
Quadrise
Fuels International plc

2016 Annual General Meeting

12pm December 2nd - Hilton Double Tree

Quadrise Fuels International plc

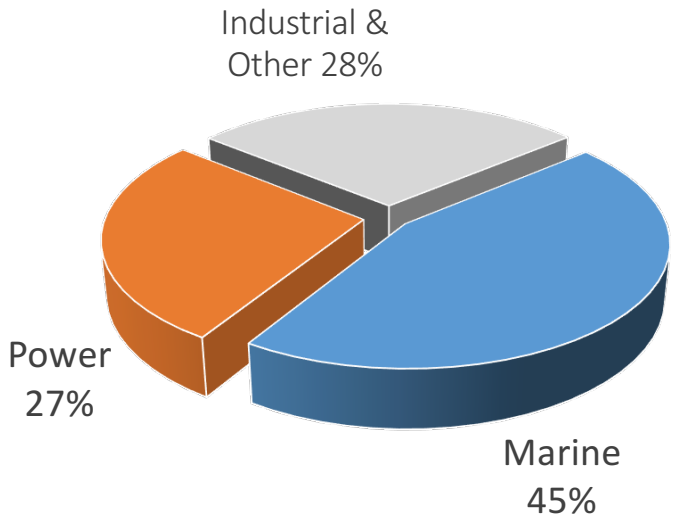


Introduction

- Quadrise is the supplier of MSAR® technology that produces a lower cost, cleaner synthetic Heavy Fuel Oil ("HFO") for marine, power and industrial applications
- MSAR® is proven, proprietary oil refinery technology offering material economic and environmental benefits to producers and consumers
- IP is protected jointly with Akzo Nobel and projects are being developed with major global companies
- HFO is a US$106 billion global market, >450 million tonnes sold annually

MSAR® Synthetic HFO = Multiphase Superfine Atomised Residue

The $106 billion HFO market



Quadrise is focused on two major sectors:

- Marine ($48 bn/annum)
  - *…concentrated in 5 main sales hubs*
- Power generation ($28 bn/annum)
  - *…main consumers: the Middle East and Asia*

Worldwide some 455 million tonnes of HFO is sold annually

The marine fuel market alone is expected to require 320m t/a by 2020

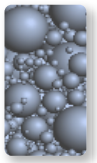
Significant Progress

- 2016 is proving to be a pivotal year for Quadrise
- Significant progress made in core marine and power generation projects:
  - Marine operational trial with Cepsa and Mærsk commenced in July, progressing well
  - A successful outcome is key to establishing commercial contracts for marine operations in 2017
  - Kingdom of Saudi Arabia MOU signed, major 'Production to Combustion' trial planned for 2017
  - Long-term Akzo Nobel partnership underpins commercial plans and IP – agreements recently extended to at least November 2018
  - Expansion to UK Research, Development & Innovation facilities to underpin Intellectual Property
- Quadrise is poised for commercialisation during 2017

MSAR® Technology – driving value delivery

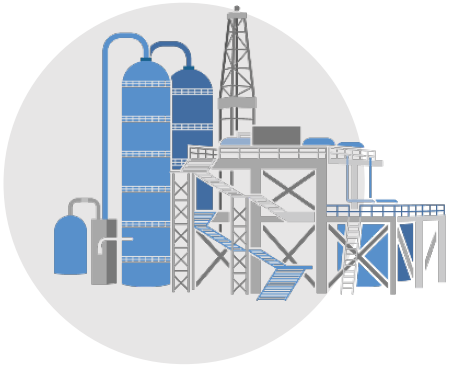


Quadrise license and supply MSAR® technology and additives to produce a stable 'Oil-in-Water' emulsion fuel



How it works:

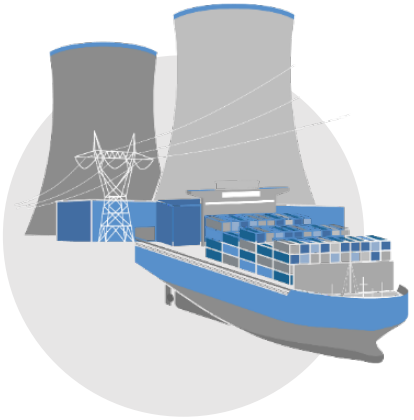
Tiny droplets of extra-heavy hydrocarbon are dispersed in water using proprietary processes and additives



MSAR® provides refiners with low-cost, rapidly deployed upgrading solutions for HFO

Key benefits:

- ✓ *Water & chemicals replace premium fuels*
- ✓ *Significant value is added*
- ✓ *MSAR® viscosity is lower*



Delivers HFO consumers with tangible cost savings and environmental benefits

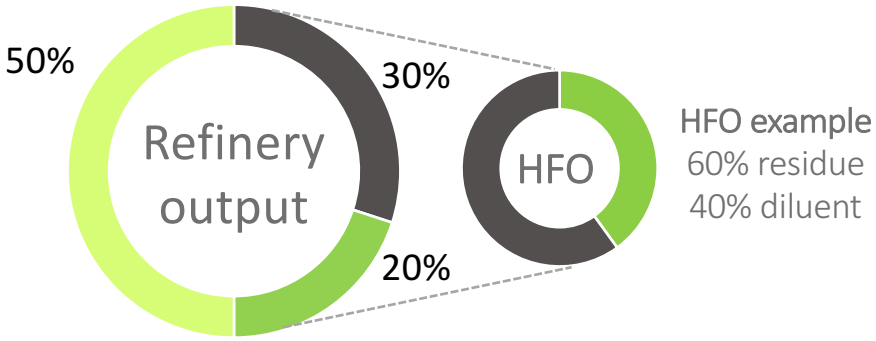
Key benefits:

- ✓ *Stable, lower cost synthetic HFO*
- ✓ *Enhanced combustion & lower emissions (NOx, PM)*

Economic drivers

Creating value at the refinery - shared with consumer* and Quadrise

Traditional refinery process



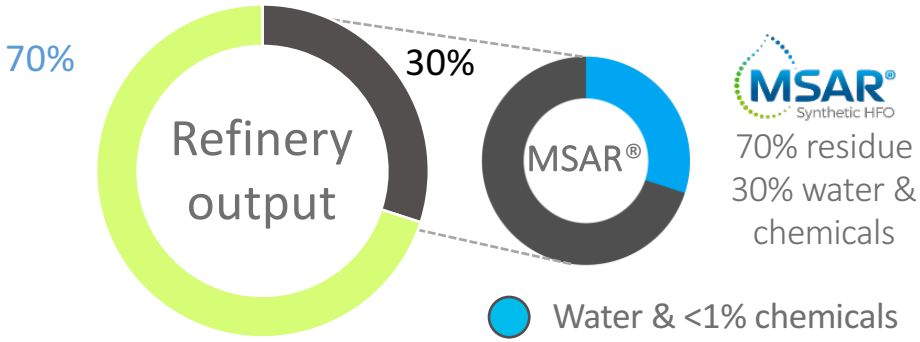
Every barrel of high value premium fuel used to create HFO is lost margin to the refinery

High value transport fuels

High value fuels used to dilute HFO

Residual fuels

An MSAR® refinery



An additional 20% of high value fuel can be sold by the refinery at the market rate

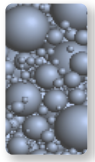
Other MSAR® benefits:

- Modular scalable units
- Low capital cost, rapid payback
- Rapid execution (<12 mths)

* Price of MSAR® < HFO on a per unit of energy basis

Environmental Benefits

With MSAR®:
Tiny droplets of hydrocarbons are dispersed in water



5-10 micron droplets

1. Energy Savings
✓ **MSAR® is stored & transported at ambient temperatures (>25°C)**

2. Efficient Combustion
✓ **Complete Carbon burnout = lower PM* emissions = less Black Carbon (BC)**

3. Lower NOx Emissions
✓ **Water reduces the combustion temperature = >20% lower NOx emitted**

MSAR® Benefits

MSAR® use = Lower Cost Fuel + Less Heating + Reduced NOx and PM/BC Emissions

Enables Affordable Compliance with Environmental Standards

** PM = Particulate Matter*
NOx = Oxides of Nitrogen

Environmental Compliance

Increased focus on emissions in Marine sector:

Oxides of Nitrogen (NOx):

- New build engine limits have reduced by over 75% in 2016
- Tier III compliance options are expensive for owners to operate

MSAR® Benefits: >20% lower NOx

✓ Tier II engines can be tuned for fuel efficiency
✓ Tier III compliance costs are lower

Oxides of Sulphur (SOx):

- ECA fuel sulphur limit 0.1% since 2015
- Global limit of 0.5%S targeted for 2020
- Implementation roadmap due May '17
- 2 Compliance options: Fuel or Scrubber*

MSAR® Benefits: Affordable Compliance

✓ Refinery investment is minimal, low CO_2 impact
✓ Expensive distillates benefit MSAR® economics
✓ **Scrubber uptake can be subsidised & accelerated**

The future post 2020 will be largely a mix of compliant fuel and marine scrubbers, with scrubbers expected to be preferred choice for larger fleets and new builds because of the lower overall OPEX

** A marine scrubber enables a high sulphur fuel to be used by the vessel, the flue gas is treated ("scrubbed") prior to release to the air, thereby reducing emissions of oxides of Sulphur (SOx) and PM/BC*

MSAR® Synthetic HFO - Key Projects

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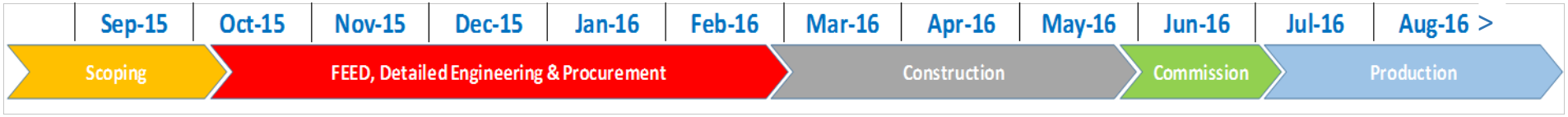




Marine MSAR® for Diesel Engines

- MSAR® is proven on Wärtsilä 4-stroke engines
- 2 stroke engine application on the final stage of testing by Mærsk
- “Operational Trial” contracts with Cepsa and Mærsk signed Q4 2015
- Fast-track operational commercial-scale MSAR® facility installed within 9 months





WÄRTSILÄ CORPORATION

Lloyd's Register



CEPSA

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Marine MSAR® - Progress

- A 6KBPD MSAR® system is installed at the Cepsa 240,000 BPD* Gibraltar San Roque Refinery
- Quadrise responsible for MSAR® system installation, commissioning, production & quality control
- MSAR® production & Mærsk vessel testing progressing well, interim vessel inspection Spring 2017
- “Letter Of No Objection” from engine manufacturer anticipated around middle of 2017
- Commercial supply opportunity pending operational and LONO trial success & contracts





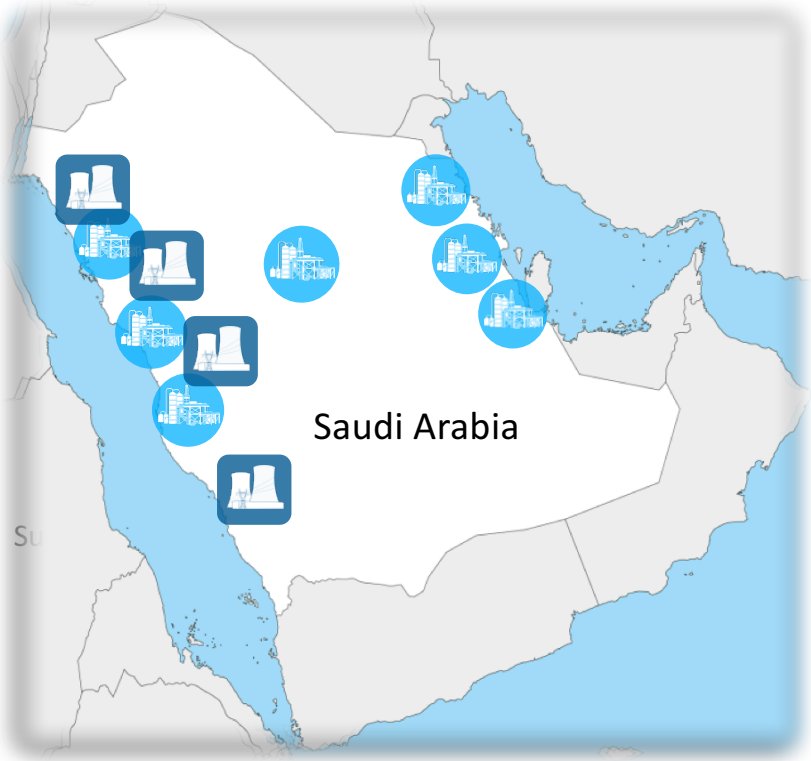
* BPD - Barrels per day

Power MSAR® - Kingdom of Saudi Arabia (KSA)

Replace oil used for power with MSAR®

- Total oil use for power generation is currently ~51mtpa
- Significant imports of distillate products and subsidies for domestic products and energy sales
- 2015 fuel mix :

  Gas 43%, Crude 32%, HFO 12%, Diesel 13%
- National imperative to reduce domestic crude oil use
- Power facilities dominated by SEC (62%)
- Recent MOU signature is the culmination of extensive work with clients and local partner over several years



Major centres of oil-fuelled power generation

Major refining centres

Power MSAR® – 400MWe Trial – KSA



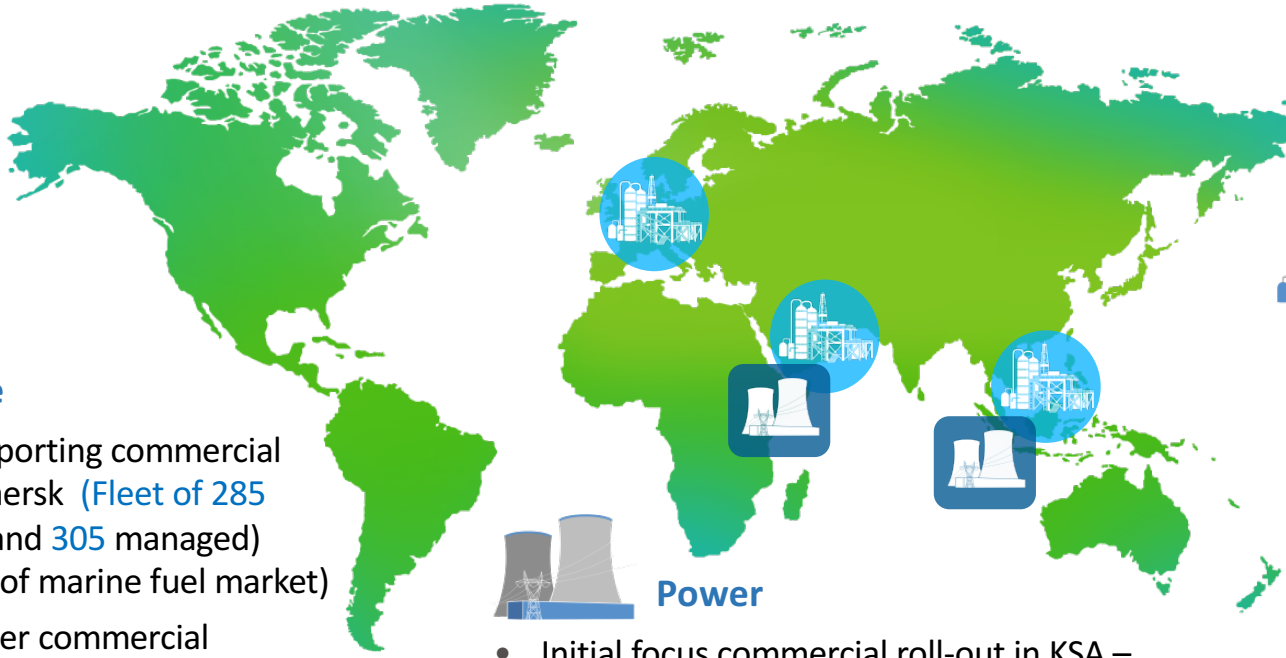
- West coast trial candidates established:
  - Major refinery complex with nearby utilities supply
  - Largest oil-fired power generation facility in KSA
- Scope of demonstration:

  Refinery production of MSAR® & associated coastal supply to…

  …a modern 400MWe* baseload unit for combustion & boiler test over several months
- Current status:
  - Refinery tie-ins completed
  - MOU signed August 2016
  - Engineering studies now underway for refinery and power plant
  - Contracts to enable trial installation to progress anticipated in 1H 2017
  - Contracts enable refinery and power plant installations for MSAR® testing during 2H 2017

** Note : One 400MWe boiler at 75% capacity consumes around 1 million tonnes/year of MSAR®*

Delivering value globally



Marine

- Initial focus supporting commercial roll out with Maersk (Fleet of 285 owned vessels and 305 managed) **9.5M mt/a** (**6%** of marine fuel market)
- Expand into other commercial shipping operators through common fuel hubs

Power

- Initial focus commercial roll-out in KSA – **51M mt/a** oil for Power generation (**40%** of power market)
- Expand selectively into other markets in Middle East and Asia

Complementary Opportunities

- Refinery power & steam opportunities
- Synergies of working collaboratively with refiners at global fuel hubs to provide MSAR® for Marine & Power sectors

Major fuel oil hubs and refining centres

Major centres of oil-fuelled power generation

Results for YE 30 June 2016

- Loss after tax of £4.8 million (2015: £4.9 million)
- Cumulative tax losses of £41.1 million (2015: £40.7 million) available for set-off against future profits
- Further investment in R&D and operations support
- £4.3 million in cash reserves at YE and debt free
- Placing and Open Offer raised £5.25 million (gross) post year end to:
  - Strengthen the company's balance sheet
  - Support continued operational and R & D resource enhancements
  - Enable the transition to self-sustaining commercial revenues

Summary

Q&A

- MSAR® is a disruptive technology in the downstream oil sector
- Substantial progress made in final stage commercial trials for both the marine fuel and power generation markets with major global clients
- Quadrise poised to move into commercial operations during 2017
- Executive and management team has the skills to drive the business through commercial roll-out
- MSAR® technology is IP protected jointly with AkzoNobel
- Funds raised in Placing and Open Offer will enable Quadrise to generate sustainable revenues and profits


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Supporting Information

Marine MSAR® Development history

- MSAR® has already been proven in Wärtsilä 4-stroke diesel engines
- Joint development with Mærsk commenced in 2008 to demonstrate MSAR® use in large 2-stoke diesel propulsion engines
- Laboratory and land-based tests completed during 2009-2013
- Two sea-borne “proof of concept” vessel tests completed in 2014
- Joint refinery scoping studies carried out during 2014-2015
- “Operational Trial” contracts with Cepsa and Mærsk signed Q4 2015



AkzoNobel relationship

- The AkzoNobel relationship remains central to the Group
- Two principal contracts;
  Joint Development Agreement (JDA) & Exclusive Commercial Agreement

Summary:

- AkzoNobel provide technical expertise to support the JDA
- AkzoNobel supply additives under the Exclusive Commercial Agreement
- Quadrise “owns” the customer (refinery & end-user) and OEM relationships

Features:

- ✓ No royalty payments where projects are developed jointly
- ✓ Shared ownership of jointly developed IP
- ✓ Quadrise:
  - Supply OEM equipment & AkzoNobel technical services
  - Own R&D capability to complement joint development

Pioneering Research, Development & Innovation

- UK Research Facility (QRF)
  - Product development to enhance economics & efficiency
  - Fuel emulsion testing from lab to industrial scale
  - QRF is the central service centre for operations support
- University of Surrey – Research Collaboration
  - Centre for Petroleum & Surface Chemistry, formerly with BP
  - Primary research with Prof Spence Taylor aligned to business needs
- Protection of Intellectual Property to create competitive entry barriers
  - JDA patent protection and future joint patents with AkzoNobel









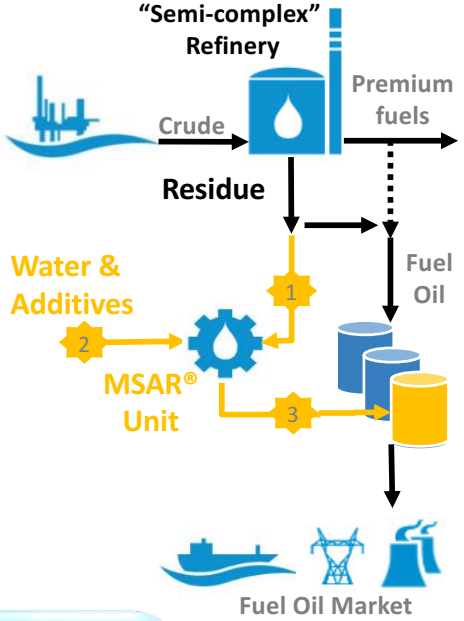
MSAR® Technology : Refinery “Plug & Play”

Refinery integration of the MSAR® blending system:

1) Oil residues are taken direct from refinery and cooled to achieve the required viscosity for the colloid mill.

2) Water together with proprietary additives are added to the residue in a high-speed colloid mill under pressure.

3) The mixture is processed in the mill and cooled to provide highly stable oil-in-water synthetic HFO that can be stored in existing HFO fuel oil tanks.









Environmental Compliance

Marine SOx Compliance Options

Compliant Fuel (e.g. 0.5% "fuel oil" or LNG):

- Likely to drive additional 2-4MB/D increased distillate demand
- Spread between LS distillates & HFO predicted to increase
- For shippers low CAPEX but high OPEX (fuel today is 50-75% OPEX)
- For refiners; billion $ investment needed, +7-16% CO_2 increase

Scrubber Compliance (to meet 0.1-0.5%S equivalent):

- Reduces 2020 distillate demand and refinery investment needs
- Costs $5-10 million per ship, +3-5% CO_2 increase
- For shipper; scrubbers offer higher CAPEX but lowest OPEX
- For refiners; provides an outlet for low value residual oil

Future post 2020 is expected to be a mix of these two options, with scrubbers expected to be preferred choice for large fleets and new builds.

MSAR® options:

1. **make compliant fuel using LS residues.**
2. **Make lower cost HS MSAR® for use in conjunction with scrubbing.**

Option 2 is expected to be the most economic option for both refiners and shippers.

…Future Legislation: Black Carbon (BC)? **MSAR® Benefits: Low BC**


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