

Making headway

‘EGCS technology is now gaining traction in the maritime sector. Sam Lowrey and Rebecca Byers talk to the technology developers and the end users’

In the final run up to the implementation of the 0.1% sulphur emission mandate within Emission Control Areas (ECA) in 2015, the maritime industry has already made much headway in adopting technological strategies to achieve compliance with more stringent environmental regulations.

There are several options available to achieve sulphur oxide (SO_x) reductions: a switch to low sulphur fuel inside an ECA, a full time switch to marine gasoil (MGO), the conversion of vessels to enable them to be powered by liquefied natural gas (LNG), or the installation of exhaust gas cleaning systems (EGCS) – or ‘scrubbers’, as they are more colloquially known.

Over the past year, there has been increasing debate over a switch to distillates to meet ECA requirements, and the adoption of LNG as a marine fuel has moved swiftly from the confines of northwest Europe across to North America, China and elsewhere. The acceptance and uptake of EGCS technology has been, to date, a more low key process but owners are increasingly taking the decision to invest in this equipment.

An EGCS uses filtration technology to capture the pollutants and reduce the vessel’s emissions. Depending on the type of scrubber, the waste is dealt with separately.

There are three types of scrubbers: open loop, closed loop and hybrid. Simply put, the operation of open loop scrubbers partly depends on the alkalinity of the water used. Such scrubbers are used by ships on ocean voyages; an open loop scrubber uses

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slightly more energy than the closed loop version, but is the alternative for vessels not travelling on lakes or near estuaries.

Closed loop scrubbers use fresh water and do not depend on the alkalinity of seawater. While these systems are cheaper to run, they are slightly more complex. A tank is required to collect the residual waste, while caustic soda is also required to act as a reagent.

A hybrid system is a combination of the two that can be used onboard vessels that transit through all types of water. This system is even more complex, integrating both aspects of the previous two scrubbers in that it requires tanks, caustic soda and increased power.

With scrubbers' importance growing, manufacturers are working to produce the cheapest yet most effective systems. However, upon contacting one of the major suppliers, we found ourselves guilty of committing a cardinal sin.

Sigurd Jenssen, Director, Exhaust Gas Cleaning Systems, Wärtsilä, explained: 'The "misconception" is that we tend to talk about "scrubbers", whilst we really should be talking about "Exhaust Gas Cleaning Systems".

'The scrubber is indeed the key component, but there is more to it. Designing the overall system including all the ancillaries and integrating it into the vessel is the challenging part.'

Wärtsilä is a leading force in the development of the technology, and provides all types of EGCS – open loop, closed loop and hybrid. As Jenssen explains: 'The important thing from our perspective is that we can offer a solution to virtually every ship out there, taking into account both practical and operational aspects to find the best fit.

'The common factor for all of our systems is that they are based on more than 50 years' experience of putting scrubbers onboard ships in the form of inert gas systems, and the most extensive reference list of marine EGCSs. The

basic scrubber design and many components are the same, irrespective of whether it is an open loop, closed loop or hybrid system.'

Norwegian company Clean Marine is one manufacturer that is anticipating a big increase in orders for scrubbers in the future – not only in the run up to 2015, but also in the longer term to 2020, as companies prepare to meet a global sulphur emission restriction of 0.50%.

'Already this year we can sense an increasing demand for EGCS,' Clean Marine disclosed, 'and we expect this demand to accelerate from 2015, when shipowners start paying the extra fuel bill.

'Many of our enquiries are for newbuilding projects but as many vessels' special surveys come up in 2014/15 there will also be many requests for retrofit during the scheduled dry-docking of the vessel.'

Clean Marine's hybrid system can run in open and/or closed loop in all waters and ports.

It says that it is 'the only supplier that offers a proven, true multi-stream EGCS. This means using only one EGC unit to handle all exhaust sources onboard a vessel, also the boiler(s).

'This is possible due to the fact that our system gives zero back pressure towards the engines, regardless of ship operation mode.'

Meanwhile, over in Sweden, Alfa Laval has recently opened a new test and training centre, constructed initially to develop exhaust gas cleaning technology.

The ship simulation facility is based on the site of the former Aalborg shipyard in Denmark. A 250 square metre (m²) testing area has been built around a 2 MW marine engine, comprising commercial and prototype equipment from all of Alfa Laval's marine product groups. Connected to the test system are a dedicated control room and a training complex, and at the heart of the test system is a large installation of PureSOx – Alfa Laval's own scrubber system.

'As emission caps approach, such as the SOx limits appearing in 2015, Alfa Laval is committed to helping customers meet them,' says Jens Peter Hansen, Alfa Laval R&D Manager, Exhaust Gas Cleaning.

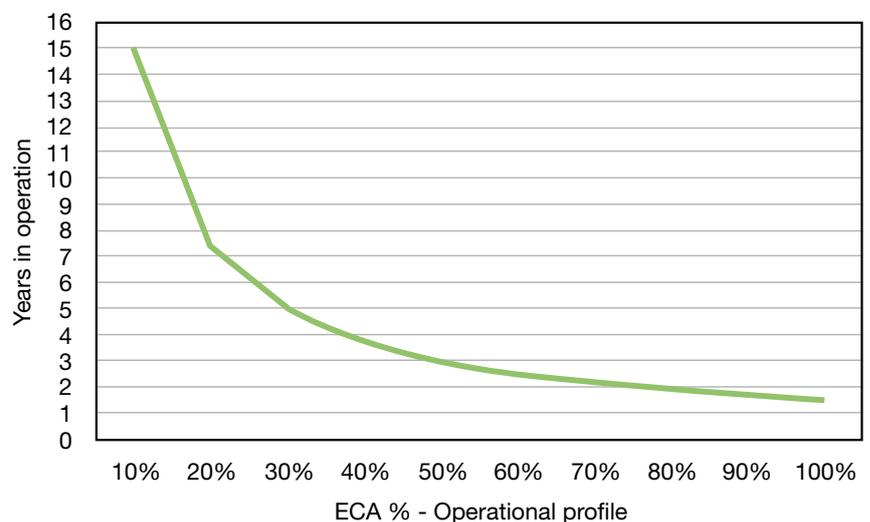
'Scrubber technology has already proven effective and commercially viable, and we will continue to refine exhaust gas cleaning through our work here at the centre.'

Despite increases in sales suggesting that EGCSs are poised to become the solution to many shipowners problems with regards to the incoming regulations, the systems do have their drawbacks.

The initial large expense of retrofitting a

Payback time from January 2015

- 1) EGCS retrofit investment cost = \$4,5 million
- 2) Assumed net price difference MGO-HFO-300 \$/mt
- 3) Vessel burning 10,000 mt fuel per year



scrubber could potentially put owners off, and, coupled with its relatively short life cycle, when compared with the option of investing in an LNG-powered vessel, there is an argument that, for something that is in some circles regarded as a 'stop-gap', it is very expensive.

Claims such as this, however, are being batted back, especially by manufacturers.

Clean Marine explained its estimates for likely return on investment (ROI) on its hybrid systems:

'The investment cost for the EGCS unit is normally in the \$3 million-\$4 million region; in addition, there are installation costs at the yard for a retrofit of some \$1 million (dependent on the yard and the vessel's design).

'Estimated operating cost is \$20-\$40/tonne fuel consumed by scrubbed combustion units, depending on caustic soda (NaOH) and fuel price, fuel sulphur level and scrubber operating mode. If assuming a realistic \$350 per metric tonne price difference between MGO (0.1% sulphur content) and HFO (around 2%-3% sulphur content), the payback time is 1-2 years for vessels operating more than 80% inside the ECA.'

For vessels with a higher fuel consumption, Clean Marine said, the payback time for its system is much less, and also for newbuildings where the installation cost will be less. Clean Marine also said that it is likely that the fuel price spread will be higher than \$350 per metric tonne from 2015, should there be an increased demand for MGO.

'The cost of installing [our] system onboard is about 75% of the cost of equipment. The ROI varies a lot as it is based on how much fuel is used inside the ECA (saving \$325,000 per 1,000 tonnes used) and the cost of equipment and installation,' says Alfa Laval.

Some firms, realising the potential of a low payback period, have made this a priority during the design phase. One such company is Oceanox, manufacturer of the Ecobox EGCS.

'We have always designed the system to pay back within two years,' Oceanox managing director and co-founder Nick Holness told *Bunkerspot*. 'We have seen paybacks that can be months.'

'Ahead of 2015 we are seeing significant interest from shipowners, which is entirely natural given the likely cost of compliant gasoil.

'What we've said all along is that we don't believe there is a 'one-size fits all' solution. There will be a number of routes of compliance that will suit different shipowners. There are some people for whom gasoil compliance, etc., will be viable but a great number of people who will feel that scrubbers will be the best solution for them, and so on.

'The primary benefit of our system is that it generates virtually no back pressure. It does that by treating the exhaust gas horizontally and having a cross flow of sprays. Because that design is basically the same as used in the chemical processing industry, this means it can be used in either pure open, pure closed or hybrid loop states. Our system is also specifically designed to be easy to retrofit.'

Another manufacturer, ViswaLab, added: 'Operational cost is another important factor in scrubber selection. Sludge disposal costs and maintenance are small compared to the cost of caustic [soda] and power use.

'The scrubber is indeed the key component, but there is more to it. Designing the overall system including all the ancillaries and integrating it into the vessel is the challenging part'

'Cost of power is usually underestimated as many use only the cost of fuel. But the real cost of power to the operator is higher and should include the cost of maintenance and operation. The power use by our scrubbers is small, only about 10 kw/MW.'

'Previously,' ViswaLab added, 'we have installed over 200 scrubbers and dryers in the onshore industry. We have analysed various problems with scrubbers on ships in the past and we have devised suitable remedies to solve them. With our experience we are able to provide scrubbers at competitive rates, keeping the capital expenditure (CAPEX) low for the shipowners.

'We are just entering the market, but at the right time; we expect to be in-line to deliver a lot of scrubbers. There is a big gap between supply and demand and we are getting ready for this.'

Carl Dahlberg of Green Tech Marine also spoke about the advantages of the GTM R15, a hybrid system that can use both fresh and sea water when running in closed loop.

Dahlberg said: 'The main advantages with our scrubber are the size and weight, and that there are no moving parts inside the scrubber tower that can cause problems. Thanks to that, the scrubber

tower is designed for dry running (when the scrubber is off), and no bypass is required which saves even more space and weight.

'Furthermore, the scrubber acts as silencer reducing the requirement for an external silencer and saving even more space and weight.'

All manufacturers are positive about an upswing in their EGCS businesses ahead of tighter sulphur emission regulations.

'Our main focus is on vessels which operate more than 50% of their time inside an ECA,' summed up Alfa Laval. '[But] the impact will be bigger than the 2015 ECA we are facing now. In fact, we believe 2020

to be the biggest thing in shipping. This is due to the fact that it impacts every vessel.'

While a degree of confidence is to be expected amongst those who produce the technology, this is a thought clearly echoed around the industry, with one engine manufacturer telling *Bunkerspot* that scrubbers will 'be around for a long time.'

Michael Finch Pedersen, Head of Emission Reduction Technology, MAN Diesel & Turbo, said: 'We believe that high sulphur fuels for marine applications will be around for a long time, and MAN believes that our engines must be designed to cope with this, and to be compatible with SOx scrubbers.'

While MAN is not directly involved with research or development on scrubbers, Pedersen was keen to stress that it is important that, as engine manufacturers, they work alongside EGCS manufacturers.

Looking to the future, Pedersen acknowledges that: 'We mainly see the 2020 global 0.5% cap as the driver for SOx scrubber installation.'

What the owners say...

When it comes to the installation of exhaust gas cleaning solutions, their effectiveness in meeting SOx reduction requirements is clearly a major consideration but another key issue for shipowners is return on investment (ROI).

For example, Carnival Corporation says that its investment in what it terms 'ground-breaking technology' will not just meet but exceed emissions standards and this 'means cleaner air, [providing] a public health benefit that you can't put a dollar value on. It is an ROI that can't be beat.

'From a business standpoint, based on our estimates of savings that Carnival will realise from reduced fuel costs, we believe this is a good investment,' explained a company spokesperson.

'We are still in the process of completing calculations as we finalise which ships and itineraries will be involved.'

Carnival's current schedule calls for 25 ships to be fitted with scrubbers in 2014 and 2015, with seven vessels scheduled for 2016. In September 2013, the company announced that it had allocated \$180 million for the installation of exhaust cleaning technology on these 32 ships. It estimates the cost at \$2 million per unit, with ships being equipped with multiple units.

The scrubbers will be installed on vessels from Carnival Cruise Lines, Holland America Line, Princess Cruises and Cunard, which sail regularly within the North American Emission Control Area (ECA). In addition, AIDA, another Carnival subsidiary cruise line, announced in August

that it will spend €100 million (\$136,9 million) on environmental protection, some of which will go towards installing scrubbers.

To date, Carnival has largely focused on retrofitting vessels but it also plans to look at newbuilds in the future.

Carnival describes scrubbing systems as 'a major advancement in environmental technology that will significantly reduce air emissions from cruise ships and large marine vessels'.

'Working together with the Environmental Protection Agency (EPA), US Coast Guard and Transport Canada,' says a company spokesman, 'Carnival Corporation has developed a breakthrough solution for cleaner air that will set a new course in environmental protection for years to come. At the same time, the solution will also help the company mitigate escalating fuel costs.'

'Exhaust gas cleaning technology has been successfully used for decades in land-based environments, such as power plants, factories and vehicles. But for cruise ships, and other vessels, the big challenge has been finding a way to implement the technology in a restricted space. The technology solution that Carnival has developed combines – for the first time – a particulate filter with a sea-water scrubber. The result is a significant reduction in sulphur emissions as well as reduced particulate matter and black carbon. That is why this represents a major breakthrough. This is the first time a solution for using the exhaust gas cleaning technology has overcome the issue of being able to work properly in restricted spaces on ships.'

DFDS Seaways is also a proponent of the use of scrubbers. To date, the company has installed scrubbers on four of its vessels and is currently in the process of expanding this to a further 15 ships. This will mean, therefore, that of its fleet of 50 vessels, more than a third (38%) will benefit from this technology.

Like Carnival, all of the DFDS vessels that have had the scrubbers installed to date have been retrofitted. DFDS says that it is prepared to invest around €100 million in scrubber technology.

'The key challenges have been in trialling and installing the scrubber technology, as the equipment is heavy and the technology is still being developed,' says DFDS. 'This type of technology is also not compatible with all of our ships. As we install the technology into more of our ships another challenge would be installation time, as it means our ships could be out of service for up to four weeks at a time, which is a challenge on both our shipping and customer routes.'

Challenges aside, the company sees its investment in scrubber technology as a long term investment, designed to help safeguard the viability of its services in the Emission Control Areas (ECA) in the English Channel and the Baltic and North Seas.

'However,' it concludes, 'not all of our ships are compatible with this kind of technology, which means that we are likely to need to use more refined fuel, which is extremely expensive and the operating costs will inevitably increase.'