EDISON

Quadrise Fuels International

Update on programmes

Steaming ahead

Oil & gas

Since our last outlook note, Quadrise has begun to supply MSAR for extended LONO sea trials, paving the way for commercial adoption from calendar H217 onwards. In August it signed a memorandum of understanding with clients in the Kingdom of Saudi Arabia (KSA), which is a key enabler for progressing the production-to-combustion pilot there. In October it completed a placing and open offer raising a total of £5.25m (gross). This should enable it to transition comfortably to the commercial phase on successful completion of the LONO and KSA trials.

Year end	Revenue (£m)	EBITDA* (£m)	PBT* (£m)	EPS* (p)	DPS* (p)	P/E (x)
06/15	0.1	(2.6)	(2.7)	(0.3)	0.0	N/A
06/16	0.0	(4.0)	(4.1)	(0.5)	0.0	N/A
06/17e	0.9	(4.6)	(4.8)	(0.6)	0.0	N/A
06/18e	18.3	(0.4)	(0.5)	(0.1)	0.0	N/A

Note: *PBT and EPS are normalised, excluding amortisation of acquired intangibles, exceptional items and share-based payments.

Substantial progress on two key programmes

The extremely positive newsflow regarding the Maersk marine programme indicates that the timetable for commercialisation of a substitute bunker fuel in 2017 is achievable. However, while the news of the MoU in KSA clearly demonstrates that the clients in Saudi are committed to a thorough evaluation of the technology, the commercial scale demonstration has been pushed back by around a year compared with our November 2015 note. We have revised our estimates and valuation to reflect this delay and introduce estimates for FY19.

MSAR – the lower-cost fuel solution

The Quadrise process mixes heavy oil residues with water and specialty chemicals from AkzoNobel to produce MSAR, which is a cost-effective, environmentally cleaner substitute for HFO. Refineries produce HFO by mixing residues with valuable middle distillates. More than 450Mt of HFO is consumed globally each year. About 40% is consumed by marine fleet operators, for which fuel is the largest proportion of operating costs, making a potentially lower-cost, more environmentally friendly substitute such as MSAR an attractive proposition. Around 30% of HFO is used in power generation. By substituting MSAR for power generation, oil-based economies can reduce the volume of middle distillate consumed in HFO production and crude oil used in power generation. Refineries can divert middle distillates to more profitable applications and generate revenues from MSAR sales.

Valuation: Increase in value with commercialisation

Our valuation is based on potential cash flows from projects in different markets, applying a blended discount factor to reflect specific country and execution risk. We revise our indicative value from £431m to £325m (38p/share) to reflect more conservative estimates of the volumes of MSAR produced longer term for both the marine and KSA programmes as well as the delay to the Saudi programme.

1 November 2016

Price	**11.4p**
Market cap	**£98m**
Net cash (£m) at end June 16 Prior to open offer and placing raising £5.25m (gross)	4.3
Shares in issue, including shares issued from placing and open offer	862.2m
Free float	64%
Code	QFI
Primary exchange	AIM
Secondary exchange	N/A

Share price performance

%	1m	3m	12m
Abs	(8.9)	19.8	(35.9)
Rel (local)	(9.2)	16.2	(40.7)
52-week high/low		18.5p	8.7p

Business description

Quadrise is the innovator and global licensor of disruptive residual oil technology that produces a synthetic, enhanced heavy fuel oil called MSAR. This enables refiners to produce MSAR for use as a low-cost substitute for heavy fuel oil in the marine bunker and power generation sectors.

Next events

AGM	2 December 2016

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Investment summary: Industry game changer

Company description: Multiple routes to commercial revenue

Management continues to focus on those sectors of the US$106bn pa HFO market where the potential business opportunity is large. The first is the global marine fuel market where Quadrise has developed a marine-specific variant in partnership with Maersk, the world's largest shipping line. Once Maersk begins to deploy MSAR commercially, other shipping lines are likely to follow. Other refineries are also likely to adopt the MSAR process to supply newly created demand for the novel bunker fuel, beginning with those that have already started programmes with Quadrise to evaluate the suitability of their residues for conversion to MSAR. The second sector is power generation. The largest single opportunity for this at present is Saudi Arabia, where a long-term programme could potentially include the bulk of the available heavy residue in the country. In addition, adoption of the process to produce bunker fuel by refineries in Asia would support sales to clients like YTL PowerSeraya for power generation. The third sector is the use of MSAR to generate steam and power for use in refinery complexes themselves.

Financials: Adjustments to timing of key programmes

FY16 adjusted losses before tax widened by £1.5m to £4.1m as Quadrise prepared for the onset of commercial production by increasing project, research and development activities. However, while the delays to the Saudi programme meant that revenues were lower than our estimate (£0.0m vs.£1.2m), costs were also lower, so group adjusted losses before tax were less than our £5.1m estimate. Although the LONO trials with Maersk remain on schedule for completion in mid-calendar 2017, we have revised our model to reflect a more conservative roll-out across the Maersk fleet than previously assumed. In addition to the delays to the Saudi programme noted by management, we model slippages in the other identified markets. These changes to the assumptions in our model are summarised in Exhibit 2. Changes to our estimates are summarised in Exhibit 5.

Sensitivities: Oil spreads, not crude price are key

Oil-spreads: the refinery price 'spread' between diesel and HFO determines the economic attractiveness of a switch in converting heavy residue from HFO to MSAR and thus the amount by which MSAR may be discounted with respect to HFO. The spread has remained broadly stable over the last 12 months, despite significant oil price volatility.

Key client/partner risks: delays to the LONO programme or slower than projected substitution of MSAR across the Maersk and other shipping companies' fleets would affect our estimates and valuation. For the KSA programme the key risk is Quadrise's ability to influence the pace at which the client proceeds with the pilot, rather than the risk of the trial not proving technical viability.

Customer attitude: although Quadrise's MSAR has been proven in field trials, it still needs to be accepted as a marketable, environmentally friendly and economic substitute for HFO by the power and marine bunker sectors, which are inherently conservative.

Valuation: Value to be realised through commercialisation

Our valuation is based on the NPV of the sum of the cash flows from five projects over a 15-year period from FY17 to capture their long-term potential. It assumes revenues are derived from chemical sales, licence royalties and service fees, thus incurring minimal capital outlays. This gives an NPV of £325m at current perceived levels of risk. As discussed later in our note, this indicates that the current market capitalisation only ascribes value to the marine programmes, effectively treating the Saudi and other programmes as upside. The indicative valuation rises to £427m if a lower discount factor of 10% is applied as key projects progress towards commercialisation.

Company description: Disruptive residual oil technology

Quadrise is an AIM-listed oil technology and service company. Its goal is to replace HFO globally with MSAR (multiphase superfine atomised residue), its proprietary enhanced emulsified synthetic heavy fuel oil. The opportunity addressed is substantial since the global HFO market exceeds 450Mt/year, worth approximately US$106bn pa. Management estimates that 45% of this HFO is used as marine bunker oil, 27% in power generation, generally in oil-producing economies, the remainder in industrial applications such as thermal boilers, cement kilns and gasifiers. Quadrise is currently focusing on the marine segment, where it is partnering with Maersk Line, the world's largest container shipping line, and CEPSA and the power generation segment, where it has a Memorandum of Understanding for a commercial scale production-to-combustion trial in the Kingdom of Saudi Arabia (KSA).

The market for MSAR is proven because more than 60Mt of a first-generation heavy oil emulsion, BP's Orimulsion, was supplied to the global market for power generation between 1993 and 2006, when production was discontinued because of pricing issues. Key members of Quadrise's senior management team, including chief operating officer Jason Miles, were instrumental in the development and commercialisation of Orimulsion. They have since continued this work in developing a technically improved second-generation emulsion fuel, MSAR.

Quadrise is headquartered in London. It has its own independent R&D and operational support facility in Essex. In November 2015 it signed a collaboration agreement with the University of Surrey providing for the shared use of the university's Centre for Petroleum and Surface Chemistry. This facility is equipped with additional hardware and expertise to meet Quadrise's primary and applied research needs.

MSAR: Simple, economic and rapidly deployed

Traditional refining and MSAR process compared

After refining, 70% of the output from a typical semi-complex refinery is high-value transportation fuel, 30% low-value residue, which is solid at room temperature and, if not processed further, can only be used for limited volume applications such as road surfacing material. Refineries increase the value of this residue by blending it with some of the high-value transportation fuel to create heavy fuel oil (HFO). This fetches a lower price than crude oil even though over a quarter of the distillate material (eg diesel) that could otherwise be sold as high-value transportation fuels is used in the process.

The MSAR process significantly improves refinery yields by eliminating the need to blend the heavy residues with distillates to make HFO. MSAR is made by mixing the hydrocarbon residue with water and small amounts of specialised surfactants and emulsifiers. This is done through a proprietary process whereby the hydrocarbon residue is reduced to particles of approximately five to 10 microns in diameter. The chemicals, which are supplied by long-term partner AkzoNobel, ensure that the resultant emulsion is stable throughout transportation, storage, fuel handling and consumption. Quadrise is able to tailor the MSAR production process to suit different residue types and applications, broadening its applicability.

Generating higher value from the bottom of the crude oil barrel

Adoption of the MSAR process means all of the high-value middle distillate can now be sold as transportation fuel. Quadrise calculates that for a 50,000b/d semi-complex refinery, a switch to MSAR will generate additional middle distillate sales of 2,700-5,400b/d. Note that the value generated is not linked directly to the price of crude oil, but is a function of the pricing spread between diesel and residue-based fuel oil. MSAR production capacity expansion is relatively

inexpensive and requires short lead times. The switch to MSAR may be effected relatively swiftly and inexpensively. The production technology is modular and can be integrated into an oil refinery's existing operations in less than 12 months. The total capital expenditure required for full conversion of such a refinery would be around $7-10m, giving a payback period of 12-18 months. The alternative approach for this type of refinery to achieve a comparable increase in crude 'yield' would be to undertake a substantial facility upgrade costing c $1bn and taking four to six years. In addition, MSAR can be stored and transported at ambient temperatures of 20-30degC, while HFO must be heated to over 50degC, so less energy is required to handle and transport MSAR, generating further savings.

Environmental credentials from switching to MSAR

MSAR produces significantly lower levels of black soot on combustion than HFO because the hydrocarbon particles are so small. In addition, a straight switch from HFO to MSAR gives a reduction in NOx emissions of at least 20%. This is helpful in marine bunker fuel applications, where new environmental regulations regarding open ocean operation are being introduced and also for refinery applications.

Marine MSAR programme

Quadrise has been engaged with Maersk, the largest marine fleet operator, since 2010 when the two parties signed a joint development agreement, which established a programme for the development of a marine MSAR formulation. This involves specialists from Quadrise, AkzoNobel and Maersk, as well as oil refining companies and major marine engine manufacturers. It is now in the final phase of pre-commercial accreditation.

Exhibit 1: Marine MSAR timeline

Joint development agreement with Maersk (March 2010)
Marine MSAR1 formulation
Maersk/Quadrise royalty agreement (February 2011)
Land-based marine engine tests
Seaborne trial on Soroe Maersk (calendar Q112)
Marine MSAR2 formulation
Land-based RTX4 2-stroke engine trials (late CY12)
Manufacture of Marine MSAR2 at ORLEN Lietuva refinery (September 2013)
Seaborne proof of concept confirmed calendar H114 on MAN and Wärtsilä engines
LONO supply contracts signed with CEPSA refinery and operational trial announced (September 2015)
Installation of MSAR manufacturing unit at CEPSA refinery and commencement of MSAR production (Calendar H116)
Commencement of LONO trial (July 2016)
LONO certifications (mid-calendar 2017)
Commencement of commercial roll-out (calendar H217)

Source: Edison Investment Research

Recent progress – commencement of LONO trials

During calendar H116, a commercial scale MSAR manufacturing unit (MMU) and associated equipment was installed and commissioned at CEPSA's Gibraltar San Roque refinery. This refinery adjoins the Algeciras bunker fuel supply hub, which services European and Mediterranean shipping and is a prime location for supplying marine fuel. The MMU is producing batches of MSAR on a regular schedule for use in the LONO trial. Upon successful completion, this trial should pave the way for commercial use of MSAR. It involves a demonstration of the extended use of Marine MSAR in a Wärtsilä-powered vessel so that the engine manufacturer can issue a LONO validating the use of MSAR in this engine type. The trial started in July 2016. The nominated Maersk vessel has been

burning MSAR successfully while outside of the European Emission Control Area and feedback received on the performance to date has been positive.

Next steps – completion of LONO and move to commercial roll-out

Typically, around 4,000 hours of performance data is required to complete the LONO phase. The programme also provides an opportunity to refine and further de-risk fuel handling and operating practices on the vessel, especially those relating to switching between fuels when in service. All parties involved in the trial are committed to co-ordinating the schedules for MSAR production, bunkering and burning so that the elapsed time taken to complete the 4,000-hour trial is minimised. Management anticipates that an interim assessment will be possible in early calendar 2017 and trial completed mid-calendar 2017, potentially leading into the early commercial phase in H217.

Under the terms of the revised royalty agreement completed in September 2015, Maersk and Quadrise are committed to jointly using all reasonable endeavours to develop the commercialisation of Marine MSAR in the global marine fuels market, fuelling both qualifying Maersk and third-party vessels. This indicates that commercial MSAR production output is likely to be much greater than that required solely for Maersk's requirements, encouraging other refineries close to bunker fuel supply hubs to start MSAR production. Confidential discussions and technical evaluations are proceeding with other refiners with the intention of broadening the supply base and extending the future availability of fuel.

Economic and environmental benefits for shipping

Since it is potentially highly cost-effective for refineries to convert heavy residue into MSAR rather than HFO, they will be able to offer MSAR at a discount to HFO. This potential discount is attractive to fleet operators, which face intense competition over freight rates, because fuel accounts for the largest proportion of a fleet's operating costs. There are additional cost savings associated with the switch because MSAR can be stored and transported at lower temperatures than HFO, reducing the need to heat transportation pipelines, storage tanks and ships. The potential switch to MSAR is made easier because it can be transported to end-users in the same way as HFO and may be used in conventional diesel engines without the need for major modification or retuning. This compares favourably with liquefied natural gas (LNG), which is often cited as an alternative marine fuel, but has specialised and expensive storage and handling requirements.

Switching to MSAR also presents a cost-effective way to meet new legislation from the International Maritime Organisation which has reduced the global sulphur cap from 3.5% to 0.5%, effective from 1 January 2020 onwards. The options are for vessels to switch from HFO to low sulphur marine diesel, to continue with HFO and install on-board scrubbing units to remove sulphur from exhaust or switch to an alternative fuel such as LNG. Diesel is already more expensive than HFO, and the increased demand caused by this legislation is likely to widen the spread. It is costly to convert vessels to LNG and widespread adoption would require investment in additional LNG bunkering facilities. The cost-savings associated with switching from HFO to MSAR would make a material contribution towards the capital and operating costs of on-board scrubbers, potentially making this the most cost-effective option for ship operators in the foreseeable future. We note that the widening spreads resulting from this legislation reduce the feed stock costs for manufacturing MSAR, further improving the economic case for switching. Given an appropriate residue, it may be possible to produce a low-sulphur MSAR variant.

The potential switch to MSAR brings other environmental benefits. The International Maritime Organisation has imposed an 80% reduction in NOx emissions for the North American and US Caribbean Emission Control Areas, applicable for ships whose keels are laid from January 2016. It is considering regulating particulate (soot) emissions. A switch from HFO to MSAR would give a

reduction in both NOx and black soot emissions. This is expected to drive demand for MSAR in the longer term.

Scale of opportunity – partnering with largest container shipping line

Maersk is an ideal partner for Quadrise because it operates more than 600 vessels, including its own fleet of 300, making it the largest container shipping company in the world. These vessels collectively consume around 10Mt of marine fuels (largely HFO) each year. This makes Maersk a significant potential consumer of MSAR in its own right, thus encouraging other refineries close to bunker hubs worldwide to adopt the technology. Additionally, if Maersk decides to convert its fleet to MSAR, other shipping lines are likely to follow, initially taking up any surplus MSAR capacity and reducing refineries' reliance on Maersk. The global bunker fuel market is 200Mt/year worth over US$40bn a year.

Other refineries

In an initiative instigated in FY13 to broaden the project portfolio, Quadrise embarked on a programme with an unnamed global oil major to add value to heavy residue streams produced in a proprietary refining process at multiple large-scale process plants. Quadrise has succeeded in converting these residue streams to MSAR. The results so far indicate that Quadrise's technology will offer a higher-value route to market for the oil major. The relationship is ongoing and the technical scope has been extended. It is likely that successful completion of the LONO programmes with Maersk will encourage this oil major and others to proceed with MSAR production.

The availability of MSAR to supply the Singapore bunker market would be of benefit to long-term potential consumer YTL PowerSeraya. PowerSeraya is a power utility company based in Singapore, which consumed up to 1.8Mt of Orimulsion emulsion fuel annually until 2006, when production ceased. It continues to view MSAR as an attractive alternative emulsion fuel.

Power MSAR in Saudi Arabia

Recent progress – MoU for production-to-combustion trial signed

Quadrise has been engaged in activities in KSA since 2012, when it signed a memorandum of agreement with Rafid Group, giving it a commercial partner that has long-established relationships in the oil and energy industries in the KSA. Since then Quadrise technology has been approved for application in client refineries. However, initiatives to create a modest demonstration and reference plant have met with repeated delays, resulting in successive slippages to the programme. For example, the launch of Saudi Arabia's Vision 2030 economic reform plan in April 2016 had a short-term impact on the clients' decision making process for the programme. In August, however, Quadrise achieved a major breakthrough with the announcement of the execution of a memorandum of understanding (MoU) to progress the Production to Combustion trial in KSA.

Next steps – signing contracts for the trial

The MoU defines the basis of collaboration between Quadrise and its KSA clients to progress the production-to-combustion trial. It is a critical enabler to commence the preparations required to bring this project to reality. The trial will involve installation of a commercial scale 350,000 tonne pa MMU at a coastal refinery and large power station complex with aggregate output in excess of 5,000MW. The MSAR produced will be used to fuel a 400MWe thermal power unit for at least one month, enabling the client to assess its performance, economic and environmental credentials. Funding for this phase will be provided by the clients. One of the agreed objectives of the trial is to advance the application and evaluation of the technology in Saudi Arabia for both refining and power station applications. This is part of the client's assessment of the fit and role of emulsion fuels in KSA's future national energy strategy.

The next major milestone is the signature of contracts covering the delivery of manufacturing equipment, chemicals and services for the trial. Management anticipates this will happen during calendar H117, at which point a firm schedule for the trial will be confirmed. Management currently anticipates that the trial will start by the end of calendar year 2017, preparing the way for potential commercial roll-out in calendar 2018. Quadrise has already shown that it is able to deliver a commercial-scale MSAR production facility to a tight timetable for the LONO trial, where only nine months elapsed between signing the contract and starting production. Moreover, the "tie-ins" to supply the residue to an MMU are already in place at the designated refinery.

Economic and environmental benefits for KSA

As a major oil producer, KSA's economy has much to gain from the adoption of MSAR, because it would release for sale both crude oil used for power generation and middle distillates used to produce HFO. Quadrise estimates that the release of these distillates for domestic sale (domestic demand continues to be strong) or export is potentially worth billions of dollars a year at a national level. Given the current imbalance between the supply and demand of middle distillates in KSA, a significant portion is imported. The cost of the imports and the domestic subsidy are a pressing concern for the government, as is the increasing domestic use of crude oil, which results in reduced revenues from oil sales. These factors support an interest in a switch to MSAR at the highest levels.

As discussed above, MSAR is highly attractive for individual refineries from an economic perspective as they are operating in a challenging low-margin environment. From a power utility's perspective, using MSAR cuts fuel costs: for example adoption by Saudi Electric Company, the main power generator in KSA, would potentially result in the substitution of one-third of the 33m tonnes of oil it consumes each year, resulting in savings of several billion US dollars over a five-year period. There is also further benefit from the reduction in carbon particulate and NOx emissions since the carbon particulates removed from output gases during power generation from conventional sources frequently have to be transported to remote disposal sites, incurring additional expenditure.

Scale of opportunity – potential to convert bulk of residues in KSA

The designated refinery supplies fuel oil to several large power plants in the region. If the commercial-scale demonstration is successful and the refinery elects to adopt the MSAR process, this refinery could produce up to 5m tons of MSAR a year for power generation purposes. This is a substantial opportunity in its own right. Roll-out would take place with minimal capital expenditure for Quadrise, as the participating refinery is expected to bear the costs of purchasing and installing equipment for MSAR production.

Adoption by this major refinery would encourage its adoption elsewhere in KSA. Quadrise estimates that because of a shortage of natural gas, over 50% of power in KSA is generated from crude and fuel oil, resulting in over 30m tons of oil being consumed each year in thermal power generation. Demand for power in KSA is growing very rapidly. There is insufficient heavy residue produced in KSA to produce sufficient MSAR domestically to meet even current oil-fired thermal power generation requirements. It is possible that if MSAR production becomes widespread, KSA could potentially import at least 10m tons of MSAR annually, thus gaining considerable financial advantage from reducing HFO imports. Adoption of MSAR is therefore completely aligned with several of the aims of the Vision 2030 Programme: redirecting subsidies on fuel towards individuals in need; reducing environmental pollution; participating in emerging technologies and increasing the competitiveness of the energy sector.

We note that MSAR is attractive to other oil-based economies, representing substantial opportunity for Quadrise in the longer term.

Refinery refuelling

Substitution of MSAR for the HFO used to generate steam and power in oil refinery complexes presents an opportunity for refiners to reduce costs. Moreover, since refineries have frequently installed power-generation capacity in excess of their own needs the swap would potentially enable refineries to generate power and steam for sale to third parties, providing an additional source of income. Any surplus MSAR could also be sold to third parties, for example as marine bunker fuel. As noted in the section on KSA, switching to MSAR would be economically beneficial and relatively simple to carry out.

Feasibility study completed

During FY16 Quadrise worked with a mid-sized refining company on a detailed design feasibility study on the adoption of MSAR for steam generation within a refinery complex. The study endorsed the project as being low cost, feasible and profitable, but the programme is on hold for reasons unrelated to the viability of MSAR adoption. Quadrise is in preliminary discussions with other refineries about similar projects. Our financial model assumes that either the original candidate refinery or one of those more recently identified will begin to produce commercial volumes of MSAR in FY19. While each of these projects may be modest in scale, collectively they could be a meaningful business sector.

Management

Quadrise's management has the breadth and depth of experience required to commercialise the MSAR technology. Collectively the team has over 70 years' experience of commercial emulsion fuels supply, having been instrumental in the Orimulsion business with BP and PDVSA. It has been expanded to include experts from refining, power, trading and engineering backgrounds. This enables to Quadrise to develop bespoke solutions for residual oils from different refineries and for different applications and to project manage MSAR conversion projects from feasibility studies to commercial fuel production and consumption. These skills are complemented by significant downstream oil, financial and capital markets experience.

There have been several changes to the board since our last full length note. Michael Kirk became a non-executive director in December 2015, stepping up to the executive chairman's role in April 2016 on the retirement of Ian Williams. Non-executive director, Dr Ian Duckels, who has served as a director of Quadrise since 2008, will be retiring immediately after the AGM in December 2016.

Sensitivities

Fuel oil spreads: the refinery price 'spread' between diesel and HFO determines the economic attractiveness of a switch in converting heavy residue to MSAR, rather than HFO, and thus the amount by which MSAR may be discounted with respect to HFO. Spreads ranged from $155/tonne to $235/tonne during FY16, and were sufficient to support conversion to MSAR for suitably configured semi-complex refineries. However, depressed oil prices have tended historically to extend decision making cycles.

Not applicable to all refineries: only one-third of refineries globally are producing residue suitable for MSAR feedstock. However, this still offers substantial scope for MSAR uptake.

Customer acceptance: Quadrise's MSAR has been proven both in the laboratory, in numerous field trials and in a commercial and technical demonstration in Lithuania. However, MSAR still

needs to be adopted as a marketable, environmentally friendly and economic substitute for HFO by the power and marine bunker sectors, which are inherently conservative.

Environmental: changes in environmental restrictions on marine engine emission characteristics play to the advantage of MSAR as a marine fuel. However, for power generation, environmental and supply concerns, as well as the availability of cheap gas in certain regions, may lead to a number of oil-consuming power stations converting to gas where they can.

Client/partner risk: delays to the LONO programme or slower than projected substitution of MSAR across the Maersk and other shipping companies' fleets would negatively affect our estimates and valuation. For the Saudi programme the key risk is Quadrise's ability to influence the pace at which the client proceeds with the pilot, rather than the risk of the trial not proving technical viability. However, the MoU signature in August 2016 is a clear indication of the client's desire to progress with this programme. In September 2016, the contracts with AkzoNobel were extended until at least November 2018.

Valuation

Since Quadrise is neither an energy company nor an industrial manufacturer there are no credible peers with which to carry out a multiples-based comparison. Our indicative valuation is therefore based on the NPV of the sum of the potential cash flows from several projects in different markets. We apply a separate discount rate to each programme based on specific project and country risk, in effect applying a blended discount rate of 13.1% to the sum of the cash flows. Further progress on any one of these projects would imply a reduction in the blended discount rate used in our valuation. We model the cash flows over a 15-year period beginning in FY17 to capture the long-term potential of the projects.

Exhibit 2: Changes to assumptions in model

Programme	Changes in assumptions
Marine MSAR for Maersk	No change in LONO schedule from completion mid-calendar 2017, but more conservative roll-out across fleet.
Marine MSAR for other shipping lines	Slippage of one year, so adoption now from FY19 onwards.
Power generation in Saudi Arabia	Slippage of one year, so onset of material revenues now FY18. More conservative estimate of volumes.
Refinery refuelling	Slippage of two years, so onset of material revenues now FY20.
Global oil major	Slippage of 18 months, so onset of material revenues now FY19.

Source: Edison Investment Research

Although the LONO trials with Maersk remain on schedule for completion mid-calendar 2017, we have revised our model to reflect a more conservative roll-out across the Maersk fleet than previously assumed. As well as the delays to the Saudi programme discussed earlier in the note, we model slippages in the other programmes, which are summarised in Exhibit 3. By FY21, we estimate that the marine programmes will contribute 51% of total programme cash flow, Saudi 29%, refinery refuelling 8% and the global oil major 12%. Each of these cash flow streams is derived from chemical sales, licence revenues and service fees. Project-related capex will be minimal, even when the programmes enter their commercial phases, because the MMUs required for fuel production will be resold to the refineries producing the fuel. Similarly, working capital requirements will be relatively low because Quadrise will resell the chemicals required for fuel production to the refineries.

Exhibit 4: Sensitivity of NPV to range of discount rates (15 year, FY17 base)

Blended discount rate	10.0%	11.0%	12.0%	13.0%	13.1%	14.0%	15.0%
NAV (£m)	427.2	390.3	357.2	327.5	324.7	300.8	276.7

Source: Edison Investment Research

Our analysis gives an indicative value of £325m (£431m in our November 2015 note) for the group at current perceived levels of risk. Based on the number of shares in issue on completion of the

placing and the open offer, this is equivalent to 38p/share. We see potential for an uplift towards £427m (at a 10% blended discount rate, see Exhibit 4) as each of the key programmes makes further progress towards reaching the commercialisation phase and the blended discount rate is consequently reduced. We note that the Maersk marine programme contributes £92m of value to the £325m total at current levels of risk, which is similar to the market capitalisation.

Financials

Earnings – still at pre-revenue stage

FY16 losses before tax (excluding share-based payments) widened by £1.5m year-on-year to £4.1m. Production and development costs increased by 70% and other administrative expenses by 28% as Quadrise prepared for the onset of commercial production by engaging additional management resources to support the increasing project, research and development activities. However, while the delays to the Saudi and refuelling programmes meant that revenues were lower than previously estimated (£0.0m vs £1.2m), costs were also lower, so group adjusted losses before for the year were less than our £5.1m estimate.

The changes to our model discussed in the valuation section result in the changes to our estimates summarised in Exhibit 5. FY17 benefits from the first significant revenues from client programmes, primarily from the Maersk programme, but with a modest proportion from the pilot in Saudi Arabia. However, this is more than offset by increased costs supporting the programmes, resulting in widening losses. Strong growth in both the Maersk and Saudi programmes during FY18 is expected to result in a big reduction in losses during the year. Continued growth from both these programmes, together with the first material revenues from programmes supplying bunker fuel to other shipping lines and work with the global oil major with which Quadrise has a long-standing involvement, are expected to take the group to profitability in FY19.

Exhibit 5: Revisions to estimates

	PBT (£m)			EBITDA (£m)			Revenue (£m)		
	Old	New	% change	Old	New	% change	Old	New	% change
2016	(5.1)	(4.1)	-24	(5.1)	(4.0)	-28	1.2	0.0	N/A
2017e	(1.0)	(4.8)	+380	(0.9)	(4.6)	+411	10.1	0.9	-91.1
2018e	20.3	(0.5)	N/A	20.6	(0.4)	N/A	81.5	18.3	-77.5
2019e	N/A	13.0	N/A	N/A	13.1	N/A	N/A	71.3	N/A

Source: Edison Investment Research. Note: *Actual results.

Balance sheet and cash flow

Cash used in operations during FY16 increased £1.0m year-on-year to £3.7m, reflecting higher project development costs. Capex totalled £0.6m as Quadrise's research facility in the UK was further expanded with facilities to support the extended scope of operations, logistics and product development services. Cash decreased by £4.1m to £4.3m at the period end.

Going forward, the majority of the pre-commercial costs, including the purchase of MMUs to produce MSAR for the trials, will be recovered from clients. We therefore model minimal capital expenditure. As the programmes proceed to commercialisation, we model an increase in debtors in line with revenues, supported by some use of working capital finance from FY17 onwards.

Our previous full note commented that no further funding would be required for Quadrise to reach profitability provided that there were no material delays to the key programmes. Given the delays to Saudi programme additional funding is required to support Quadrise during the early phases of commercialisation. This has been satisfied through the recent placing and open offer (which was 2.5x oversubscribed), both at 10p/share, raising a total of £5.25m (gross). Additional funding may be required longer-term, once Quadrise has become profitable, because at that point the group

may engage in programmes on a tolling basis or ultimately as a manufacturer of MSAR in its own right.

Exhibit 6: Financial summary

£m	2014	2015	2016	2017e	2018e	2019e
Year end 30 June	IFRS	IFRS	IFRS	IFRS	IFRS	IFRS
PROFIT & LOSS						
Revenue	0.000	0.066	0.002	0.862	18.302	71.296
Cost of Sales (excluding depreciation)	(0.643)	(1.160)	(2.008)	(3.412)	(16.498)	(55.936)
Gross Profit	(0.643)	(1.094)	(2.006)	(2.550)	1.804	15.360
EBITDA	(2.285)	(2.598)	(3.989)	(4.626)	(0.357)	13.145
Operating Profit (before amort. and except.)	(2.362)	(2.706)	(4.137)	(4.777)	(0.503)	12.999
Intangible Amortisation	(0.685)	0.000	0.000	0.000	0.000	0.000
Exceptionals	(1.006)	(0.404)	0.000	0.000	0.000	0.000
Share option charges	(1.924)	(1.914)	(0.802)	(0.250)	(0.250)	(0.250)
Operating Profit	(5.977)	(5.024)	(4.939)	(5.027)	(0.753)	12.749
Net Interest	0.001	0.049	0.033	0.000	0.000	0.000
Profit Before Tax (norm)	(2.361)	(2.657)	(4.104)	(4.777)	(0.503)	12.999
Profit Before Tax (FRS 3)	(5.976)	(4.975)	(4.906)	(5.027)	(0.753)	12.749
Tax	0.064	0.072	0.149	0.000	0.000	0.000
Profit After Tax (norm)	(2.297)	(2.585)	(3.955)	(4.777)	(0.503)	10.399
Profit After Tax (FRS 3)	(5.912)	(4.903)	(4.757)	(5.027)	(0.753)	12.749
Minority interest	(0.077)	(0.005)	0.000	0.000	0.000	0.000
Net income (norm)	(2.220)	(2.580)	(3.955)	(4.777)	(0.503)	10.399
Net income (IFRS)	(5.835)	(4.898)	(4.757)	(5.027)	(0.753)	12.749
Average Number of Shares Outstanding (m)	783.5	808.7	809.6	849.0*	862.2*	862.2*
EPS - normalised (p)	(0.3)	(0.3)	(0.5)	(0.6)	(0.1)	1.2
EPS - normalised fully diluted (p)	(0.3)	(0.3)	(0.5)	(0.5)	(0.1)	1.2
EPS - (IFRS) (p)	(0.7)	(0.6)	(0.6)	(0.6)	(0.1)	1.5
Dividend per share (p)	0.0	0.0	0.0	0.0	0.0	0.0
Gross Margin (%)	N/A	N/A	N/A	N/A	9.9%	21.5%
EBITDA Margin (%)	N/A	N/A	N/A	N/A	N/A	18.4%
Operating Margin (before GW and except.) (%)	N/A	N/A	N/A	N/A	N/A	18.2%
BALANCE SHEET						
Fixed Assets	4.975	3.634	4.080	4.029	3.983	3.937
Intangible Assets	2.924	2.924	2.924	2.924	2.924	2.924
Tangible Assets	0.612	0.710	1.156	1.105	1.059	1.013
Investments	1.439	0.000	0.000	0.000	0.000	0.000
Current Assets	11.327	8.932	4.685	5.091	5.731	22.071
Stocks	0.000	0.000	0.000	0.000	0.000	0.000
Debtors	0.170	0.333	0.297	0.827	1.880	5.274
Cash	11.081	8.361	4.268	4.144	3.731	16.677
Prepayments	0.076	0.238	0.120	0.120	0.120	0.120
Current Liabilities	(0.241)	(0.422)	(0.576)	(0.457)	(1.555)	(4.850)
Creditors	(0.241)	(0.422)	(0.576)	(0.457)	(1.555)	(4.850)
Working capital finance	0.000	0.000	0.000	0.000	0.000	0.000
Long Term Liabilities	0.000	0.000	0.000	0.000	0.000	0.000
Project finance	0.000	0.000	0.000	0.000	0.000	0.000
Other long term liabilities	0.000	0.000	0.000	0.000	0.000	0.000
Net Assets	16.061	12.144	8.189	8.662	8.159	21.158
CASH FLOW						
Operating Cash Flow	(2.284)	(2.728)	(3.679)	(5.274)	(0.313)	13.047
Net Interest	0.001	0.049	0.033	0.000	0.000	0.000
Tax Credits	0.064	0.072	0.149	0.000	0.000	0.000
Capex	(0.129)	(0.220)	(0.596)	(0.100)	(0.100)	(0.100)
Acquisitions/disposals	0.000	0.000	0.000	0.000	0.000	0.000
Financing including equity finance, working capital finance and project finance	10.186	0.107	0.000	5.250*	0.000	0.000
Dividends	0.000	0.000	0.000	0.000	0.000	0.000
Net Cash Flow	7.838	(2.720)	(4.093)	(0.124)	(0.413)	12.947
Opening net debt/(cash)	(3.243)	(11.081)	(8.361)	(4.268)	(4.144)	(3.731)
HP finance leases initiated	0.000	0.000	0.000	0.000	0.000	0.000
Other - new asset finance	0.000	0.000	0.000	0.000	0.000	0.000
Closing net debt/(cash)	(11.081)	(8.361)	(4.268)	(4.144)	(3.731)	(16.677)

Source: Company accounts and Edison Investment Research. Note: *Including placing and open offer (gross value).

Contact details	Revenue by geography
1 Gillingham House 38-44 Gillingham Street London, SW1V 1HU UK +44 20 7031 7321 www.quadrisefuels.com	N/A

Management team

Executive chairman: Mike Kirk	Finance director: Hemant Thanawala
Mike Kirk was managing director of Weber Shandwick Square Mile until 2005. Prior to that he worked in the corporate finance department of Cazenove for over 13 years, advising on the demerger of Centrica plc from British Gas plc, the Lattice plc demerger from BG plc and the UK listings of John Wood Group plc and KBC Advanced Technologies plc. He is currently non-executive chairman of First Wessex Housing Association and Portsmouth Water and was previously a non-executive director of KBC Advanced Technologies plc and KSK Power Ventur plc.	Hemant Thanawala is a chartered accountant with over 29 years' professional and commercial experience. He was responsible for the AIM listing of Nautical Petroleum where he was finance director from 2005 to 2008.
Chief operating officer: Jason Miles	
Jason Miles spent 12 years developing emulsion fuel projects, initially as a process engineer with BP and subsequently as business development manager for PDVSA, where he implemented various Orimulsion projects. He is also chief operating officer of Quadrise International Limited, Quadrise's wholly-owned operating subsidiary.	

Principal shareholders	(%)
Ruudowen Limited	6.8
Phibatec Limited	6.4
Intertrust Trustees Limited	6.0
International Energy Group AG	4.1
Anthony Lowrie	3.9
Hemant Thanawala	3.4
Orangefield Corporation Trustees (Mauritius) Limited	3.2

Companies named in this report

A.P. Moeller-Maersk (MAERSKB:DC), AkzoNobel Surface Chemistry (AKZA:NA), KBC Advanced Technologies (KBC:LN); KSK Power Ventur (KSK:LN); Wartsila (WRT1V:FH), YTL Corp (MYX:4677)

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