

Lloyd's List

# Maximising ship efficiency: Ending the debate

A special Lloyd's List report  
with Craig Eason



## Maximising efficiency: Ending the debate

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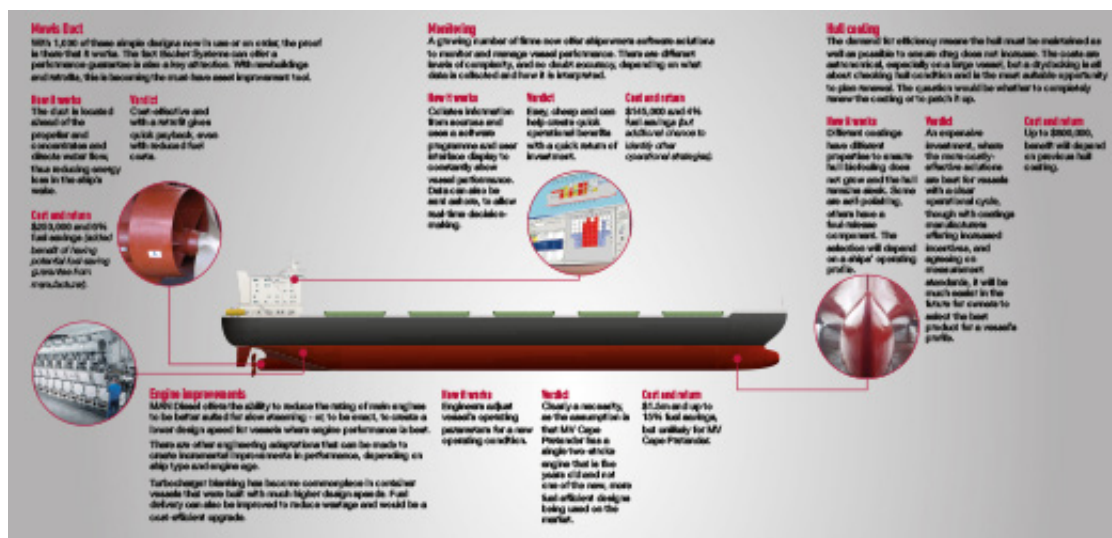
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# Maximising efficiency

Should an owner order a newbuilding or retrofit a secondhand vessel to be competitive in the market?



**Craig Eason**  
Deputy Editor

SHIPPING is known to be fuel-efficient yet polluting at the same time. The problem is the sheer size of the industry, and the sheer size of the ships in comparison to the freight capacity of cargo planes, freight trains and trucks.

It can easily be demonstrated that by a unit of cargo moved a unit distance, shipping is fuel-efficient and therefore reasonably well environmentally sound. Yet when a single ship can burn 60 tonnes of heavy fuel oil, the levels of pollution per hour are therefore quite high.

The environmental argument has been driving shipping to become more fuel-conscious, but so have fuel prices.



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While crude prices were high, the price of heavy fuel oil was around \$600 per tonne and cleaner low-sulphur distillates were even more expensive.

Prices may have dropped heavily, but this is not an incentive for owners to go back to ordering vessels with the level of fuel efficiency seen a decade ago.

The application of technology has advanced, as have the regulations. There is also reasonable certainty that fuel prices will eventually climb.

A newbuilding ordered today will have to be 10% better than an allocated reference index line, which is the average of vessels built between 1990 and 2010.

Shipowners with five to 10- year-old vessels that were built when the focus was on freight and speed are in danger of losing out to the newbuildings that are being delivered today.

Vessels being built today are achieving levels of efficiency that appear to surpass the mandatory standards so far created by international regulators, with efficiency gains on some ship types of up to 30%, according to ship designer claims.

Should you, as an owner, order a newbuilding or retrofit a secondhand vessel to be competitive in the market? What incentives are there and will it prove to make financial sense? Can your secondhand vessel be retrofitted to a high enough efficiency so it is comparable to a newbuilding?

It is a buyers' market. Prices are competitive and yards are looking for orders.

There was a debate last month in which there were claims that the designs of tankers, bulk carriers and containerships had not improved in terms of fuel efficiency between the 1990s and 2009. There is evidence to support that, but also the regulations to drive efficiency forward.

This means that two comparable vessels — let us say, for example, two capsize dry bulk vessels ordered five or six years apart — will have notably different results from their delivery sea trials.

So this is the exercise we have undertaken at Lloyd's List. Two years ago, we did a similar exercise on a medium range tanker and a capsize bulk vessel. This year, because the debate has raged over larger vessels, we will focus mainly on the capsize vessel that we have called *MV Cape Pretender*.

The objective of this exercise is to examine the parameters for retrofitting such a vessel and how it compares with a newbuilding.

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**Vessels being built today are achieving levels of efficiency that appear to surpass the mandatory standards so far created by international regulators ””**

# Take-up of energy-saving technologies reviewed in new UCL study

Results show large shipowners have refrained from selling and purchasing vessels as a way to improve fleet efficiency, while smaller owners have done so

A SOON-to-be published survey by the Energy Institute of the London-based University College London shines light on current take-up of energy-efficiency technologies, both in newbuildings and as retrofits in existing vessels.

The results are revealed for the first time in this report.

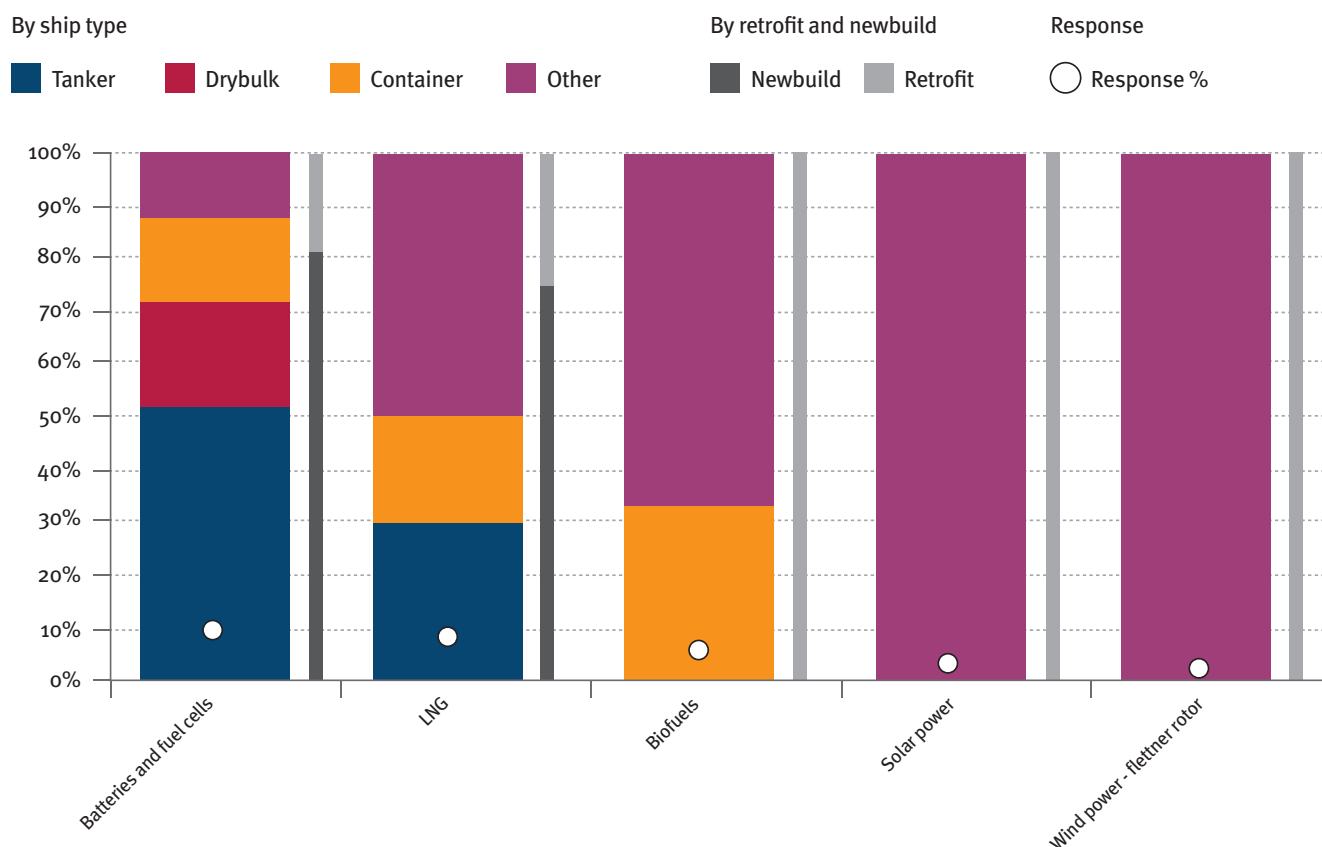
The survey sought to take a representative sample of shipowners, operators and managers from around the world, which would

## ALTERNATIVE ENERGY SOURCES

Lloyd's List | Graphic

This diagram shows the level of implementation of alternative energy sources on vessels. The list is quite well defined, being any batteries or fuel cells, the use of liquefied natural gas or biofuels, experience with solar power or wind power, such as sails, kites or flettner rotors.

As is experience of these measures is limited with never more than 10% of the respondents saying they have any experience. The two alternative energy sources with which respondents have had experience are LNG fuel and batteries or fuel cells, with most being installed on newbuildings.



Source: UCL Energy Institute survey report

also be representative of the three main ship types causing CO<sub>2</sub> emissions in shipping — namely tankers, bulk carriers and container vessels.

The 283 respondents represented more than 10% of the total number of shipowning companies.

From the survey, one can see that large shipowner respondents have refrained from selling and purchasing vessels as a way to improve fleet efficiency, while smaller owners have done so.

The debate on whether owners are ordering newbuildings or retrofitting vessels to be more efficient by design remains unclear, as about 58% of respondents suggests they have invested in retrofitting and a little over 60% have invested in newbuildings.

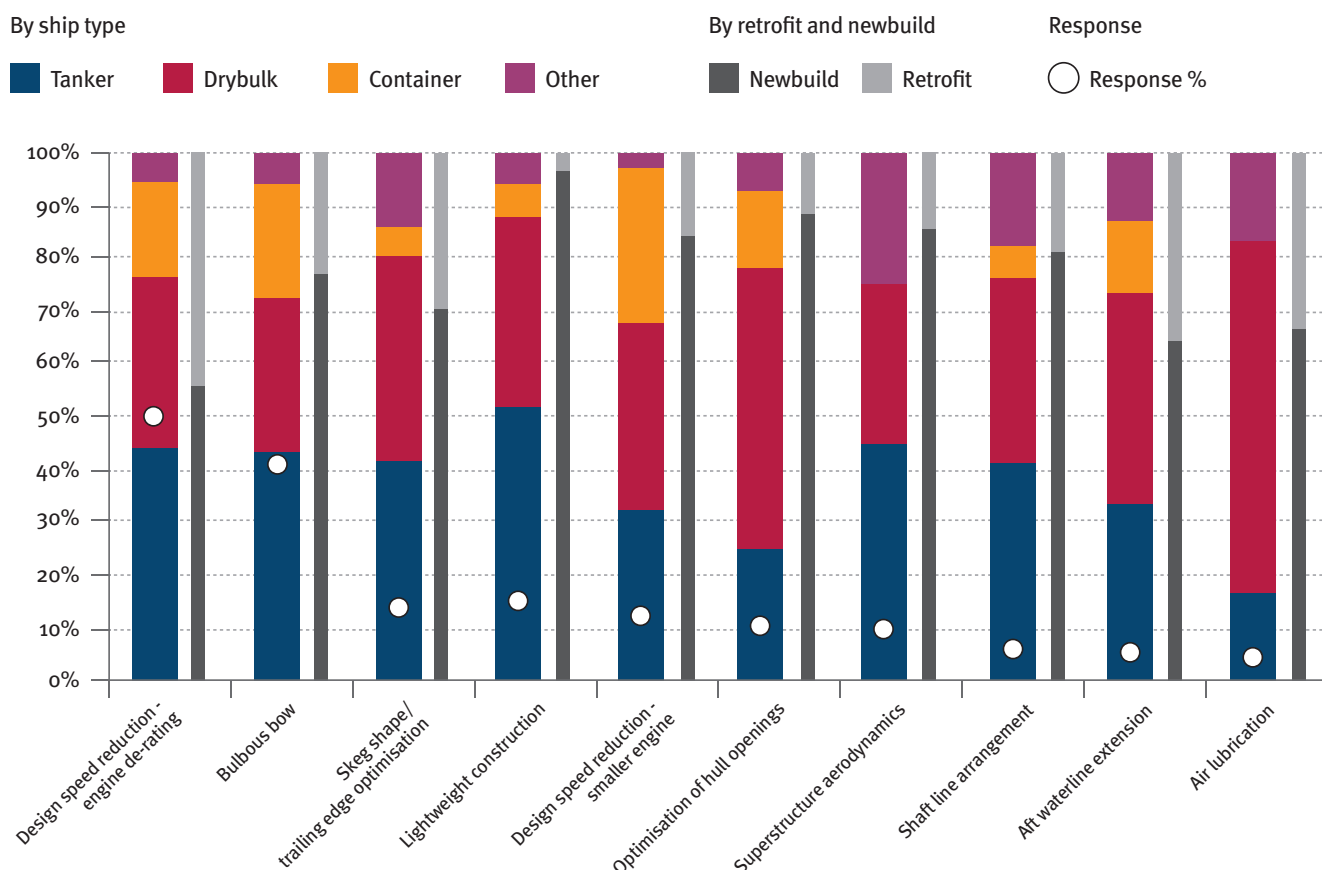
It can be assumed that all newbuildings are fuel-efficient to some degree, as they have to comply with EEDI requirements. Some owners have done both: ordered newbuildings and opted to upgrade some existing vessels.

## DESIGN MEASURES

Lloyd's List | Graphic

The diagram shows that the design measure with the highest implementation across the world fleet is a speed reduction achieved through engine reconfiguration, and removal and changing a bulbous bow. 50% of the survey respondents have experience of engine de-rating, while 42% have experience of adapting the bow shape.

Almost 45% of the respondents said the engine de-ratings were on tankers and slightly more engines were de-rated on existing vessels (retrofits) than having newbuildings with lower design speeds. On average, more design measures have been installed on bulk vessels than other vessel types and retrofitted on existing vessels more than applied to newbuildings. 18% of the respondents have implemented no design measures on newbuildings or retrofits.

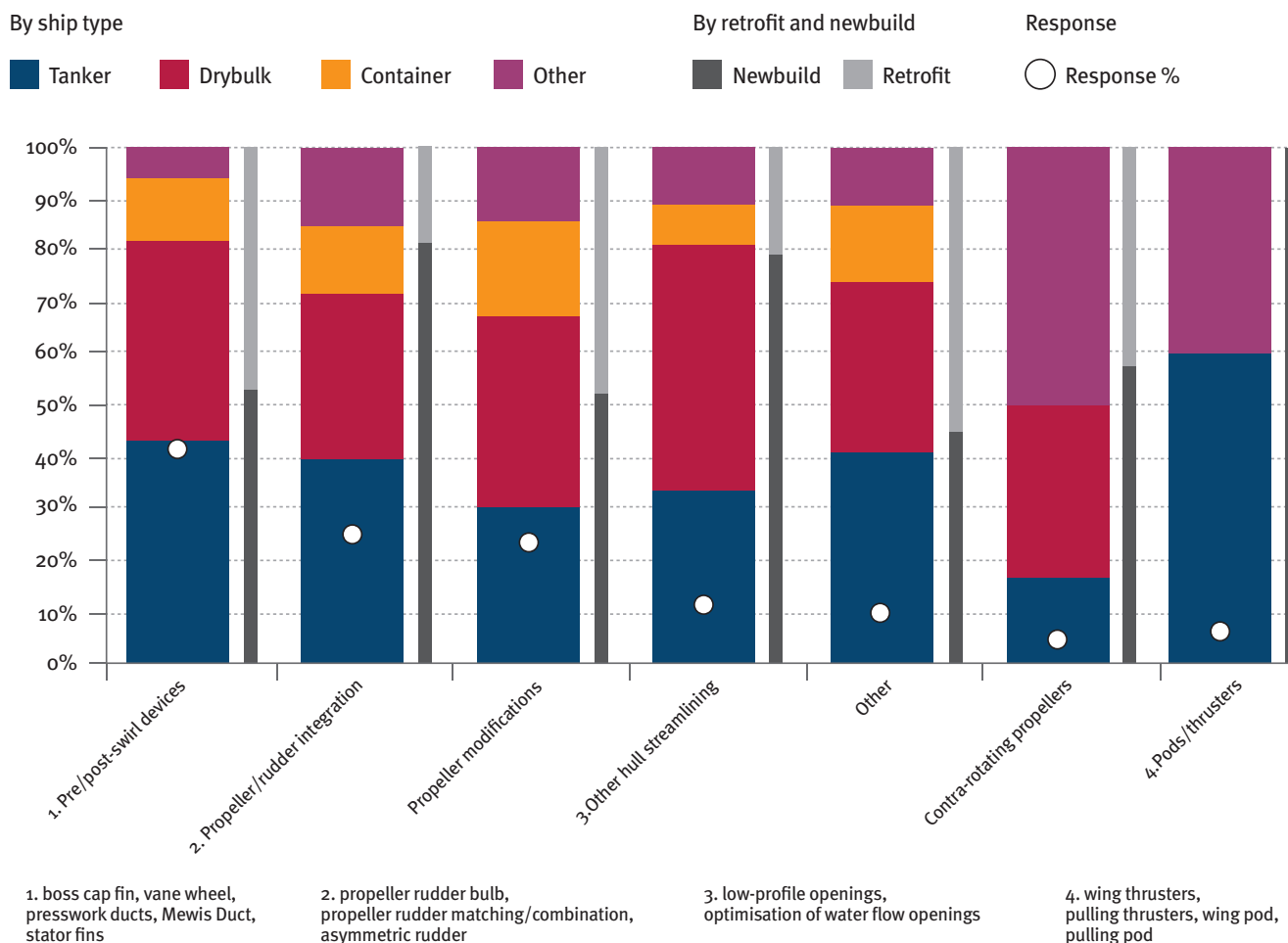


Source: UCL Energy Institute survey report

## HYDRODYNAMIC MEASURES

Lloyd's List | Graphic

The diagram shows how popular improved hydrodynamic measures that improve water flow round the hull, propeller and rudder, have been popular amongst survey respondents. 42% of the survey respondents said they have installed a pre- or post-swirl device like a Mewis Duct. 62% of the hydrodynamic measures have been on newbuildings.



Source: UCL Energy Institute survey report

There is an indication that some owners have let less-efficient vessels idle, according to the report; however, this may be due to current market conditions in some sectors, making it difficult for less-efficient vessels to gain employment.

There are some findings the report statistics do not directly reveal. One is that the level of implementation of energy-saving solutions and systems are not fleet-wide; they are often test or trial installations as owners take a cautious approach.

There are some technologies that are more popular, mostly due to them being the easiest, less-expensive technologies, giving the fastest returns.

## MACHINERY MEASURES

Lloyd's List | Graphic

The diagram shows the level of implementation of machinery measures to a ship's engine and other engineroom-related improvements such as improved lighting or waste heat recovery.

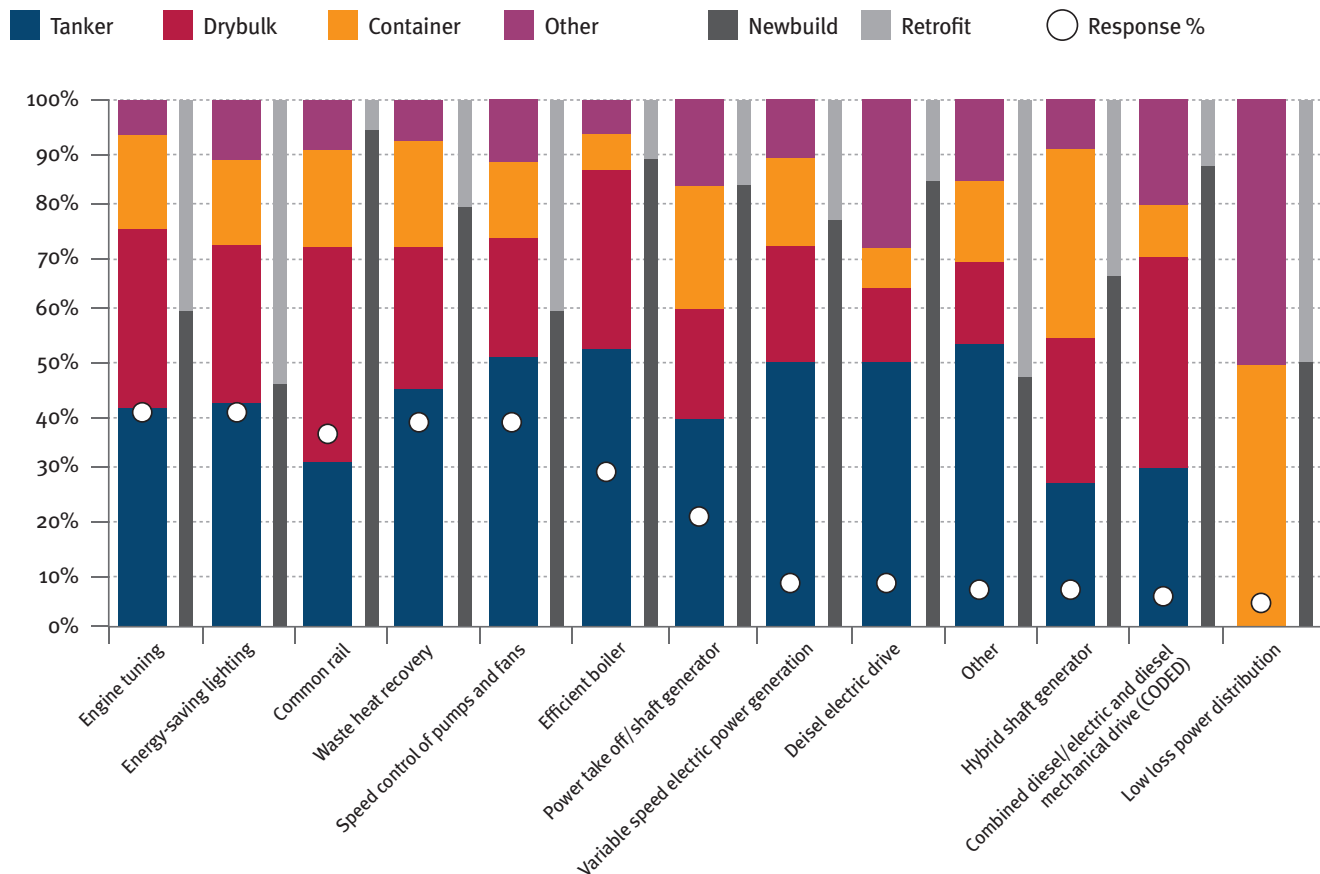
42% of the respondents have had ship engines re-tuned, and an equal number have had energy-saving lighting installed in vessels. It is unclear if these are the same respondents.

On average, it appears that machinery measures have been installed on more tankers than bulk vessels. The measures appear also to be more common on newbuildings than with retrofitting, according to the survey respondents.

By ship type

By retrofit and newbuild

Response



Source: UCL Energy Institute survey report



# Retrofit versus newbuilding: defining the market

A UBS report says while the latest newbuildings are seen as more likely investments, the decision will depend on fuel price predictions and the attitude of the lender

ACCORDING to UBS analysts, the basic retrofit to improve efficiency is the installation of a Mewis Duct, the blasting and recoating of the hull with a top-of-the-range coating, the replacement of the propeller and rudder and the use of performance monitoring technology.

This is the set of projects we will be assessing for the Lloyd's List hypothetical vessel, *MV Cape Pretender*.

In the report "Are eco-ships investor friendly?", UBS quotes a white paper from shipowner Euronav, where the company states that the 30% reduction in fuel savings claimed by shipyards is not a fair representation because the figure is based off favourable benchmarks that consist of high-consuming vessels.

However, the report then cites Scorpio Tankers, saying the operator had seen a 2012-built medium range tanker performing between 28%-30.5% better than one delivered in 2008.

The UBS report concluded that while the latest newbuildings have an edge and are seen as more likely investments, the decision will always depend on fuel price predictions and the attitude of the lender.

As reported in Lloyd's List earlier in the year, banks are already seeing the benefit of fuel efficiency in tonnage on which they have mortgages.

UBS concludes the report saying: "The argument really comes down to growing the fleet or optimising the fleet. Posed in this manner, we continue to call for consolidation and ordering restraint. An ordering spree of newbuildings to capture a fuel advantage alone will likely end up pressuring market rates down and negating the positive impact from fuel savings."

So we will opt to retrofit *MV Cape Pretender* to try to get a further five to 10 years' profit before selling the vessel.

The first set of retrofit parameters are those seen to be happening most regularly in the market, namely the installation of a Mewis Duct.

UBS also suggests a retrofit should include a Mewis Duct and a larger propeller: Becker Systems, the owner of the Mewis Duct,

**As reported in Lloyd's List earlier in the year, banks are already seeing the benefit of fuel efficiency in tonnage on which they have mortgages ”**

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is about to announce its 1,000th installation. Together, these two adaptations can give a 5%-10% saving and a direct payback, so a five- to 10-year-old vessel should be making these improvements.

Maximising existing ships to compete with the newbuildings that are being developed has turned into a controversial topic. It has been made more acute with the dramatic fall in bunker prices, highlighting how precarious payback times and operational cost predictions can be.

Following on from earlier exercises, this report lays bare some of the facts to allow owners to make more valuable assessments of their options.

To do that, one must be able to look at what is being compared. In a recent paper, financial analysts looked at the economic value of purchasing an eco-ship, over investing in a retrofit.

The problem identified fairly quickly is how to define an eco-ship. A few years ago, Japan wanted to do it. It struggled.



The Koreans said recently that any ship with a mandatory and valid energy efficiency design index will be deemed an eco-ship. This means all newbuildings, so it is not very helpful.

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UBS's definition — albeit the report from which this is taken focuses on VLCCs — is as good a starting point and can be defined thus:

- Optimised hull form;
- Two-stroke slow-speed long-bore G-type engine: these new engines give lower revolutions, less torque and more power to a larger propeller;
- Large propeller and use of Mewis Duct and optimised rudder;
- Latest generation of hull coating.

These are not onerous definitions. In fact, with some of the latest instruments entering the market and beginning to make serious headway, this list should include:

- Latest generation vessel performance software;
- Use of advanced fuel-saving tools, such as underwater

lubrication or flettner rotor;

- Remote monitoring for enhanced performance;
- Fully-trained crew, including electrical engineers.

The UBS report suggested use of a modern hull coating with advanced low-friction properties, either foul release or silica-based. The cost for a retrofit coating to meet this standard is \$500,000 for a VLCC and \$300,000 for a suezmax.

The saving — or rather the lack of deterioration of performance — can be as high as 30%, though this measurement remains suspect, as the coating manufacturers have yet to fully use a set of standards that are near industry agreement.

# Crew can be a crucial element in vessel performance

Technological developments are offering industry a double-edged sword, as they may be demotivating for those on board

WITH the focus on technology and design, the efficiency debate often excludes a ship's crew as a critical component in vessel performance. This is partly due to owners often seeing crew as a cost that must be endured, rather than used as an optimisation tool.

Some owners that have retained a strong focus on crew have long held the belief that if a crew is engaged with a vessel and its company, it can be a crucial element in the vessel's improved performance.

But technological developments are offering industry a double-edged sword. The trend towards outsourcing performance monitoring to land-based solution

providers such as BMT Smart is a concern for some, as it could be demotivating for crew engagement, as is the debate on autonomous or remote-controlled vessels.

Industry is at an odd paradox, where ships' crews are seen as an integral part of improving a vessel's operational performance, yet as a cost that must see shore-based control of a vessel in the future.

However, as fuel efficiency is about operational and design measures, there is a need for ships' crews to be better trained and made aware of why they should, and how they can, improve a vessel's performance.



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# How does *MV Cape Pretender* compare?

Taking a look at the performance and economic value of Lloyd's List's theoretical vessel ahead of installation of any retrofit solutions

MV Cape Pretender is a mid-size capesize vessel, about 160,000 dwt and five years old.

It is coming up for its first special class survey and so this is a good opportunity to undertake fuel efficiency measures during the compulsory two-week drydocking.

When we looked at potential measures, especially some of the more dramatic retrofit solutions, it became apparent that planning ahead is crucial; in some cases, up to a year ahead.



The Australia-based vetting group RightShip has an existing vessel design index, which can give a ball park comparison of such a vessel as MV Cape Pretender with its peers, and we can make some general assumptions about the performance and economic value of the vessel ahead of docking (see tables).

## RESULT: ANNUAL FUEL BILL COMPARISONS\*

Fuel price	MV Cape Pretender (pre retrofit)	Difference	Retrofitted MV Cape Pretender	Difference	Newbuilding delivered 2015	Super-retrofitted MV Cape Pretender**
\$400 per tonne	\$7.1m	\$1.1m	\$6.0m	\$1.0m	\$5.0	4.9m - \$5.3m
\$600 per tonne	\$10.6m	\$1.6m	\$9.0m	\$1.4m	\$7.6m	\$7.4m - \$7.9m
<b>RightShip efficiency modelling</b>						
EVDI	3.032		2.55		2.467	c.2.46
A-to-G rating	E		B		A	A

\* If the retrofit measures demonstrate better efficiency returns than assumed in this exercise, then the efficiency will more closely resemble a newbuilding delivered today

\*\* The installation of wind technologies and/or under-hull air lubrication could add a further 5%-10% to net gains (giving daily fuel consumption of between 44.1 tonnes and 47.3 tonnes), thus potentially performing better than an average newbuilding delivered in 2015 without any of these efficiency systems installed



## VALUES

	Newbuilding	Five-year-old	10-year-old
2011	\$54m	\$44m	\$35m
2013	\$47.5m	\$34m	\$21.5m
2015	\$51.5m	\$34m	\$22m

## FUEL COSTS

Item	
Time charter rates (one year)	\$10,000/day
Revenues from charters and spot market activity	
Sailing days a year	280 (poor markets may see the sailing days reduced)
Newbuilding fuel consumption	45t/day, 12,600t/yr
Annual fuel bill modern newbuilding (\$400/t HFO)	\$5.0m
Annual fuel bill modern newbuilding (\$600/t HFO)	\$7.6m
Average daily and annual fuel consumption MV Cape Pretender, prior to retrofit	63t/day, 17,640t/yr
Annual fuel bill MV Cape Pretender (\$400/t HFO)	\$25,200/day, \$7.1m/yr
Annual fuel bill MV Cape Pretender, prior to retrofit (\$600/t HFO)	\$37,800/day, \$10.6m/yr
Assumed retrofit investment package (see report for measures chosen)	c.\$4m
Fuel savings*	c.15%
Post-retrofit fuel consumption	53.6 t/day, 15,008 t/yr
Fuel bill after retrofit**	
- \$400 per tonne	\$21,440/day; \$6.0m/yr
- \$600 per tonne	\$32,160/day; \$9.0/yr

\* The saving percentages of all measures will not be a sum of the offered savings. Some savings will be reduced

\*\* The installation of wind technologies and/or under-hull air lubrication could add a further 5%-10% to net gains (giving daily fuel consumption of between 44.1 tonnes and 47.3 tonnes), thus performing better than an average newbuilding delivered in 2015

# Six of the best energy-efficient technologies available

From hull coatings to air bubbles, there are many new systems that are aimed at helping improve a ship's efficiency

## 1. Ducts

Becker Systems told Lloyd's List that installation of a Mewis Duct in the drydock takes three days. The cost is about \$25,000 for the installation and the selling price is \$200,000. The average saving is 6%, and comes with a power-saving guarantee based in model tests.

Becker has seen 700 systems installed and has another 300 on order, with 60% being retrofits, proving the tool is popular. There have been some rumours that charterers will insist on vessels having the tests to see if a Mewis Duct should be installed.



## 2. Hull coatings and performance

Lloyd's List readers will recall that three years ago, a project was launched to create standards in how hull and propeller performance should be monitored and measured.

The work started out contentiously. As well as shipping gurus and class, the work sought the input of coatings makers, the software companies that measure fuel efficiency and other bodies.

The work was accepted by the International Organisation for Standardisation to become a voluntary standard, and that is now set to come to fruition later this year.

These are not mandatory standards; they are voluntary. They are also designed to allow a shipowner to monitor an individual ship's performance in a clearly defined way.

Those working on the standard are aware that this could become a tool by regulators to measure performance and then calculate CO<sub>2</sub> emissions from ships, but remain keen to keep it away from any mandatory CO<sub>2</sub> rules. The standard is also a way for coatings makers to state performance of hull coatings.

Contrary to what the coatings makers say, a hull coating does not directly save fuel. The selection of the right coating for the vessel and its operating condition will deteriorate less rapidly than other options, thus keeping the hull in as near-perfect a condition as long as possible.

As time goes by, the hull may acquire biofouling or pitting, which will create hull drag as it goes through the water, thus requiring more engine power for a set speed, and in so doing increase fuel consumption.

Coating manufacturers would often make outlandish claims of a product's fuel-saving capabilities, by making irrelevant comparisons that would not help an owner make an educated decision.

For the sake of this exercise with MV Cape Pretender, we have bundled the coating cost and benefit in with a range of other options, taking the recent UCL survey and UBS report as a basis.

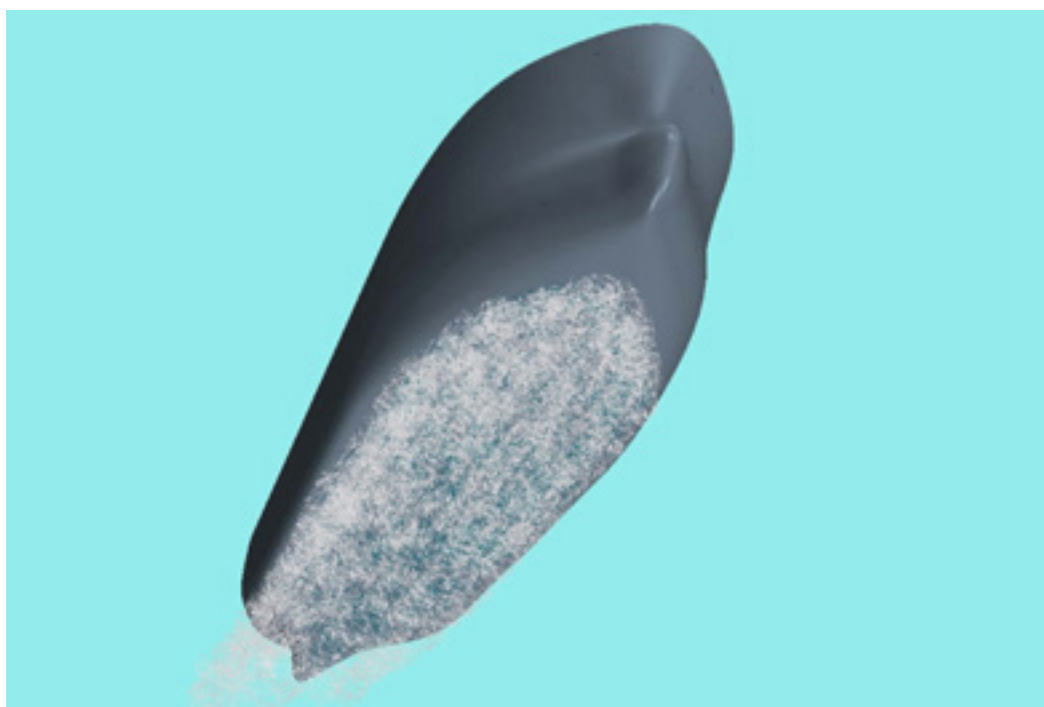
The installation of a brand new hull coating will involve blast-cleaning the hull in drydock to remove the previous coating, plus the application of one or more pre-coatings before the final hull coating is applied.

For a capesize vessel, the maximum underwater area at loaded draft will be about 20,600 cu m. Each coating will need to cover that area.

We asked Norwegian coating maker Jotun for a quote for installing the company's latest product. It is called Sea Quantum X200.

The company's claim is that the product will maintain the ideal condition of the hull for longer than other products. For a VLCC, the claim is that a 15% hydrodynamic performance gain translates into a fuel cost saving of around \$6m during a five-year docking cycle.

**As time goes by, the hull may acquire biofouling or pitting, which will create hull drag as it goes through the water, thus requiring more engine power for a set speed ”**



This calculation assumes the VLCC consumes 62 tonnes a day, is at sea for 274 days and the cost of heavy fuel oil is \$500 per tonne.

For MV Cape Pretender, Jotun said the assumption it made was that the vessel had 40t fuel consumption a day, was at sea for 275 days a year, the fuel price was \$400 and the vessel's charter speed was 12 knots.

The fuel consumption over the five years between the drydockings is an astonishing 55,000 tonnes, costing about \$22m.

The cost of the premium product would be \$853,000 compared to a market average product costing \$208,000.

Yet Jotun claims the speed loss due to hull fouling or coating degradation would be about 1.5% for its premium product, and about 5.9% for the market average.

Speed loss has to be compensated for if a vessel has a charter speed to maintain. This means \$990,000 is added to the fuel cost, compared to \$3.89m for the market average, so the difference would be \$2.9m.

The claim that MV Cape Pretender's fuel bill could be down by \$2.9m over a five-year period comes with a cash-back guarantee from Jotun if the speed loss is greater than 1.5% over the five-year period.

A standard procedure for measuring the performance deterioration of a ship's hull and its propeller is set to be approved and be available in 2016.

Work has been ongoing to create the standard for nearly three years. Discussions began when it became apparent that manufacturers were not making similar comparisons when making fuel-saving claims of their services and technology, and many owners lacked the capability to understand performance.

The standard, to be known as ISO 19030/Hull & Propeller performance, comes from work at the International Organisation for Standardisation. Shipowners, lobby groups, coatings makers and monitoring software firms have all taken part in discussions. The ISO members are from national standards bodies around the world, 17 of which took part in and voted in the standard in May this year.

When a vessel leaves a drydock, its hull and propeller are in the best condition possible, but over time, biofouling and other unwanted coatings such as slime can impact performance, which can be by more than 10%.

Hull coatings manufacturers have over-simplified this in the past and made claims on how their best coatings will perform

**A standard procedure for measuring the performance deterioration of a ship's hull and its propeller is set to be approved and be available in 2016 ””**

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better than others, though usually not identifying what the ‘other product’ is.

This standard helps the coatings manufacturers verify their claims and also allows owners and operators to better determine maintenance.

However, while it could theoretically be used to make ship-to-ship comparisons, this is not what its aim has been.

### **3. De-rating the engine, propeller change, turbocharger cut-out and improved fuel injection**

There is some question over the need to fully derate an engine. According to some analysts, if there is the risk that a segment may see average speeds increase during the life of a vessel, it may not be wise to do so, as this could hamper performance if market conditions change.

In addition to de-rating, there are options for installing turbocharger cut-outs, improved fuel injection and improved lubrication application. More modern vessels have some of the latest generation engines, which are electronically controlled rather than mechanically controlled.

The price of a de-rating is very much dependent on what the customer wants — but MAN Diesel says it has recently made de-rating for some S70-bore engines, including new propeller and rudder bulb, where the price was in the range of €1.5m (\$1.6m) to €2m.

Besides de-rating, MAN Diesel offers turbocharger cut-out and the MAN EcoCam.

A turbocharger cut-out is applied when a vessel has more than one turbocharger. One of them can be blanked off and no longer used. This will provide savings of up to 6g/kWh, in the low load range. The price for the 50-80-bore engine will be in the range of €150,000-€175,000.

The MAN EcoCam is a solution for the low-load optimisation of mechanical engines. The EcoCam makes it possible to adjust the closing time of exhaust valves according to engine load and provides savings in the range of 2-4g/kWh. The price for 50-70-bore engines will be in the range of €45,000-\$85,000.

The latest large vessel newbuildings are being ordered with ultra long-stroke engines, which offer the chance for larger propellers. MAN Diesel owns Kappel propellers, which have a unique trailing edge, similar to the winglets on the tips of aeroplanes that offer additional efficiency gains.

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**The latest large vessel newbuildings are being ordered with ultra long-stroke engines, which offer the chance for larger propellers ”**



## 4. Monitoring software

If fuel or energy consumption is not being measured, then it is difficult for any improvements to be accurately monitored and quantified.

One of the growing numbers of software system-makers providing help in performance optimisation is NAPA, the Finnish company now owned by Japanese Class Society Class NK.

However, there is competition in this field, with companies such as BMT Smart, Marorka, Eniram and Greensteam. These companies all have software tools that can be used to monitor energy use, and thus fuel consumption, by using data from an array of sensors.

More modern equipment has more sensing capabilities, but the basic data would be engine power, propeller torque, prevalent sea conditions and vessel draft and trim.

For MV Cape Pretender, the fuel savings will be between 4% and 6%, according to NAPA. We will assume 4%.

We are assuming pre-retrofitting fuel consumption of 62 tonnes a day, but the fuel saving may not be as great if the ability to better monitor a vessel is combined with the de-rating engine and other common measures.

The software system costs €130,000, although the company recommends an analysis of the hull form, which is a further €30,000. There may be other third-party equipment needed. The monthly cost is €1,830 for office reporting, analytics and weather and sea currents data.

The work to install the system would take two days of drydock time, and involve the installation of flow meters in fuel lines and shaft torque sensors if they are not already in place. Work that can be completed out of drydock includes shaft torque cabling, installation of hardware, LAN cabling and system configuration.

## 5. A case of bubbles and wind

IN the past two years, there has been an increase in the development of technological solutions that go beyond what we may call the basic upgrade.

Of these, there are two that owners — and, just as importantly, charterers — seem to have taken an interest in: air bubbles that form a lubricating carpet under a ship's hull, and the use of wind as a source of power.

These are two completely different technologies and at differing levels of maturity, so are best approached separately.

## Underwater lubrication

The basic premise is that a controlled stream of bubbles pumped under the fore part of the ship will slow aft and reduce the friction between ship and water as the vessel powers forward.

UK-based Silverstream has extensive data from its first installation retrofit. Given that there will be operational differences between vessels, there is leeway in the results expected. But the estimated costs and benefits offered by Silverstream are:

**Installation and installation costs: Not provided**

**Payback time based on \$500/tonne fuel oil and 280 operational days a year: 4.5 years**

**Net fuel efficiency: 5%**

More can be read about Silverstream in the accompanying Next Generation report published by Lloyd's List in conjunction with Nor-Shipping.

There are other companies developing similar concepts. Foresight in Finland has a system installed on two cruise vessels, and Mitsubishi has a system installed on a pair of heavylift cargoships in Japan.

## The sail or flettner rotor

Just as with Silverstream, investors are taking an interest and backing green-tech start-ups looking at developing tools that harness wind in a modern way.

The solutions on the market are not revolutionary; they take long-known principles about wind propulsion, but are trying to secure market support as they seek to apply them into modern shipping.

We got three quotes from Crain Technologies, Norsepower and SkySails. All three are members of the International Windship Association, which was formed in 2014.

Norsepower has developed a flettner rotor system and has a single rotor on board a Finnish vessel under trial and hopes to secure more commercial orders as soon as possible.

SkySails is the developer of the towing kite concept, which has had a working model for a number of years, although a lack of orders led it to suffer financially five years ago.

Crain has a concept that it believes is about two years from bringing to market, called a suction wing. The company said four of these 40 m-high towers would cost up to \$8m, offer a 20% saving and have a five- to seven-year payback if fuel prices were back at \$600 per tonne. Clearly with prices below \$400 per tonne, payback would be considerably longer.

## Norsepower flettner rotor

Norsepower recommended that we install five rotors on MV Cape Pretender, our large five-year-old bulk vessel. The company said the rotors can easily be placed down the centreline of the vessel,

but also on one side, should there be an issue with the use of either the vessel's own gearing, if it has any, or shore-side loading cranes and arms. The total air draught would become about 45 m.

System capital investment	\$4.3m
Annual maintenance costs	\$86,000 per year
Fuel savings	c.12%-18% (though route dependent)*
Payback time	Four to seven years

\* The efficiency of a flettner rotor, just as with any wind-based power mechanism, is dependent on the prevailing weather conditions. Some routes may not be ideal for use of such systems. The calculations given assume a service speed of 13 knots, and a specific fuel oil consumption of 190g per KWh. The vessel is assumed to spend 75% of the year at sea. Fuel prices are \$500 per tonne

## SkySails

Germany-based SkySails lists three vessels that have had the kite successfully installed in recent years, including the 1994-built Aghia Marina, a 28,000 dwt geared dry bulk vessel owned by Greece's Anbros Maritime and on charter to commodity giant Cargill, which sponsored the installation.

There have been no published results of trials on Aghia Marina, which clearly is significantly smaller than MV Cape Pretender. SkySails told Lloyd's List it believes MV Cape Pretender could save 550 tonnes of bunker fuel a year with a kite system installed.

## 6. The hull

A recent paper prepared by CE Delft on behalf of the green lobby group Transport and Environment created a bit of a storm recently. The lobby groups had commissioned the report because they believe the energy efficiency design index is too lax.

The EEDI is a mandatory index that all newbuildings from 2013 must have. The value of the EEDI must be better than a specific benchmark for the ship's size and type. The regulation is such that over the coming years, the designs must be a certain percentage better than this reference line.

The lobby group claim the reference line should have been calculated better. The ships used to help create the reference line, namely vessels delivered between 1999 and 2009, were ones that had been designed for speed and freight, not fuel efficiency. Vessels built before this time were better.

The headline claim was ships were worse than 20 years ago. The claim has some backers, who point to the block co-efficient of most large bulk carriers and tankers. In essence — and this is behind most of the eco-ships claims — hull shapes can very easily be improved to achieve much of what the EEDI is trying to achieve.

Clearly, hull design improvements are not possible on existing vessels; the most the industry has seen has been some vessels —

mostly containerships — having bulbous bows cut off and replaced with ones better suited to slower speeds.

The design changes/trends during the past 20 years are summarised in the following tables:

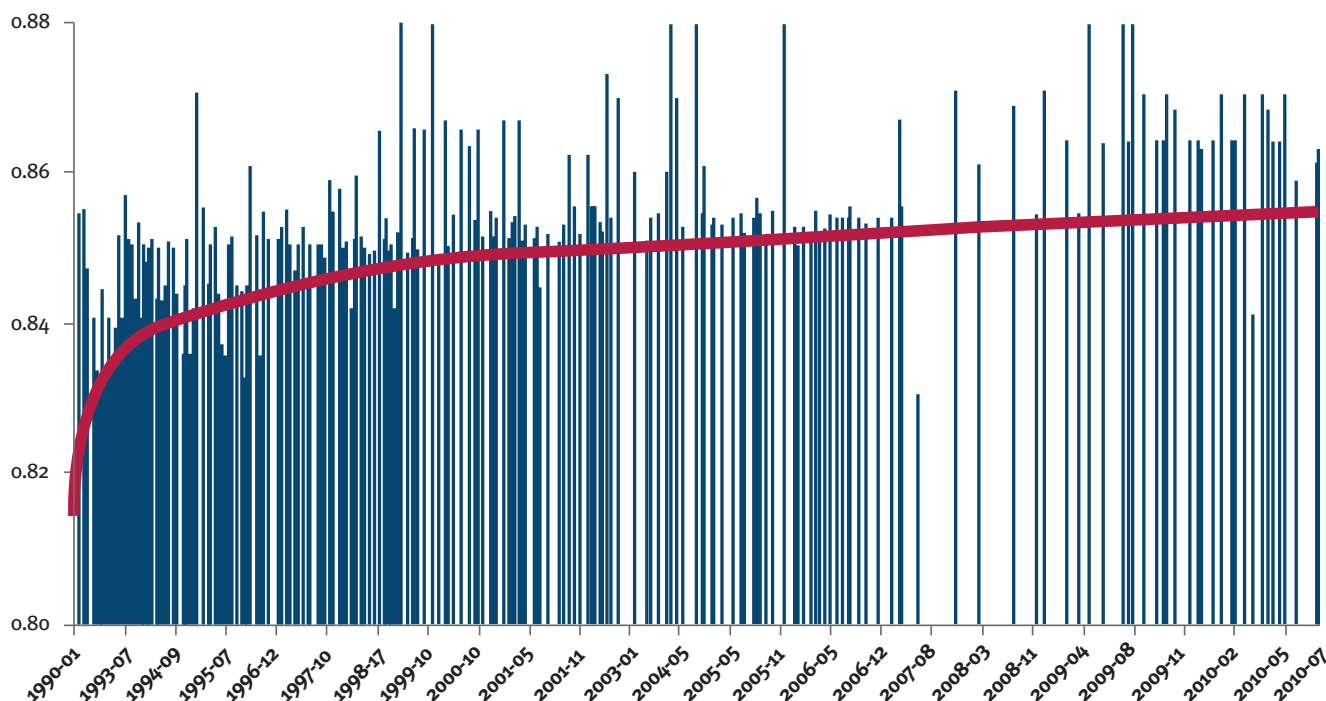
#### DESIGN CHANGES FOR TANKERS AND BULK VESSELS

Ship type	Block co-efficient		Length displacement ratio	
	1990	2010	1990	2010
Handymax tankers	0.80	0.81	4.9	4.5
Panamax tankers	0.83	0.86	5.1	4.95
Aframax tankers	0.82	0.84	4.9	4.7
Suezmax tankers	0.83	0.825	4.8	4.7
VLCC	0.815	0.82	4.7	4.55
Panamax bulk carriers	0.84	0.87	5.1	4.6
Aframax carriers	0.81	0.87	4.85	4.8
Suezmax bulk carriers	0.84	0.86	4.8	4.85
VLBC	0.82	0.82	4.7	4.6

The increased values for block co-efficient, and reduction in length displacement ratio show a trend that indicates vessels have fuller, less-streamlined hull forms and require more engine power to attain a specific speed

Source: HOK Marine Consult ApS

#### BLOCK CO-EFFICIENT FOR BULK CARRIER DESIGNS DELIVERED OVER 20 YEARS



A larger block co-efficient suggests a less streamlined hull form that requires more engine power to attain a specific speed. The table demonstrates the trend of increased block co-efficients over the past two decades.

Source: HOK Marine Consult ApS

# Market provides incentives for investing in retrofits

Heavyweight shipping banks have noted there is much more interest in the quality of the asset than there was five years ago

THE market is taking note of asset condition. Heavyweight shipping banks have noted there is much more interest in the quality of the asset than there was five years ago.

With a lower risk appetite, financial institutions are more concerned that an asset with a mortgage has work potential, i.e. that the vessel gains maximum employment and thus ensures the owner/operator can remain compliant with loan conditions. If an owner has to sell off the vessel, or worse goes into bankruptcy proceedings, the bank wants to reduce its risk by having high-quality vessels.

There has been a lot of debate on the owner-charterer responsibilities in some of the sectors.

With a high spot market, such as one sees currently with the tanker markets, operators are more minded to take the spot rates and pay the bills. In more volatile markets, the owners will look at the stability of long-term charters, where the charterers may have to pick up the fuel bill.

Charterers are also paying attention to fuel bills. RightShip, the vetting group, says its ship efficiency rating scheme is highly popular, with charterers using it to see which vessels are more fuel-efficient.

RightShip's model works by replicating the energy efficiency design index, although its index is the existing vessel design index. It takes a set of similar vessels and, using available data, calculates where they sit compared to each other.

With the Carbon War Room, the company controversially created an A-to-G rating, making the data readily available to allow vessels





to be compared. Clearly owners with poor-performing vessels tend to be unhappy with this.

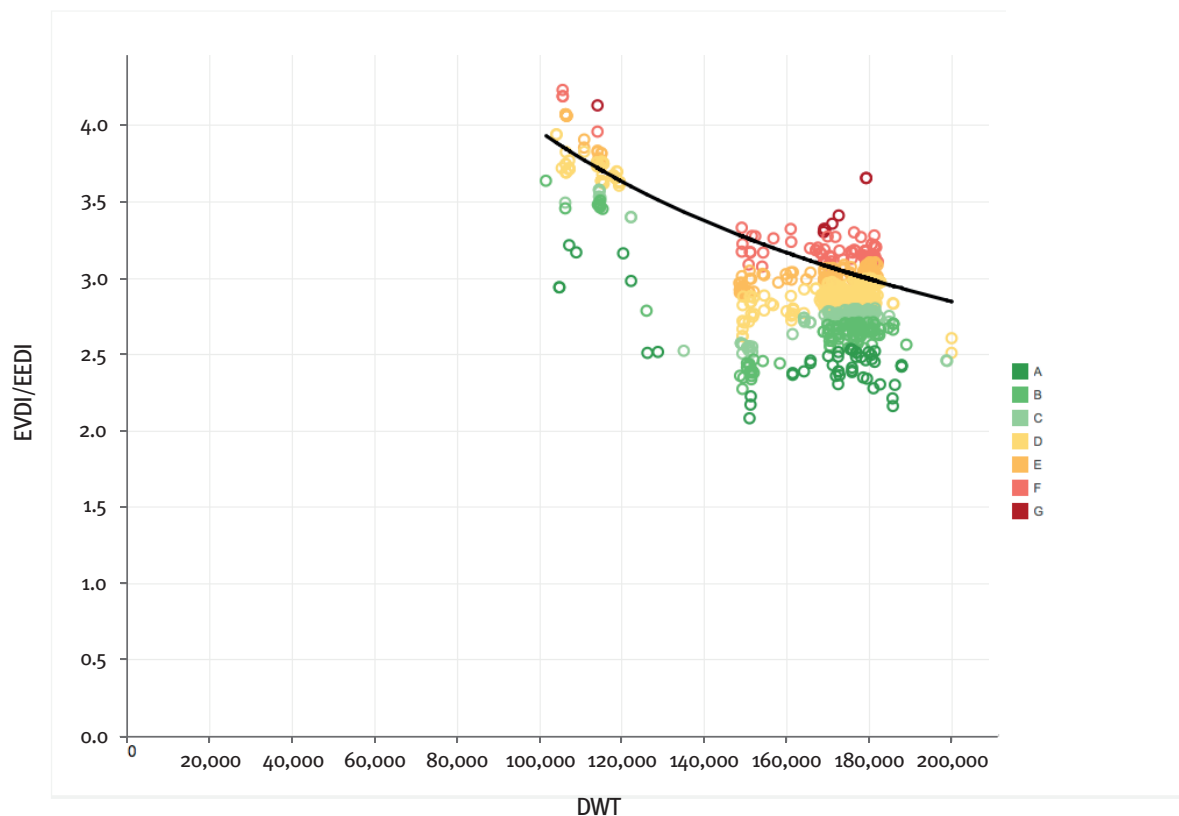
We asked RightShip where MV Cape Pretender, our five-year-old vessel, would sit. The EVDI index for the vessel would be 3.032, which is about the same as most similarly-sized bulk vessels built around 2008 or 2009.

On the A-to-G scale, that would put MV Cape Pretender at the lower end of the scale, while a newbuilding capesize today would average 2.467. The mean average EVDI for all capesize bulk vessels is 2.877.

Upon retrofit, with about a 15% improvement in sea trials, MV Cape Pretender would jump to a B-rated capesize bulker, which RightShip says will make it a more attractive vessel to charter than when it was poorly rated. The vetting group insists charterers do take this rating into account as part of their tonnage selection process.

If the subsequent installation of an under-hull lubrication system or a flettner rotor would potentially add a further 8% in fuel efficiency, it would make this once poor performer an A-rated vessel, although the payback for all the retrofit work could be up to seven years, which may lessen the interest in investing.

#### BULKER PHASE 0 REFERENCE LINE VS GHG EMISSIONS RATING



The above table shows the reference line and the EVDI/Values for the current fleet of dry bulk vessels 100,000 dwt -200,000 dwt (capesize). A-rated vessels are better performing than those rated G. According to regulations all vessels ordered after 2013 must be on or below the reference line. All vessels ordered after 2015 should be 10% better, those ordered after 2020 should be 20% better and those from 2025 30% better. The concern has been that the targets are already being reached, creating no additional incentive for improvement.

Another key incentive for retrofitting if one takes the RightShip rating as a market force is the level of scrapping in a particular sector. As a capesize vessel, MV Cape Pretender is fighting for business in a very harsh market.

The level of scrapping of capesizes is high; already in the first half of 2015, the tonnage scrapped has exceeded that of 2014.

It is the older, less-efficient vessels that are being scrapped, some only 16 years old. While MV Cape Pretender's EVDI value remains constant, its position on the A-to-G scale will deteriorate as scrapping of older vessels continues and any newbuildings are delivered.

The risk, though, is in getting the market to charter the vessel. Silverstream, makers of underwater lubrication, told Lloyd's List it is the charterers that are taking the strongest interest in its concept, keen on reducing the efficiency of vessels they have on long-term charter.

Poten and Partners, the New York-based brokers, announced last year that it saw a two-tier market in some sectors and would be publishing to market rates, one for more efficient vessels and one for standard vessels.

Fuel price will clearly be a determining factor in any market discussion. Most analysts and market commentators see a steady rise in fuel prices after the sudden drop in early 2015.

The UBS study looking at the market incentives for investing in retrofits for a very large crude carrier saw \$500 a tonne for fuel oil as the inflection where retrofit investments begin to make sense, though it raises the point that newbuilding prices and yard availability will also influence an investment choice.

A two-year wait to get a more efficient newbuilding leaves an owner with that period operating less-efficient tonnage if no other action is taken.

Another factor would be the age of the vessel considered for a retrofit; as a five-year-old vessel, it would be expected to have 15 to 20 years' service life. Yet, the trend is for vessels to be scrapped younger in poor markets.

**A two-year wait to get a more efficient newbuilding leaves an owner with that period operating less-efficient tonnage if no other action is taken ”**

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# Maximising efficiency: time to reach some conclusions

In effect, all newbuildings are eco-ships and you only get a premium when you beat the benchmark

THERE is now consensus on what an eco-ship is. It is simply a ship built to a set of new standards and will soon be the common form of vessel on the water.

Therefore the term should soon disappear from the everyday lexicon of the industry — unless we begin to see shipyards and designers, for the sake of marketing only, refer to ships as ultra eco-ship or some other similarly meaningless term.

The technology firms and innovators are the ones making it possible to improve the operational aspects of the vessel, with designers returning increasingly to adapting and improving the ship designs that were used before the focus of the industry turned to speed and freight capacity.

When a time charter owner sees a net benefit, they will likely retrofit a five-year-old vessel, but the fuel price needs to be \$500 a tonne.

Owners are likely to put a vessel on the spot market, as one sees with bulk vessels today. This will incentivise cash-rich owners to look for retrofitting, as they have to bear the fuel costs.



Owners of efficient fleets have told analysts they do see charterers willing to pay a premium. This has been corroborated by Poten and Partners, which now has separated standard and eco-ship indexes.

*Shutterstock.com*

But the fact is that all newbuildings are eco-ships. They all have increased performance, and it appears they can easily meet mandatory performance design requirements.

You only get a premium when you beat the benchmark. The clear

impact will come as older vessels are scrapped and new vessels, ordered after 2013, are a larger percentage of a ship type's global fleet, and then become the worldwide market average.

But the design of a ship is one factor; the bigger one is how it is operated. There can be a 10% swing factor in the data, which makes overall performance very difficult to pin down. There is also a difference between laden and ballast voyages.

MV Cape Pretender's fuel efficiency needs to be improved, otherwise it will struggle to give the shipowner sufficient returns. The easiest option, with the least investment cost, is what is now seen as a standard retrofit package to achieve a 15% fuel improvement.

This is probably what will happen if the vessel is on the spot market. If the vessel is in a long-term charter with a charterer that has a keen involvement in their fleet fuel costs, then further measures will be considered, especially if further analysis shows the fuel bill is likely to increase.

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