

What is the progress of the scrubber market?

The scrubber market is still far from 'booming' as the maritime industry's interest in scrubber technology has hit a snag with the global crude oil price collapse and added financial uncertainty. In order to comply with the 0.1% sulphur in fuel content from 1 January 2015, in the Sulphur Emission Control Areas (SECAs), many shipowners are in wait-and-see mode. What are the upcoming trends and developments?

Technology

Scrubbing is a mature technology because it represents the most effective SO_x removal system for land based application. Scrubbers have been added in many ships from the 60's (when the first ones were installed) in tankers as part of Inert Gas systems. But there is no doubt that the designs out in the market can be improved in terms of weight, size, effectiveness and their effect on the sea environment.

We see that the single stream, open loop design is quite beneficial when it comes to space and consequently lowers costs as it fits quite easily in funnel and casings with a relatively simple installation. But we see this variant is not flexible enough when it comes to a broader use in different seas and waters. Besides it is not the most sustainable option when it comes to the effect on the marine environment. We need the industry to focus more on hybrid systems and the use of active caustic soda to better neutralise the discharge.

A recently launched technology based on Membrane's looks promising. The basic units can be made much smaller (by up to 50%) with no wash water discharge at all. This makes the installation easier and simpler. This technology is similar to others but the key difference is that it does not spray the liquid absorbent (caustic soda) into the exhaust stream. Instead it suspends the liquid in membranes that comes in contact with the exhaust gasses but it does not mix with the exhaust. Only the sulphur dioxide is absorbed. Whether this technology will

be future proof, only time will tell.

Updates on legislation

Ships are a prime source of sulphur dioxide (SO₂), which is produced by burning fossil fuels containing sulphur. SO₂ is a major air pollutant that is toxic to humans, plants and animals as well as being the main cause of acid rain. The regulations to protect the marine environment have gradually tightened in the last several years. What can we expect in the future?

A global 0.5% sulphur cap may be around the corner

The European Union (EU) has already agreed that the 0.5% sulphur cap will apply to all EU Member States within 200 miles of the coast from 2020, regardless of IMO decision to postpone the global cap until 2025. In the event that IMO decides to postpone this, it would create a narrow corridor along the coast of North Africa in which the use of less expensive residual fuel will continue. The United States also strongly opposes to any postponement.

BIMCO is however concerned that a global 0.5% sulphur limit, will significantly increase the cost of fuel as a level playing field is commercially critical for owners. Failing to ensure uniform compliance with the sulphur emission limits within any segment of shipping will significantly distort the competition between ship owners globally. It will not be sustainable for a compliant ship to compete with another ship operating in non-compliance. In BIMCO's view, robust enforcement of the applicable

sulphur limits, and not only in so-called emission control areas (ECA), is essential.

Following this discussion, BIMCO's Past President John Denholm is calling on governments and the maritime administrations to exercise robust enforcement of applicable sulphur limits to ensure a continued level playing field. Failure to do so would seriously expose compliant shipowners and operators who are bearing the high cost of ultra-low sulphur diesel oil.

Fuel availability study results are likely to be ready in October 2016

The IMO members at the meeting number 68 in IMO's Marine Environment Protection Committee (MEPC) in May made progress in defining how the global fuel availability study should be carried out, with the study results needing to be available by MEPC 70, which will likely be around October 2016. This will allow for the final report of the committee to be available and any decision made by 2018.

New ECAs and incentives for scrubbers

Hong Kong has implemented a new low-sulphur regulation for vessels moored or anchored at berths in Hong Kong waters from 1 July, 2015. Ships must use fuel with a sulphur content below 0.5%; LNG or any other fuel approved by Hong Kong. If a vessel uses scrubber technology then it may be exempt from fuel switching. Masters and owners of any vessels using non-compliant fuel while at berth in Hong Kong may be liable to a maximum fine of \$200,000 and imprisonment of six months. Masters



Jeroen Berger



and owners who fail to keep the required records may also be liable to a maximum fine of \$50,000 and imprisonment of three months.

The Port of Rotterdam Authority rewards vessels that have a Green Award certificate with discounts on port duties. The Green Award is a certificate that is issued by the independent Green Award Foundation to vessels and shipping companies that have made additional investments like scrubbers in the vessel in order to improve the environmental performance, safety and quality.

The Green Award incentives for sea-going vessels are 6% discount for oil and oil product tankers with a Green Award certificate with a deadweight of 20,000 tonnes and more and 6% discount for LNG tankers with a Green Award certificate with a deadweight of 20,000 tonnes and more.

Antwerp grants LNG bunker and scrubber users discount for lowering particulate emissions. Ships that are powered by LNG for at least a 24-hour period prior to calling the Port of Antwerp will be able to receive a 20% discount. Ships that can demonstrate effective use of scrubbers in closed-loop mode only will be eligible for a 15% discount.

Adoption of calculation-based method to prove compliance with pH criteria set for scrubber washwater

At MEPC 68, calculation-based methodology was adopted as an alternative to physical measurements in order to prove

compliance with the pH criteria set by IMO for scrubber washwater.

The pH discharge limit is the value that will achieve as a minimum pH 6.5 at 4 meters from the overboard discharge point with the ship stationary – while most of the systems run at full load. This is a contradiction in itself, but it is the way the regulation has been written.

Direct measurement (e.g. with a diver) has been done, but this is both very risky and the results are arbitrary. *“The opportunity to use a calculation-based methodology (computational fluid dynamics or other equally scientifically established empirical formulae) is therefore good news”*, said Kees Berger from Berger Maritiem.

Most ship operators comply with the 0,1% sulphur limit

Fuel checks show 6% ECA non-compliance. The European Maritime Safety Agency (EMSA) has spot tested the fuel content of 1,458 vessels operating in European waters during the first four months of 2015 – and says that 90 samples failed to line up with ECA requirements. The EU has stipulated that member states should conduct spot checks on a minimum of 10% of ships in its waters in 2015.

Only a few countries - Sweden and Lithuania - carry out inspections at sea, while Denmark, Norway and Poland are considering to do so. The remaining countries carry out inspections when the ships are docked or at ports, and it is much easier to

display inaccurate measures while at ports.

The “sniffer” in Gothenburg showed that 20% of the smoke plumes that were measured indicated levels of sulphur above the regulated level, but the bunker fuel samples made by the responsible authority (The Swedish Transport Agency) have not shown any non-compliance at all. There have been no fines imposed in Gothenburg so far.

Level of acceptance

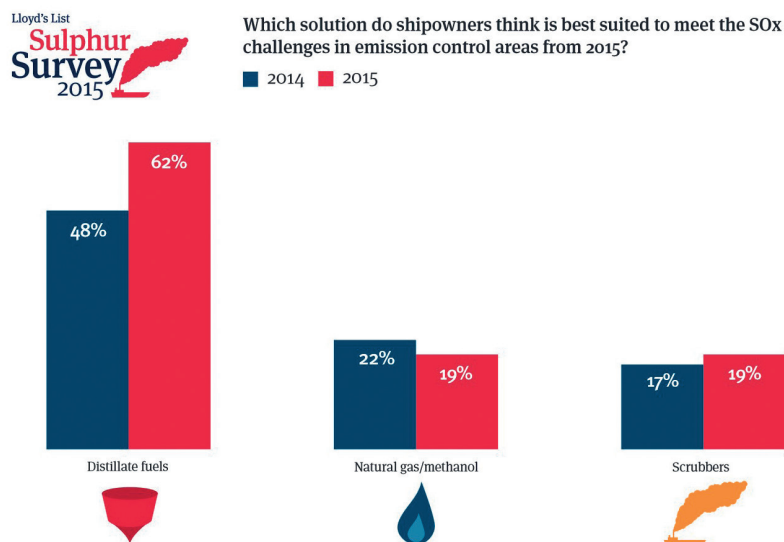
How is the level of acceptance of the scrubber technology developing? Loyd’s List scrubbers survey (April 2015) shares the interviews of several in the shipping industry on this topic (see Figure 1).

Although the majority, 62% finds the switch over to low sulphur distillate fuel the best solution, we can see from this report that 19% of the respondents finds scrubbers the best suited solution to meet the regulations of 2015. Compared to figures from 2014 we see an increase in the confidence by more than 10% in selecting the scrubber technology. We believe this gain in confidence is propelled by the sharp increase in successful installed scrubbers worldwide last year.

The switch over to low sulphur fuels

We see that a majority of ships meet the new sulphur emission limits by changing to a compliant low sulphur fuel prior to entering an ECA. The Marine gas oil (MGO) and marine diesel oil (MDO) at or below 0.10% sulphur is the most commonly available low sulphur fuel. Other new grades of marine fuel like hybrid fuels or Ultra Low Sulphur

Figure 1: Solutions to meet the SOx challenges in SECAs from 2015



Source: Lloyd's List scrubbers survey, April 2015

Fuel Oil with a maximum 0.10% sulphur content may be a viable and economical option in some ports.

It is well known that heavy fuel oil (HFO) compared with low sulphur distillate fuels have very different properties and can create operational challenges. For instance, a change-over between two different fuel types can put machinery equipment at risk, and in a worst case scenario involving loss of power. It could jeopardise the safety of the vessel and its crew.

The new grades of marine fuel or hybrid fuels or hybrid ultra-low sulphur fuel oils (ULSFO) should be beneficial according to

the advertisements of suppliers. With additional processing to reduce the sulphur to required low levels, these fuels could have challenging cold flow characteristics. With higher pour point, cloud point and cold filter plugging point (CFPP), some hybrid fuels may also require heating. A critical factor when selecting these fuels is that no published ISO 8217 specifications exist for these new products and although preparations for approved specifications are in progress, these are not expected to be ready in the near future.

And when referring to the impact on lubrication, there is very little experience or data gathered where this type of fuel has been

in use for extended periods. The fuel will contain some asphaltenes and lube formulations and must be able to deal with this contaminant with respect to engine component cleanliness. Unstable fuel may lead to combustion difficulties, and the residues will need to be handled and tolerated by the lube oil.

Concerns for the marine environment

Based on literature review and experience scrubbers (wet) for ships appear to reduce the emissions of sulphur to the atmosphere by 90-98%. The emissions of particles and soot by 60-90% and the emissions of NOx by 10% or less. However the SOx is converted to sulfuric acid. Also a number of other pollutants (e.g. metal and PAH) occurring in the exhaust gas are trapped in the wash water, in varying degrees.

It is a fact that the concentrations of hazardous substances in the discharge of closed loop systems are higher than in open loop systems, but the mass flow rate of these substances determines the environmental burden. This is larger in case the vessel is equipped with an open loop scrubber (no hybrid), as they are not equipped with costly discharge water cleaning systems.

Although the IMO criteria is met, different studies show that the large scale use of scrubbers have a negligible impact on the Marine environment and the raised concern by different organisations needs to be taken seriously and be counteracted by detailed study and open communication.

But it is the responsibility of the scrubber manufacturers to advise its customers on the best options for the environment - long run hybrid systems, open loop mode with discharge cleaning system, the active use of caustic soda and more despite the negative impact on the CAPEX and thus ROI.

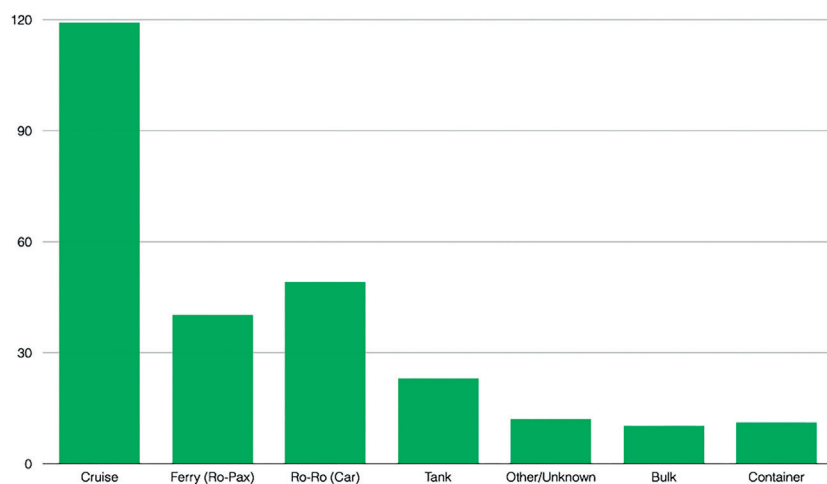
Market overview

A market study "Business case for scrubbers" in 2015 shows that scrubbers are popular in passenger and Ro-Ro segments, but still there is limited adoption for cargo vessels (see Figure 2).

Figure 3 shows that hybrid and closed loop scrubbers are increasingly gaining terrain over open loop scrubbers, but as all Carnival's scrubbers are open loop (until further) this is still the largest group in total.

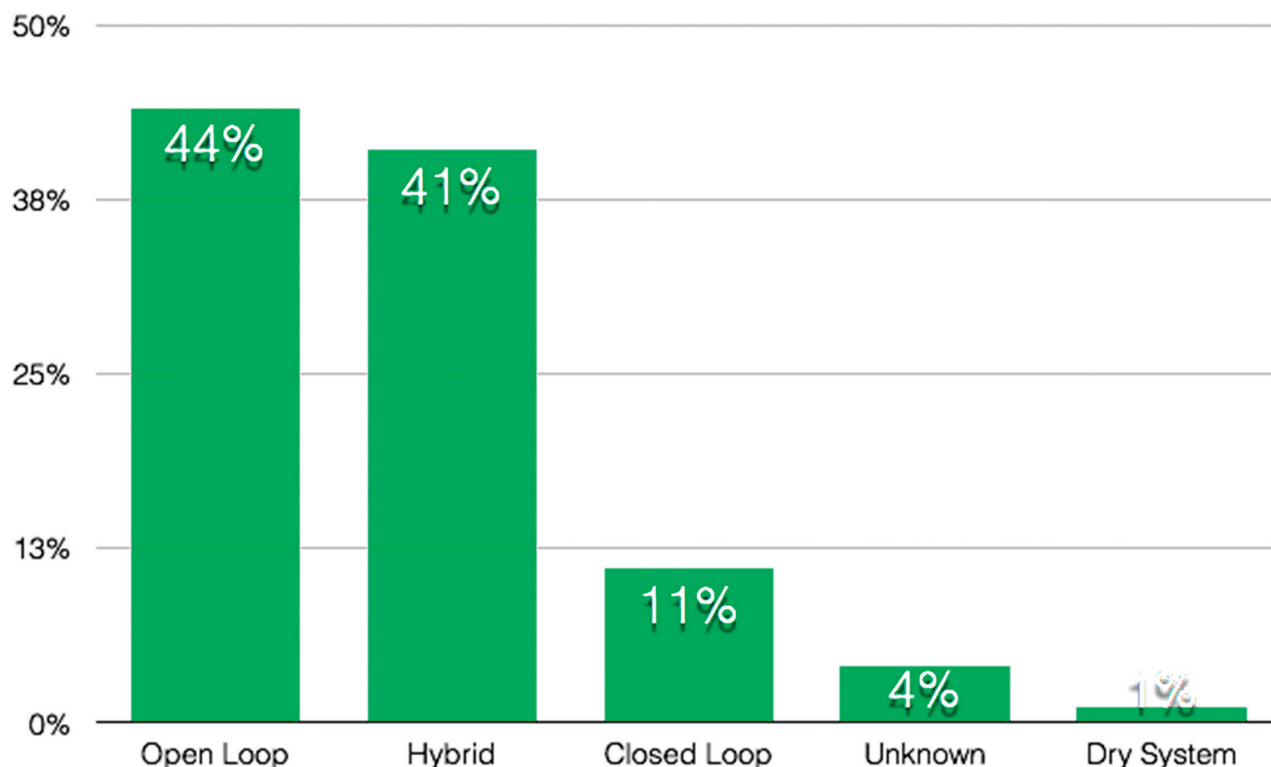
If we are looking at only cargo vessels, then we see in Figure 4 that hybrid and closed loop dominate.

Figure 2: Segments with scrubbers installed or contracted in 2015



Source: Berger, J. (2015). Business case for scrubbers

Figure 3: Scrubber type installed or sold in 2015



Source: Berger, J. (2015). Business case for scrubbers

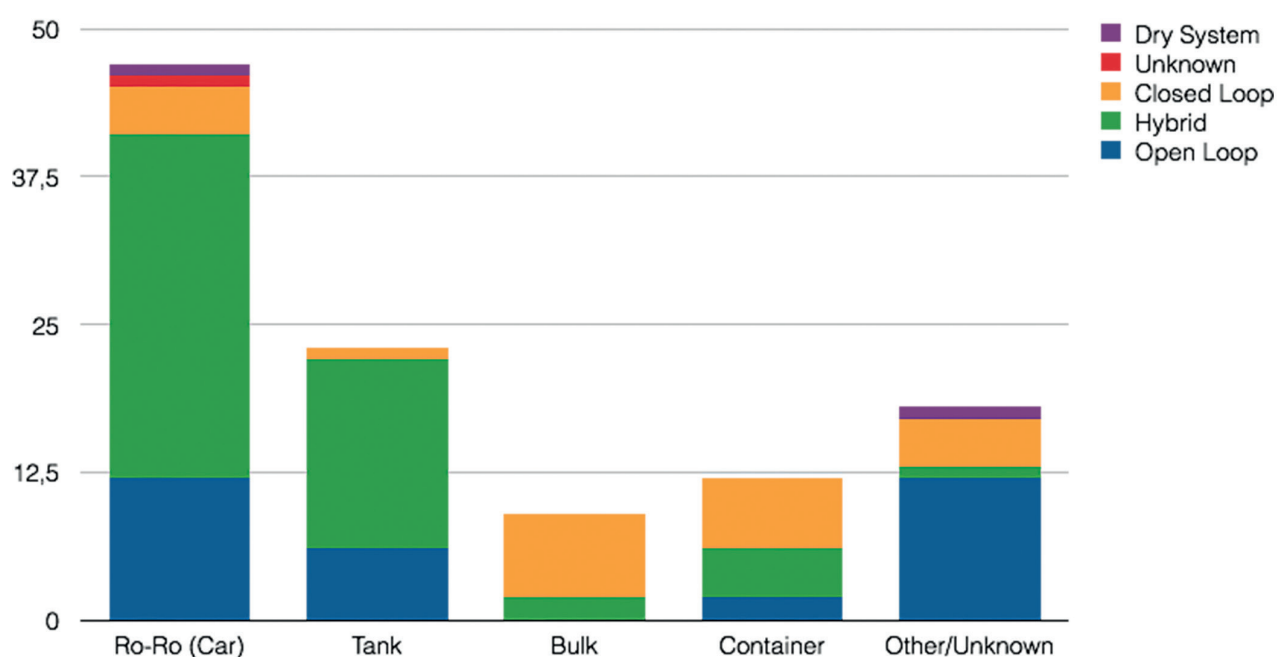
Innovative financial instrument

Up to 13,000 different vessels visiting or sailing in the North Sea and the Baltic Sea annually are affected by the sulphur rule, which is now in force. But for the majority of the shipowners who predominately

have their ships in charter it is not easy to find resources to invest in equipment like scrubbers due to prevailing difficult shipping market. It is also because they personally take no advantage of the investment as the charterer does as they practically pay his

fuel bill (good example of a typical chicken and egg story). Berger Maritiem has identified this challenge and have a solution that could overcome this hurdle; we call it Bunker Funding.

Figure 4: Technology per target segment (cargo vessels only) in 2015



Source: Berger, J. (2015). Business case for scrubbers

What is Bunker Funding? Through an individual supplement (by customer or charterer) on a verifiable market price of HFO bunkers. This is usually paid by the customer or in many cases paid by the charterer, where a premium is raised which should cover for repayment, interest and credit insurance of the investment. For each individual customer a different term and conditions will apply considering the specific customer business model. This is to be included in a long-term bunker- or HFO supply agreement. Figure 5 shows how Bunker Funding works as an example for a specific customer.

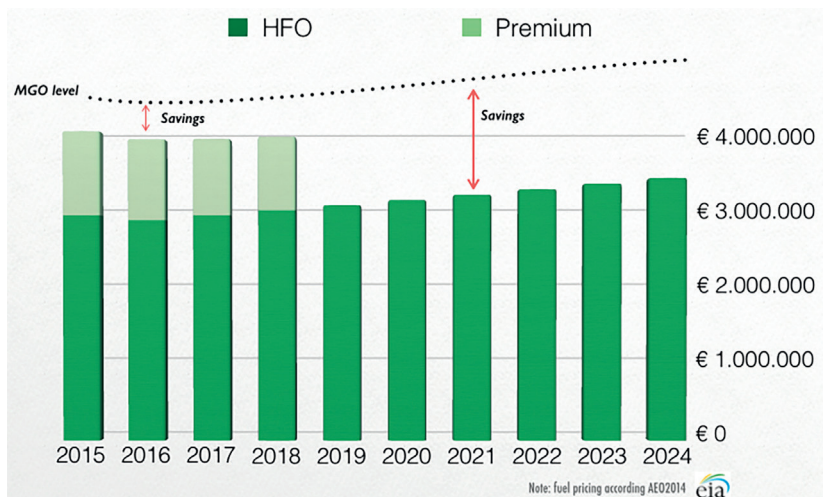
Kees Berger, owner of Berger Maritiem, said: "We have done extensive research towards this financial tool and we have found serious interest among owners, investors, EU commission and parties in the bunker scene. There is more financing available than well-prepared, viable projects."

The big question

The year 2015 with the enforcement of the limitation of the sulphur content of ship fuel has changed the upwards trend for this abatement technology into a downwards turn trend but is this going to continue or will the market recover?

One of the biggest question is: "Is the business case for scrubber still valid?" The crude oil's price collapse certainly had quite an impact and raised deep concerns towards the feasibility of the business case. But as seen in Figure 6 the price gap between low sulphur MDO and HFO (from April 2014 –

Figure 5: Bunker Funding principle based on calculations in 2014



Source: Berger, J. (2015). Business case for scrubbers

October 2015) is however slightly reduced and is still intact as this is the basis for the savings when installing a scrubber.

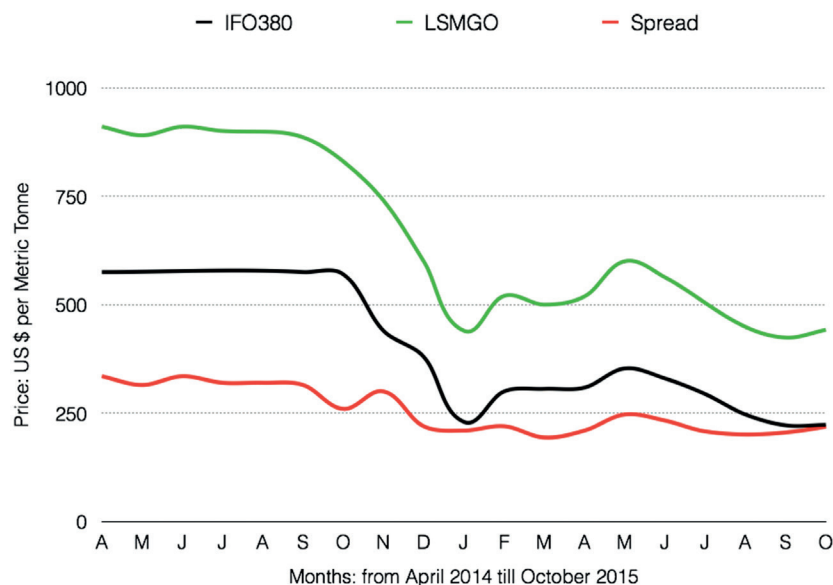
In general you can say that due to this decrease of 20-30% in price spread which can be compiled from Figure 6 the payback time has been increased by more or less 25-40% compared to the time before the price of crude oil plunge. So, where cases previously had a payback time of 2-3 years, you now have to account in theory for an ROI of 2.5-4.5 years, which is still an acceptable figure. But the scrubber manufacturers who saw this trend and also noticed a slowdown in the order intake adjusted their pricing strategy in order to compensate as

much as possible the planned huge sales and investments made.

The scrubber in general is widely accepted today and has demonstrated that more vessels are sailing successfully with this abatement technology. And it is true that there isn't a long track record available that can prove the long term reliability of this technology, but we also see that the use of the alternative low sulphur fuels in the traditional diesel engines is not without serious concerns - not a mature solution either.

So, to see how the market will respond to the developments will just be a matter of time, but from our point of view this technology has a future. The biggest advantage of installing this technology is that operators can stay flexible in the use of fuel; it is just not possible to predict the price of oil, or gas (LNG) in the future. ■■

Figure 6: Price gap between low sulphur MDO and HFO



Source: Ship and Bunker in Canada, 2015

Editor's Note: Berger Maritiem is a business consultation company for the maritime industry. With a passion for sustainability, specialised in ship performance optimization and emission-reducing technologies.
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