B)

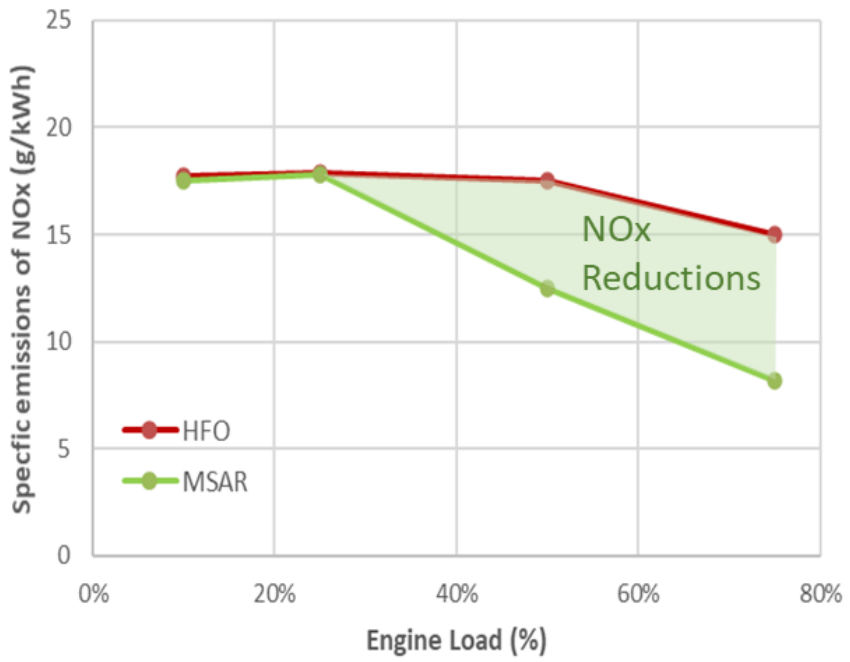
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2S DIESEL
NOx EMISSIONS

Up to 45% lower NOx reductions at higher engine loads

Stationary Engine Test

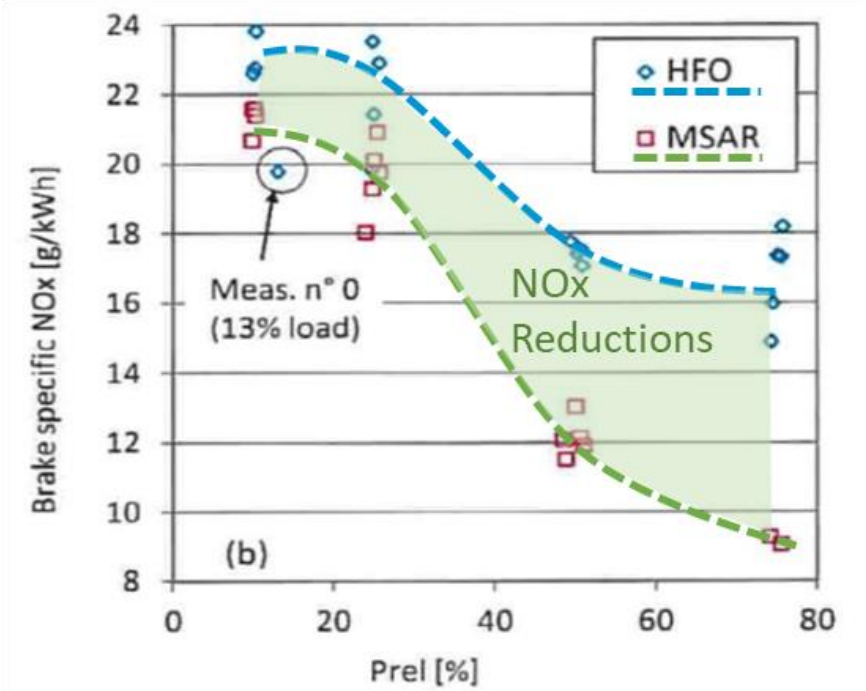
Engine Loads: 10% 25% 50% 75%



Wartsila Winterthur (Flex 4RT 60C)

Seaborne Commercial Vessel

Engine Loads: 10% 25% 50% 75%



Seago Istanbul (12RT Flex 96C-B)

Plus… reduced smoke (black carbon) emissions

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THE TRANSITION
TO NET ZERO

REDUCING FUEL COSTS

IMPROVING EFFICIENCY

LOWERING EMISSIONS

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Fuel consumption & resulting GHG/CO_2 emissions are reduced, NO_x emissions are reduced substantially…

How?

1. MSAR® technology reduces the viscosity of marine fuels, which reduces fuel injection duration times needed for water addition.
2. The oil/biofuel droplets injected are 5-10µm in size, which is much lower than achieved by conventional fuel injection systems, hence they burn quickly and completely for efficient energy conversion and low unburned hydrocarbon (Black Soot).
3. Fuel injection & combustion temperatures are lower, improving engine energy transfer, overall efficiency & reducing NOx.

To deliver new solutions to the marine industry, key is collaboration & new energy pathways to meet net-zero.

COMMERCIAL VESSEL TRIALS

MSAR® Synthetic HFO

BioMSAR™

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Quadrise Fuels International plc

MSC Container Vessel Trials - 2023

2H'22

- *Wartsila Fuel Testing.*
- *Class Society & Flag Approvals.*
- *Vessel Readiness & Commissioning.*



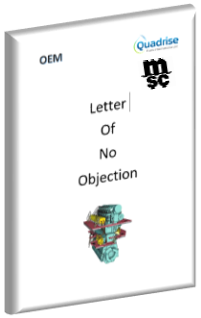
1H'23

- *Proof Of Concept Testing*
- *Bunker Partner Readiness for Fuel Supply*

2H'23

- *Interim Inspection*
- *4000h Inspection for Flex LONO*
- *Commercial Supply (STC)*







MSC Container Vessel & Main Engine Specs:

- ✓ 54,000DWT 4500TEU Feeder
- ✓ Wartsila 12 RT-Flex 96C-B

Trial KPIs:

- ✓ Fuel efficiency
- ✓ Emissions
- ✓ Safety & reliability
- ✓ Crew operations

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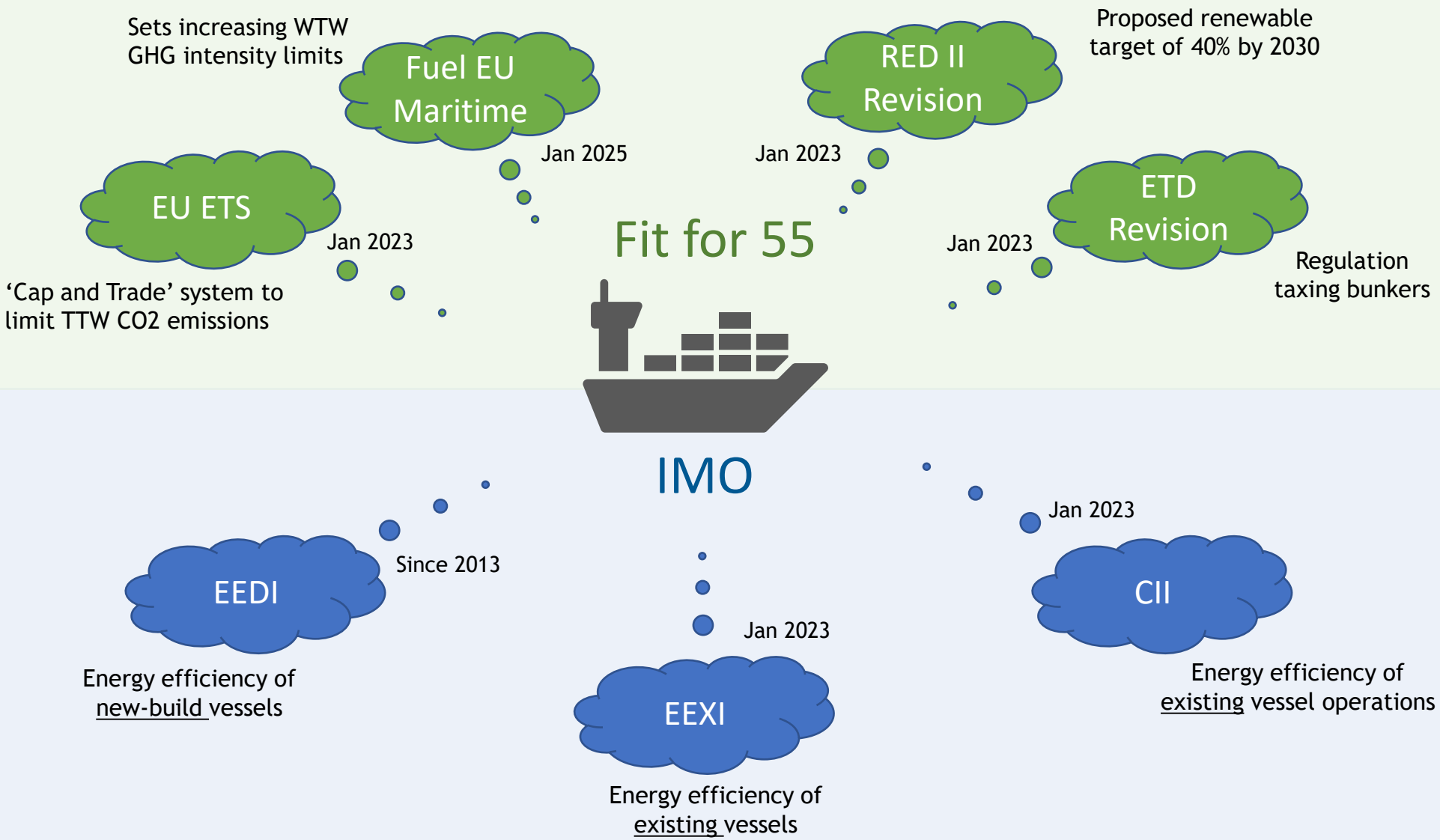
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FORTHCOMING REGULATIONS

New regulations focus on decarbonization



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These regulations are material to existing vessels >10 years old

A MULTI-FUEL LOWER GHG PATHWAY IS NEEDED FOR MARINE, ONE SIZE DOES NOT FIT ALL

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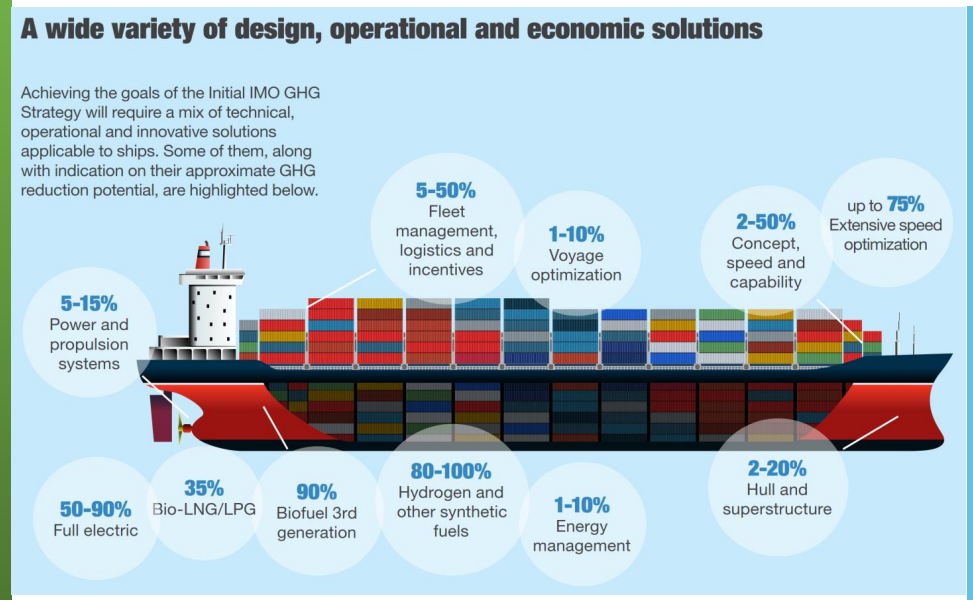
Large Container Vessel Example

Using 25,000 tpa bunkers emitting ~89,000 tpa CO_2 "Well-To-Wake" (WTW)

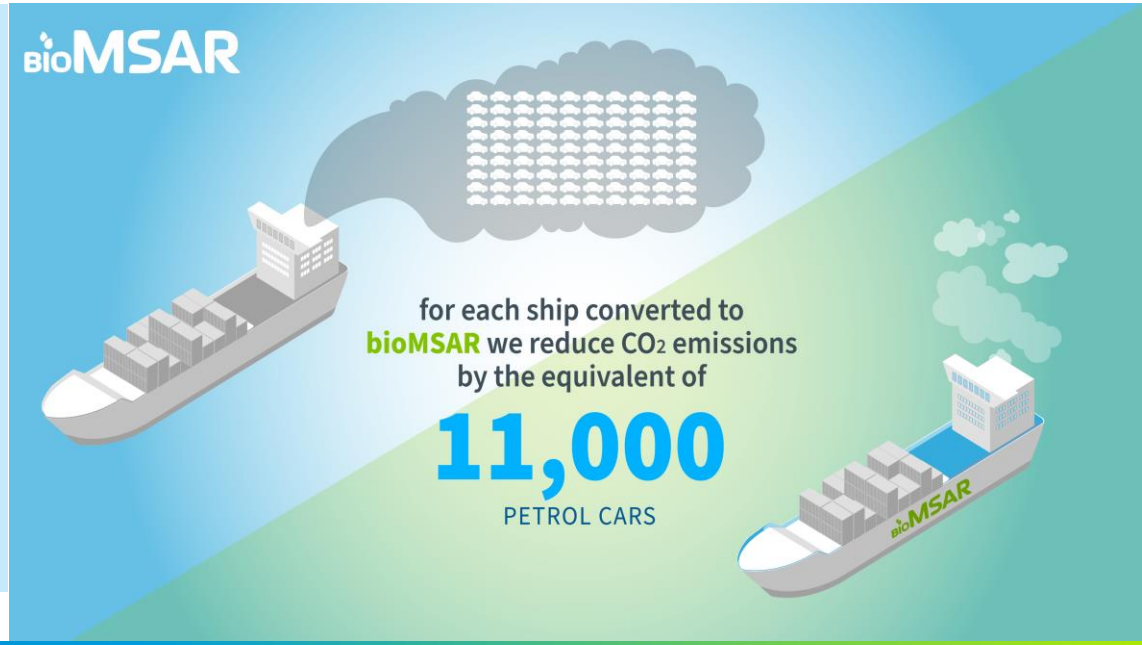
Options are available today to rapidly reduce CO_2 emissions:

- **MSAR®** is >**5%** more efficient, saving **>4,000tpa CO_2** improving CII/EEXI rating
- **LNG** conversion saves **14%** or **12,000tpa CO_2**, assuming methane slip is negligible
- **bioMSAR™** and biofuel blends reduce CO_2 by >**25%**, saving **>22,000tpa CO_2**

MSAR®, bioMSAR™ & LNG also offer solutions to reduce NOx and tune for efficiency



COURTESY OF THE INTERNATIONAL MARITIME ORGANISATION



COLLABORATING TO TRANSITION TO NET-ZERO.

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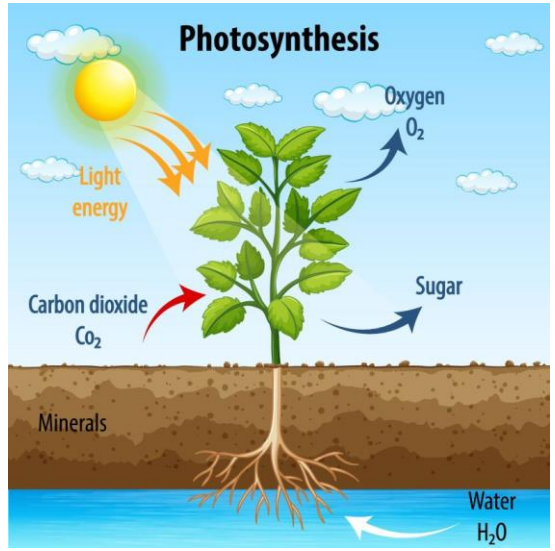
QUADRISE MSAR® & BIOMSAR™ HAVE A KEY ROLE IN ACCELERATING THE ENERGY TRANSITION TO NET-ZERO



MSC Rallies Net-Zero Momentum at Maritime Transport Efficiency Conference

29/09/2022

*"Prabhat Jha, went on to highlight MSC's partnership on a proof of concept with fuel supplier, Quadrise, to use cleaner and more efficient fuel. MSC will trial the use of Quadrise's oil-in-water emulsion fuels (MSAR and bioMSAR), which produce 25% less NOx and lower CO2 emissions. Trials are set to commence in Q1 2023 and to be completed by Q3 2023." **



WE'RE COLLABORATING WITH GREAT COMPANIES & INNOVATORS

* Ref: https://www.msc.com/en/newsroom/news/2022/september/msc-rallies-net-zero-momentum-at--maritime-transport-efficiency-conference

SUMMARY

ACCELERATING THE TRANSITION TO NET ZERO

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Addressing the need to decarbonize…

Quadrise technology offers marine solutions that:

1. Improves engine efficiency, reducing fuel use & costs
2. Enhances the use of existing and future fuels/biofuels
3. Reduces emissions of GHGs, NOx and Black Carbon
4. Provides scalable solutions for net-zero future energy

We are proud to play our part in decarbonizing shipping.

30%
WATER (INC. <1% ADDITIVES)



70%
RESIDUALS

10%
WATER (INC. <1% ADDITIVES)



40-50% GLYCERINE
40-50% RESIDUALS

SUSTAINABLE DEVELOPMENT GOALS



QUADRISE NET-ZERO SOLUTION BY 2030

Quadrise Fuels International plc

CLEANER FUEL CLEANER PLANET

Q&A



ANY QUESTIONS?

info@quadrisefuels.com @QFIPLC

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