Schroders
The costly future of green shipping

“We’re going to need a greener boat”

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Contents

01 Executive summary
03 Introduction
04 Environmental impacts and risks
11 Investor toolkit
15 Questions for investors
16 Conclusion
Executive summary

- The environmental impact of shipping operations has been known for decades. It is only recently, however, that the damages to human health and biodiversity have been demonstrated.
- Regulatory measures from the International Maritime Organization (IMO) and the European Union (EU) on air pollution, greenhouse gas emissions (GHG) as well as ecosystem disruptions will impose significant compliance costs on shipping companies.
- The most immediate operational challenge for shipping companies is abiding by international standards on emissions of sulphur oxides (SOx).
- Restrictions around nitrous oxide (NOx) emissions and carbon dioxide (CO2) emissions will kick in over the next three years. Under a yet-to-be ratified international convention, ballast water management systems will also have to be installed by the end of the decade.
- Depending on the type of environmental pollutant, the financial impact on companies will be felt on operating and/or capital expenditures.

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- It is expected that companies’ balance sheets will reflect these costs from 2016 onwards. Once the monitoring and enforcement systems have matured, we could also see an effect on provisions for environmental liabilities.
- Companies that have delayed investment in cleaner technology or cleaner vessel fleets could be more vulnerable to these environmental regulations. As a result, they may need to incur costs and essential investments for which they are ill-prepared. In contrast, those companies that have tackled these issues proactively and anticipated these regulatory requirements will be better placed to retain a competitive advantage over their peers.
- We engaged with four investee companies and evaluated their level of preparedness in relation to these environmental requirements, concluding that AP Møller Mærsk and Mitsui OSK lead the pack.
We were only able to obtain more detailed cost estimates from two of the companies. For these two, we calculated the following impacts on forecast figures as follows:

- **AP Møller Maersk**: additional fuel costs represent 3.2% of 2015 estimated earnings before interest and tax (EBIT)
- **Carnival**: additional fuel costs represent 3.4% of 2015 estimated EBIT; cumulative capital expenditures for environmental compliance represent between 3.5% and 7% of total cumulative capital expenditure for the 2015-2020 period
Introduction

With more than 90% of global trade now carried by sea, the shipping industry has played a crucial role in shaping the integrated global economy. It is estimated that if the growth trend of the last 150 years continues, nearly 23 billion tonnes of cargo that will be transported by ship by 2060, compared to 8.5 billion tonnes in 2010.1

The environmental impact of shipping operations—whether at sea or in port—have been known for decades. But it is only in recent years that the damaging effects on human health and biodiversity have been demonstrated. This has led both international and regional organisations—most notably the International Maritime Organization (IMO) and the European Union (EU)—to regulate shipping emissions more stringently.

Regulatory restrictions on air pollution, greenhouse gas emissions (GHG) and ecosystem disruptions will impose significant compliance costs on shipping companies. Environmental compliance is becoming central to the financial and operating priorities of these companies.

Even without regulations, a high oil price environment has led to cost-cutting measures being focused on fuel consumption and caused companies to optimise cargo routes, operate vessels at lower speeds or replace fleets with more energy-efficient ships. Such measures have improved resource efficiency, which has in turn led to a reduction in the overall environmental footprint of ships. These environmental benefits which have already been achieved are the positive side effects of gains in operating performance.

Abiding by international standards on emissions of sulphur oxides (SOx) represents the most immediate environmental challenge for companies in the sector. As of January 2015, strict limitations on sulphur content are forcing companies to pay a premium for low-sulphur fuels, install engine scrubbers to reduce SOx emissions or switch to alternative fuels, such as Liquefied Natural Gas (LNG). Over the medium term, limitations on nitrous oxide (NOx) and GHG emissions are also expected to kick in as well as ballast water management requirements, although the timeframe for the latter is uncertain.

This paper explains the current and future regulatory context before looking at implications for companies.

As part of this research, we have analysed the environmental responses of four companies involved in the marine transport sector (AP Møller Mærsk, Kuehne+Nagel, Mitsui OSK Lines and Carnival) and assessed the quality of their performance on SOx, NOx, GHG and ballast water management.

In light of these corporate responses, we suggest a series of questions that investors can ask in order to gauge both risk exposure and risk management of critical environmental regulations by marine operators.

Environmental impacts and risks

Table 1: Overview of environmental regulations and their impact on companies

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Source: Schroders

**Air pollution (SOx, NOx)**

Ships emit almost 8% of global sulphur oxide (SOx) emissions and 15% of global nitrogen oxide (NOx) emissions annually. When marine engines burn fuel, they also emit dust, soot and small particles known as Particulate Matter (PM).2

Air pollution emissions from ships are continuously growing. If they continue at the current rate, by 2020 shipping will be the biggest single emitter of these pollutants in Europe, surpassing all land-based sources combined.

While emissions on land are generally falling, shipping emissions are expected to increase by 5% by 2020 due to the growth of international shipping traffic in the northern hemisphere. Despite falling health costs in Europe from air pollution in Europe between 2000 and 2020, the contribution of shipping to overall health costs is likely to increase from 7% (€58.4 billion) to 12% (€64.1 billion) by 2020.3 For instance, PM emissions related to shipping activities contribute to approximately 60,000 deaths annually at a global scale, with impacts concentrated in coastal regions on major trade routes.4

This is an area where the IMO, the specialised United Nations agency with responsibility for the safety and security of shipping and the prevention of maritime pollution by ships, has been particularly active. Upcoming requirements on NOx and SOx emissions are expected to represent the bulk of the environmental cost burden on shipping companies in the next ten years. It is expected that the resulting decrease in NOx and SOx emissions will also contribute to limit PM emissions, although there are no specific requirements pertaining to PM.

In 2008, the IMO revised its standards on sulphur content of marine fuels. This was later transposed into EU law in 2012. As of January 2015, ships in Sulphur Emission Control Areas (SECA) cannot use fuel with more than 0.1% of sulphur. These control areas currently cover the North Sea, the Baltic Sea and the English Channel in Europe as well as North American coasts (see Figure 1).
Globally, the maximum sulphur content allowed in 2015 is 3.5%, with ships having to cut their fuel’s sulphur content to 0.5% in 2020. This target will be reviewed by the IMO in 2018, but the EU has already committed to maintaining it (Figure 2). This global specification change to 0.5% is expected to be delayed from 2020 to 2025. This applies to all ships, existing and new.

In addition to fuel compliance, which is a regulatory requirement, there are two other ways of complying with the stricter SOx emissions regulations: the installation of scrubbers or the use of LNG.

Source: Schroders

1 Source: Eurosif, Shipping, 2009.
2 Source: AEC Maritime
Fuel compliance

Switching to low sulphur fuels is relatively straightforward for carriers, as engines do not need to be retrofitted in order to accept this type of fuel. However, this represents an additional cost for the companies: the price of marine gas oil with 0.1% sulphur content is around $900 per tonne, which is approximately 50% more than the price of regular fuel. Shipping companies expect the total additional costs to be passed onto customers.

However, the application of these global specifications change could cause significant disruption to oil markets, whatever the scenario, with a large impact on fuel oil prices and refinery investment.

Scrubbing

Scrubbing is a method whereby ships invest in on-board devices (such as scrubbers or exhaust gas technologies) to remove SOx from exhaust gases. They can then carry on burning high sulphur fuel while achieving equivalent SOx emissions.

Over the medium term, larger ships will likely install scrubbers, once some difficulties with the marine application of the technology are overcome. The complete scrubber retrofit of the fleet may take a few years, and the costs of scrubber equipment will vary between €1 million and €5 million per ship. The investment decision will depend on time spent in Emissions Control Areas, the spread between high and low-sulphur fuels and the age of the ship.5

According to the European Commission, shipping companies will face extra costs of €2.6 billion to €11 billion to switch fuels or to fit exhaust filters that would scrub out the sulphur in marine fuel oil. But the new limits could also result in up to €30 billion of public health savings in total.

Liquefied Natural Gas (LNG)

On a longer term horizon, switching to LNG is also likely, as the burning of LNG releases less toxic emissions than conventional fuel oil.6 Several solutions are available and include complex gas combustion systems. The switch to LNG-fuelled engines is expected to contribute to a 95% reduction in SOx emissions, and to a nearly 90% reduction in PM and NOx emissions.7 One of the major obstacles at present is refuelling, as significant infrastructure investments are still needed for this to become a viable solution. The US has opened its first LNG bunkering facility in Port Fourchon (Louisiana) in early 2015 and trial refuelling tests have already been carried out.8 For many companies, LNG does not offer a profitable business model yet, as the higher equipment costs for engines and tanks are not offset by savings in fuel or operating expenses.9

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6 LNG infrastructure development will continue to enable penetration of LNG in certain sectors, representing about 8% of global bunker demand by 2030 (Source: IHS, What bunker fuel for high seas?, 2014).
The major obstacle to these requirements delivering on emissions reductions, cost savings and health benefits resides in the current lack of control systems to ensure emissions limits are being applied. This could move freight volumes away from pro-active carriers onto other carriers that have not introduced low sulphur fuel surcharges, since the risk of being caught using the wrong fuel is currently extremely limited. Unless controls are drastically increased, cheating could become an attractive alternative and give lagging carriers a competitive advantage.

**NOx**

| When: | 2016 |
| Where: | regional |
| Impact on operating costs: | limited |
| Impact on capital expenditure: | high |

The IMO has also strengthened the NOx emissions standards, with NOx emissions to be cut by 80% in 2016. This applies to new ships sailing in designated areas, the NOx Emission Control Areas (NECAs). At present, this pertains to existing areas only, which are all situated along North American coasts. Given there are currently no such areas in Europe, the immediate impact of the regulation will be limited there.

The NOx emissions standards will not be translated into lower fuel content requirements, as with SOx. Rather the solutions will be technological, and also overlap with technological retrofits benefitting SOx emissions. They include basic internal engine modifications, exhaust gas recirculation systems selective catalytic reduction, or the use of LNG as bunker fuel. The latter two options are expected to achieve reductions in NOx emissions of up to 95%.

**CO2 emissions**

| When: | 2018 |
| Where: | regional (EU) |
| Impact on operating costs: | high |
| Impact on capital expenditure: | high |

CO2 emissions from the global shipping industry amount to approximately 1 billion tonnes per year, accounting for 3% of the world’s total GHG emissions and 4% of the EU’s total emissions.
An average cargo ship of more than 8,000 deadweight tonnage emits 15 grams of CO2 per tonne-km. This is approximately three times more efficient than truck transportation (50 grams) and significantly more efficient than air freight (540 grams).11 (Figure 3)

Figure 3: Comparison of CO2 emissions between different modes of transport

The IMO had plans to drive shipping’s global GHG emissions down by developing internationally-recognised market-based measures, but industry negotiations failed and no system was established.

By contrast, the EU stance is more advanced than the IMO on this topic. As a first step towards reducing emissions and preparing companies for carbon reporting, the European Commission has proposed that owners of large ships using EU ports should report their emissions from 2018 onwards, establishing a European system for monitoring, reporting and verifying (MRV) emissions.

The MRV system is expected to cut CO2 emissions from journeys by up to 2% compared with a ‘business as usual’ scenario, according to an impact assessment from the European Commission. By 2030, the system would reduce net costs to owners by up to €1.2 billion per year.12

The proposed EU MRV is designed to contribute to building an international system, and it is likely that the EU will then propose to include the sector in the EU ETS, its emissions trading scheme, over the medium to long term.

According to previous estimates of cost savings13, industry could save $70 billion per year and reduce emissions by 30% through the adoption of technologies and operational measures.
But these technologies are not yet being broadly adopted. One of the main market barriers is the split incentive system, whereby approximately 70% of the bunker fuel is paid for by the cargo owner. This means that the ship owner does not have the financial incentive to pay for the technologies as it would need to benefit from the resulting fuel savings.\textsuperscript{14}

The dramatic fall in oil price over the past few months is likely to reduce significantly these estimated cost savings, and could jeopardise the sector’s fuel efficiency initiatives. Slow-steaming had been particularly popular with shipping companies as a way to minimise fuel expenditures. Under the current oil price context, carriers are expected to pick up speed, which could aggravate overcapacity in the sector.

**Ballast water management**

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<td><strong>When:</strong> uncertain</td>
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<td><strong>Where:</strong> global</td>
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<tr>
<td><strong>Impact on operating costs:</strong> limited</td>
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<td><strong>Impact on capital expenditure:</strong> high</td>
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Ballast water is a major cause of the transfer of non-native – or “alien” – species between regions. Organisms carried with ballast water can establish themselves in new environments, causing dramatic shifts in food webs, chemical cycles, disease outbreaks, and the extinction rates of indigenous species.

The IMO Convention on Ballast Water Management makes ballast water treatment mandatory for all ships in accordance with a defined schedule. The convention has a fixed timeline, mandating that most ships in international trade must have ballast water treatment systems installed by the end of the decade. However, it will only come into force after it is ratified by at least 30 countries, which collectively represent 35% of the world’s shipping tonnage. Currently, 43 countries have signed up, representing 32.5%. Progress has been very slow to date, which may explain why shipping companies tend to give ballast water management a low priority, as there is still considerable regulatory uncertainty around the upcoming requirements.\textsuperscript{15}

Both current and proposed environmental regulations represent significant technical and financial challenges for companies operating in the marine transportation sectors. Regulatory requirements on air pollution, greenhouse gas emissions and ballast water management systems will force companies to deploy a number of costly solutions to become compliant.

\textsuperscript{14} Source: Ibid.

\textsuperscript{15} Source: HSBC, Pollution Control in Shipping, January 2015.
Other material risks in the marine sector...

Environmental regulations represent an immediate and tangible financial priority for companies, which need to demonstrate compliance. There is, however, also a range of social risks which can have costly repercussions on operations.

Health and Safety
Marine and port operations have high exposure to fatalities and accidents. At-sea activities, loading and unloading as well as hazardous cargo handling are risky and can lead to production delays, strikes, fines and litigation costs as well as loss of market access.

Piracy
This is particularly an issue in the Gulf of Aden, Western Indian Ocean and South China Sea. Companies are increasingly hiring security providers to protect employees, contractors as well as the transported cargo. This can in turn generate further incidents and injuries in case of violent conflict aboard ships. The most targeted vessels include chemical tankers, bulk carriers and crude oil tankers. AP Møller Mærsk estimates that piracy costs the company $100 million per year due to longer routes and higher speed required on high-risk routes.

Corruption
Given its close connection with government authorities in all parts of the world, the shipping industry is vulnerable to corruption and bribery attempts, particularly in emerging markets. Widespread corruption in the customs administration as well as poor infrastructure and lack of capacity at certain ports represent major issues for cargo transport business.
Investor Toolkit

Company engagement

We contacted four investee companies (A.P. Møller Mærsk, Kuehne+Nagel, Mitsui OSK Lines, Carnival Plc) to discuss and evaluate their response to these environmental regulations. This section presents an overview of our findings and proposes a simple green-amber-red grid for each environmental issue by company, based on their level of regulatory preparedness and performance. (Figure 4)

Figure 4: Summary table of company responses

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<td>Mitsui OSK Lines</td>
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<td>Carnival</td>
<td>Hotels &amp; Travel</td>
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Source: Schroders

A.P. Møller Mærsk

Profile: It is a Denmark-based shipping and oil company, active in the container logistics (shipping and port operations) as well as upstream oil value chains, including tanker shipping.

Response: Mærsk is generally in favour of the EU’s proposal to establish a system for monitoring, reporting and verifying (MRV) carbon emissions from large ships using EU ports. This could be an early indication that the shipping industry could be included in the European Emissions Trading scheme – which would significantly increase regulatory cost and burden. Compliance with the 2015 demands on SOx emissions is directly related to the cost of fuel, since no technological solutions have proved viable for existing ships. A global sulphur cap requires that ships lower their fuel sulphur content to below 0.50% by 2025. Stricter demands will also be placed in a number of emissions control areas (Baltic, North Sea, US/Canada coastlines, Caribbean Sea). From 2015, the permitted sulphur content in fuel will be 0.10% in these areas. Maersk Line and Maersk Tankers will initially comply by switching to cleaner fuels. From 2015, this is expected to represent an additional cost of $200 million for the company as it sources low-sulphur fuel (which is 50% more expensive than marine diesel). This represents approximately 3.2% of 2015e EBIT. Mærsk hopes to pass these additional costs on to customers and is generally confident in the resilience of its balance sheet.

Upcoming regulatory requirements on NOx emissions will require complex in-engine or after-engine treatment systems or a shift to completely different fuels. The group has been actively exploring options and it believes exhaust gas recirculation systems fitted on engines are the most practical. This is estimated to add 25% to the price of new engines.

16 The 2015 forecast EBIT figure was obtained from Morgan Stanley.
The company is also preparing for regulation on ballast water management, which will come into force once the related international convention (Malmö) is ratified. Retrofitting is expected to cost $1 million per vessel.

**Kuehne+Nagel**

Profile: It is a Switzerland-based holding company engaged in the provision of logistics services, including sea freight. It does not own or operate any ships, but uses third-party carriers. Therefore, its exposure to environmental issues and regulations is indirect, through its supply chain.

Response: We discussed Kuehne+Nagel’s approach to sustainability as well as the impact of emissions regulations (SOx, NOx) on its shipping operations. We found out that the sustainability function is currently spread out between different departments. The company seems aware of the limitations of such an approach and is working towards establishing a single focal point or unit to coordinate the company’s efforts on collecting and distributing environmental performance data. This had been initiated a couple of years ago, but recent managerial changes have somewhat stalled the process.

Even though most of the environmental burden lies on Kuehne + Nagel’s shipping suppliers, the company is lagging behind peers on the disclosure of emissions data. The NOx and SOx performance of its commissioned ships is only being captured via the Clean Cargo Working Group, of which the company has been a member since 2011. The Group anonymises the data in its report on shipping emissions, thus making it impossible to assess each carrier’s performance and progress.17

As a result, one of the main areas of risk for the company is the suite of environmental regulations increasingly being placed on cargo shipping carriers. It is unclear from our conversation what additional costs the SOx emissions requirements represent for Kuehne+Nagel, but we were told that they are being passed onto the customers. The company is ‘aware’ of similar regulatory constraints for NOx emissions, but demonstrates little forward-thinking on the issue. It was unable to describe the technological solutions proposed to meet these requirements. Finally, we also took the opportunity of this call to discuss the low oil price context: the company recognised that this jeopardises its energy efficiency initiatives, and that volumes will grow as customers want to ship more goods for less.

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17 The Clean Cargo Working Group is a global business-to-business initiative made up of cargo carriers and their customers, dedicated to environmental performance improvement in marine container transport through measurement, evaluation and reporting.
Mitsui OSK Lines

Profile: It is a Japan-based company engaged in the international shipping business.

Response: We contacted the company to discuss its range of environmental initiatives as well as the overall integration of sustainability issues into the wider business strategy. The company has set itself targets to reduce SOx, NOx and CO2 emissions by 10% on a per ton-mile basis by 2016, compared to 2009 and also has plans to reduce these by 1% on a year-on-year basis. In order to comply with SOx regulations, the company has switched some fuel to low sulphur fuel in 2014, but it does not disclose in what proportion. The company plans to pass on other costs to customers through a surcharge. Its preferred solution for NOx compliance will be selective catalytic reduction technology and it is also very active on the introduction of ballast water management equipment, for both existing and new ships.

The company estimates that the total investment to respond to environmental regulations and promote energy efficiency for vessels will total between $670 million and $750 million over the next ten years.18

Carnival

Profile: Carnival is a UK-based cruise company. It operates in North America, Europe, Australia and Asia, and is therefore exposed to environmental regulations affecting the sector, especially as its cruise liners sail along coastal areas.

Response: The company has opted for installing scrubbers (exhaust gas cleaning systems) in order to comply with the SOx regulatory requirements. It aims to equip 70% of its fleet with scrubbers by 2017; the company estimates that these efforts should mitigate the majority of the impact. Until then, the additional cost of compliance (i.e. burning low sulphur fuels in ECA zones) is estimated to be in the region of $80 million for FY2015. Before this technology was finalised, the company used to estimate extra-costs between $270 million and $280 million per year.19

18 Forecast FCF figures from Morgan Stanley for Mitsui OSK are only available for the next three years and are negative, making it difficult to apportion the estimated total environmental investments to cumulative FCF for 10 years.

19 Source: Morgan Stanley.
In 2013, low sulphur fuel made up 23% of Carnival’s total fuel mix, almost four times more than in 2011. This share is expected to grow in line with volume growth until 2017, when scrubber technology will gradually render low sulphur fuel obsolete for Carnival. The total capital expenditure for scrubbers is expected to be between $600 million and $1.2 billion over five years. The additional fuel costs represent approximately 3.4% of 2015e EBIT and 3.5%-7% of cumulative forecast capital expenditures for the period 2015-2020.\textsuperscript{20}

However, for this to hold, the company will have to either equip the remainder of its fleet with scrubber technology or source more low sulphur fuel as the SOx requirement standards become global, and not just limited to Emission Control Areas. Carnival believes that “the magnitude of the fuel price increase from complying with the global standard is not reasonably determinable at this time due to the uncertainty of when the global standard will become effective, which could be as late as 2025”, but states that “the increase to [its] fuel expenses from complying with this standard will ultimately not be material to [its] consolidated financial statements”.\textsuperscript{21}

\textsuperscript{20} 2015 forecast EBIT and forecast figures for FCF (2015-2020) were obtained from Morgan Stanley.
\textsuperscript{21} Source: Carnival 10-K, 2014.
Questions for investors

When engaging with companies, investors could ask the following questions to gain a better understanding of the impact of upcoming emissions regulations on operating costs and capital expenditures. This would help assess the quality and resilience of the companies’ overall operating environment.

### Risk exposure

- What is the company’s view on the potential inclusion of the shipping industry into the EU Emissions Trading Scheme to regulate CO₂ emissions?
- Given that the lifespan of a ship is approximately 30 years, how does the company anticipate future environmental constraints? Does it perform environmental scenario analysis as part of its tendering process?
- What is the total cost burden of complying with upcoming environmental regulations? Does the company intend to adjust its provisions for environmental liabilities upwards? Will these costs be passed on to the customers?

### Risk management

- Does the company disclose data on its NOx and SOx emissions? How have emissions evolved over time?
- How does the company prepare itself for international requirements on SOx and NOx emissions? What are the preferred technological solutions and how much will they add to operating costs per year?
- What will be the impact of lower oil prices on vessel speed and operations? Will vessels pick up speed and is this going to exacerbate over-capacity problems?
- To what extent does the low oil price context jeopardise long-term environmental targets? What is management’s commitment to environmental efficiency?
Conclusion

Despite supply and demand imbalances and chronic overcapacity problems, ever more goods are being transported by sea. It is estimated that the amount of sea cargo could triple by 2060, further supporting international trade. Similarly, cruise liners are likely to benefit from growing demand as populations in both developed and emerging economies live longer and become wealthier.

Historically, shippers and cruise liners have looked to cut operating costs by reducing fuel consumption. Such energy efficiency initiatives have contributed to improved margins, with the added benefit of a lower environmental footprint. It is possible, however, that under a low oil price, companies may sacrifice prior efficiency commitments.

The current regulatory landscape in the maritime transport sector is challenging this view by placing direct environmental restrictions upon operators. These require companies to make drastic changes to their operating processes in order to minimise a variety of emissions.

Among the suite of environmental regulations that will affect the sector over the next ten years, it is the IMO standards on the sulphur content of fuels that present the most immediate and material challenge. As of January 2015, marine operators are required to contain sulphur-driven SOx emissions to certain levels depending on where they sail.

We expect most operators will choose to comply by switching to low-sulphur fuels, although retrofits and alternative fuel sources are likely to be preferred options over the medium term. Currently, the main impact will therefore be on operating costs, since low-sulphur fuel trade at a 50% premium to conventional fuel.

Complying with regulations on NOx and greenhouse gas emissions as well as ballast water management will also add significant costs, both operating and fixed, even though the timeframe on these obligations remains uncertain.

This uncertainty is somewhat reflected in the nature and quality of companies’ environmental management response.

Unsurprisingly, improvements in greenhouse gas emissions continue to be a focus, essentially through the lens of fuel efficiency. We believe, however, that companies will have to complement this approach and be more proactive in this regard as the EU is preparing to include the shipping sector in its wider Emissions Trading Scheme, thereby holding it accountable for its greenhouse gas emissions.
The global standards on low-sulphur content introduced in January 2015 will help to test companies’ approach to environmental management, and future balance sheets are likely to show the financial adjustments incurred, most notably through operating costs at first. As we have observed, companies have shown different levels of maturity on the issue. The requirements around NOx emissions and ballast water management are yet to percolate through to the business strategy, essentially because of a series of contingencies that make it difficult to estimate when they will come into force.

Generally, companies adopting a proactive approach and anticipating regulatory requirements are better placed to retain a competitive advantage over peers. We would therefore urge investors to assess the quality of companies’ responses, as environmental requirements will continue to represent their biggest operating challenge for the next decade.