DNV·GL

MARITIME

ENERGY MANAGEMENT STUDY 2014

SAFER, SMARTER, GREENER

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DEFINITIONS & GLOSSARY

CO_2	Carbon dioxide
D/G	Diesel generator
ECA zone	MARPOL Annex VI Regulations for the Prevention of Air Pollution from Ships establishes Emission Control Areas which have more stringent controls on emissions.
EEDI	Energy Efficiency Design Index
EEOI	Energy Efficiency Operational Index
FOC	Fuel oil consumption
HFO	Heavy fuel oil
IMO	International Maritime Organisation, London
(Integrated) operator	The operator directs the vessel where to go, handles cargo agreements and pays for all fuel the vessel consumes as well as port charges, commissions, etc. An integrated operator owns and manages the vessel in addition to leveraging commercial operation.
KPI	Key Performance Indicator
Managing owner	Owner of a ship who also manages the ship (see ShipManager for details) and charters out the vessel to an operator on a time-charter basis.
MARPOL	International Convention for the Prevention of Marine Pollution from Ships
M/E	Main engine
MRV	Monitoring, reporting and verification
NM	Nautical mile
Owner	Owns a merchant vessel and can perform technical management of the vessel through the company (managing owner), though this can also be outsourced or transferred onto the shipping company through bareboat charter.
SEEMP	Ship Energy Efficiency Management Plan
Ship manager	Ship management involves the duties a shipping company must perform for the technical operation of a vessel (e.g. crew management, service and maintenance), but not the commercial management.

1 EXECUTIVE SUMMARY

Establishing effective energy management to reduce fuel consumption is currently one of the – if not the – most important topic in the shipping industry. This study provides an overview how shipping companies handle the need to decrease fuel consumption in a challenging market environment. The results unveil the reasons for establishing energy management as well as the measures selected and observed obstacles on the way to successful implementation. By combining the survey results with DNV GL's knowledge on energy management, this report aims to provide insights that can be used to improve energy performance and compare one's own performance within this context.

Energy management has become a competitive factor beyond compliance – In almost every company, energy management receives substantial attention by top management. This is owed to the relevance that reduced energy consumption has on companies' profitability. On the one hand, energy efficiency results directly in cost reductions (HFO, lube oil and maintenance costs). On the other, it impacts the revenue side of an organisation. Energy performance is more and more factored in when external stakeholders – charterers, logistic companies and investors (e.g. banks, institutional investors) – make (investment) decisions. Thus, efficient ships realise higher charter utilisation rates. Companies with a good track record in energy performance even enjoy easier access to financial resources than others.

Many shipping companies have realised first savings, but only a few have succeeded in realising savings above 10% – The achieved 1–3% in fuel savings in the majority of shipping companies reflect their only moderate success in lowering their consumption in the first year after implementing the SEEMP. With industry leaders claiming 10% or more in fuel savings, significant saving potential remains untouched. For those who have not yet invested in efficient ship designs and/or efficient operations, it will become essential to increase efforts to reduce fuel consumption in a market with newbuilds operating at a fuel consumption which is 20–30% lower. Furthermore, funding for those companies will be challenging, as investors will particularly support those companies that have already proven their energy competence.

Ambitious saving targets can only be reached by selecting measures beyond the obvious – The industry has focused on implementing well-known practices that require only little investment such as slow steaming / eco speed, optimised voyage planning and weather routing. More challenging measures such as virtual arrival, which requires stronger involvement from the shipping companies to coordinate its use across the different (internal and external) stakeholders (crews, owner, manager, charterer, ports, etc.), have only been selected by some. The lack of either time or resources for making profound investment decisions and the lack of financial resources force many to miss out on opportunities that promise high savings but require investments, such as retrofitting of the hull or engine de-rating.

Soft measures are the lever for realising energy savings – Many companies struggle with the effective implementation of energy management. Implementing energy management to a great extent translates into changing the behaviour of both onshore and onboard staff. Even though many struggle with it, only little has been done to support the change that accompanies a successful implementation of energy management. Change management activities such as communication and trainings, incentive schemes and close steering of energy management activities through dedicated resources need to be established. Those who have already realised the relevance of change management activities for the successful implementation of measures are already benefiting from higher target achievement rates.

Rudimental data transfer hinders effective performance management – Regardless of selected measures, decision-makers require transparency for both the implementation status and the individual measures' impact on energy consumption. Moreover, efficient performance monitoring and management enables companies to realise additional savings. This calls for relevant, reliable and timely data. Nevertheless, many companies still rely on manual data transfer between ship and shore, thus potentially increasing the risk of inaccurate and incomplete data. This limits the ability to effectively analyse and prepare meaningful reports on time. Shipping companies aiming

for greater energy efficiency need to invest in efficient and smart performance management solutions to obtain transparency throughout their operations and to be able to proactively improve ship performance immediately.

Efforts in reducing fuel consumption will further increase in future. Only high performers will be able to reap the full benefits that come with efficient energy management. These savings need to be realised by applying measures that call for either stronger implementation efforts (e.g. virtual arrival and performance-based steering of energy consumption) or higher investments (e.g. retrofits and software solutions). Additionally, it will require more drastic changes in both organisational and employee behaviour, better cooperation between different stakeholders, and professional performance monitoring to ensure the success of more elaborate and advanced measures. The next year or two will show who is really determined to master energy management and can turn it into a competitive advantage, and who will fail to be competitive.

2 INTRODUCTION

Increased market pressure from high bunker costs, efficient newbuildings and retrofitted vessels, as well as regulatory requirements aimed at energy and emission reductions (EEDI, EEOI, SEEMP, ECA zones, etc.) has forced shipping companies to moderate their energy consumption. However, the industry only recently started to implement energy efficiency measures and thus significant savings potential remains unexploited.

Regulatory influence

The International Maritime Organisation has made it mandatory for every vessel to carry a Ship Energy Efficiency Management Plan (SEEMP), starting in January 2013. The SEEMP applies to all vessels – existing as well as newbuilds. In short, it summarises all measures that have been selected for a vessel in order to reduce bunker consumption and thus CO_2 emissions. A continuous improvement process is required, which is measured via Key Performance Indicators (KPIs) and tracked against defined goals.

For newbuilds, the EEDI comes into play. All new vessels have to remain below a reference line determined in 2013 and reflecting the average of the current world fleet. Significant tightening of requirements for newbuilds is planned to take place in three steps, ending in a total of 30% by 2025. In the first step in 2013, the EEDI became effective for container vessels, tankers, bulkers and several other vessel segments.

Beyond SEEMP and EEDI, the IMO and regional authorities (e.g. the European Union) are discussing the introduction of market-based measures for emission reduction, e.g. an emission trading system,

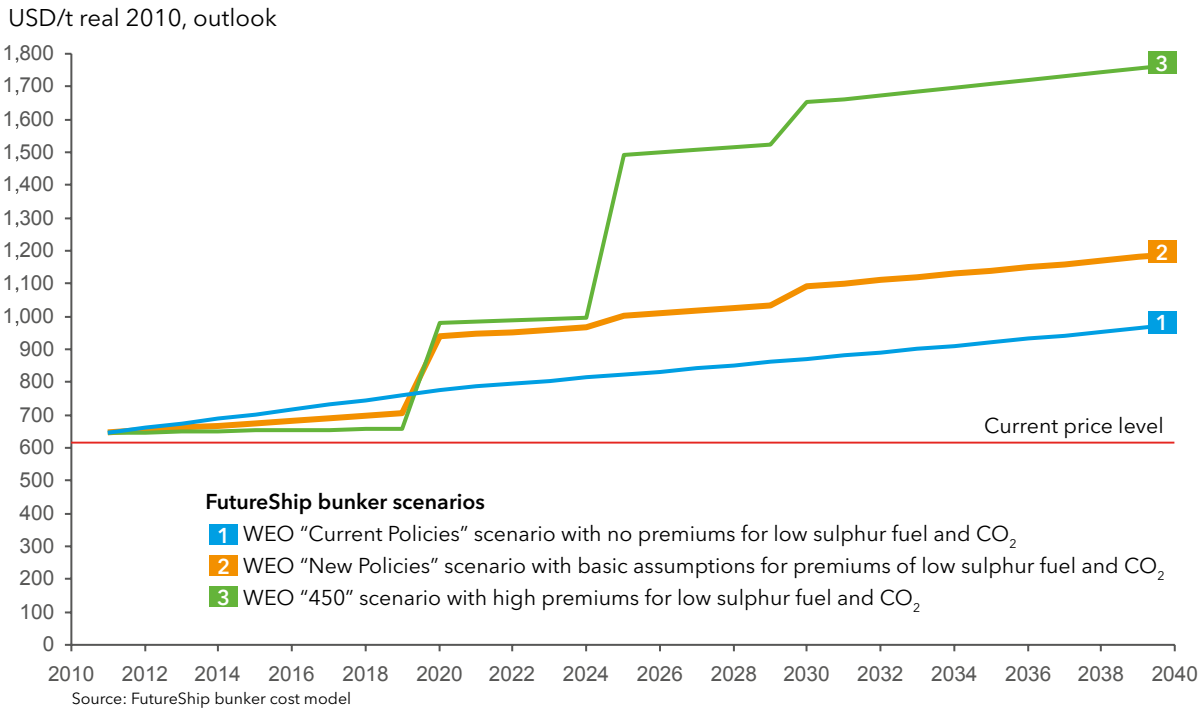


Figure 1 – Bunker cost model

emission taxation or greenhouse gas funds coupled with a bunker surcharge. Similarly, an initiative which has received increased attention lately is the monitoring, reporting and verification (MRV) of CO_2 emissions from large ships calling at EU ports. In this sense, the EU commission has already put forward a legislative proposal for such a system. All in all, more regulations on a global, regional and local level are likely to appear.

Shipping market environment in 2014

In addition to the regulatory challenges, most shipping segments are facing low to negative profits. On the one hand, shipping companies have to deal with low freight and charter rates that are not expected to recover to sufficient levels soon due to high oversupply in the market. On the other, bunker prices have increased by a factor of more than six since 2000, currently reaching a level of about USD 600 per ton. This makes bunker the largest cost position in shipping today, with a 30–60% share of total costs depending on the vessel segment and operational speed. As bunker prices are likely to exceed USD 1,000 per ton over the lifetime of today's newly built vessels, and considering crude oil prices and mark-ups for low sulphur and costs of CO_2, the cost pressure will increase further [Figure 1].

Global ship freight capacity has increased significantly in recent years. With the contracting boom in the five years before the global financial crisis (2003 to 2008), and again after the first dip in 2010, significant tonnage has been delivered or is on the order books for the next few years. Although scrapping activities have increased, with ever younger vessels being sent to scrap yards, global freight capacity is expected to increase more than trade growth in the years to come. Thus, pressure on existing vessels due to oversupply is and will remain high.

Impact of retrofitting and newbuilds

Pressure from markets and regulators stimulates efforts to optimise the energy efficiency of newbuildings. When operated at design conditions, today's newbuilds can consume 20–30% less fuel than vessels built three to five years ago. Thus, existing vessels, often optimised for high speed, need to compete against vessels with significantly better fuel efficiency on the current operating profiles. This design difference puts owners of many older vessels on edge and calls for retrofitting and highly efficient operations.

Retrofitting technologies offer the existing fleets the chance to remain active and economically appealing. The range of potential retrofitting measures is broad. When selecting these measures, it is important to consider the trade profile, ship specifics and competition. Those who have already applied measures have gained competitive advantages due to reduced fuel consumption of, in some cases, up to 10–15%. Payback periods significantly below one year can be achieved by selecting optimal retrofit measures.

3 STUDY SCOPE

This study summarises the shipping industry's progress on establishing energy management in light of increasing environmental regulations, high fuel prices and mounting external pressure for sustainable performance. With a questionnaire sent out to ship managers, (integrated) operators and owners globally, the results highlight driving forces, success stories of individual measures and hurdles companies are facing, as well as the savings and progress achieved so far. The report aims at providing participants with knowledge that can be used to improve energy usage and estimate their own performance vis-à-vis the industry.

To receive a comprehensive industry overview, more than 400 owners, ship managers and operators across the globe were asked to participate. With a response rate of about 20%, this study covers the input of 85 companies representing more than 2,000 vessels with a yearly fuel consumption estimated at more than 40 million tons or almost USD 25 billion.

Most replies have been provided from ship managers with a share of 39%. However, a share of 31% for (integrated) operators, 18% for managing owners and 11% for owners show that energy management is important for most players in the industry. All major vessel segments are covered, with respondents from the bulker (26%), tanker (25%) and container (25%) segments comprising the lion's share next to smaller segments such as general cargo/ MPV (9%) and offshore (5%). Others (10%) is the final group of companies and represents a wide variety of vessel types such as cruise, research, heavy lift, ro-ro and car carriers, etc. [Figure 2].

Survey of participants' characteristics

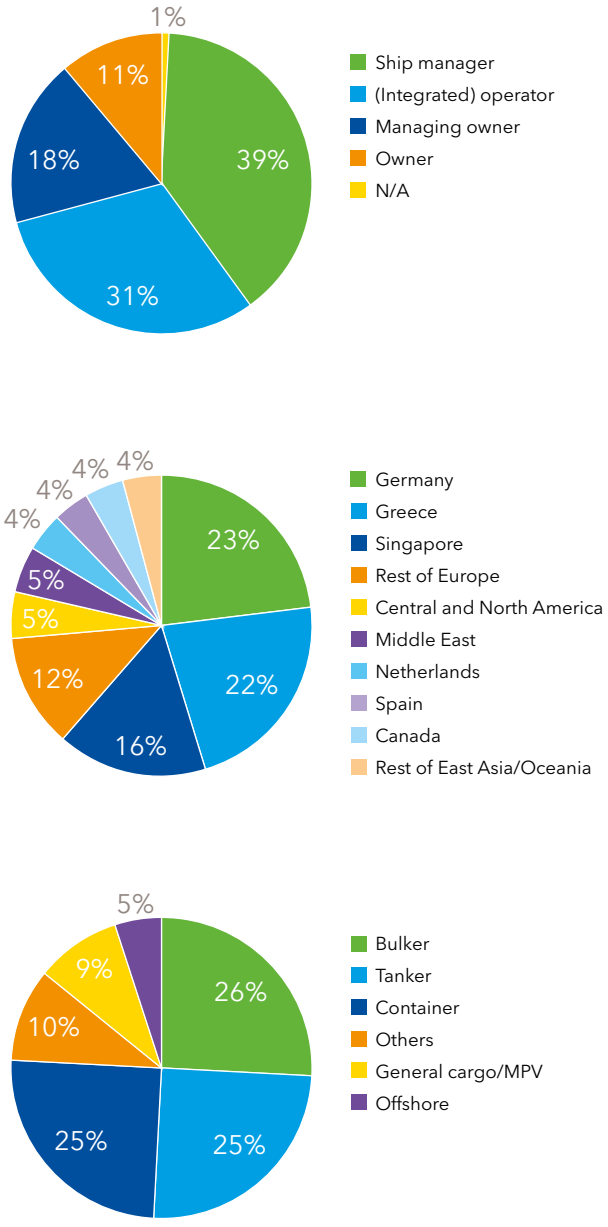


Figure 2 – Study of participants' characteristics

4
STUDY RESULTS

Structured along the key components of energy management, the analysis is split into the chapters: Energy strategy and targets (4.1), Organisational anchoring (4.2), Energy efficiency measures (4.3), Reporting and monitoring (4.4), and Change management and implementation (4.5).

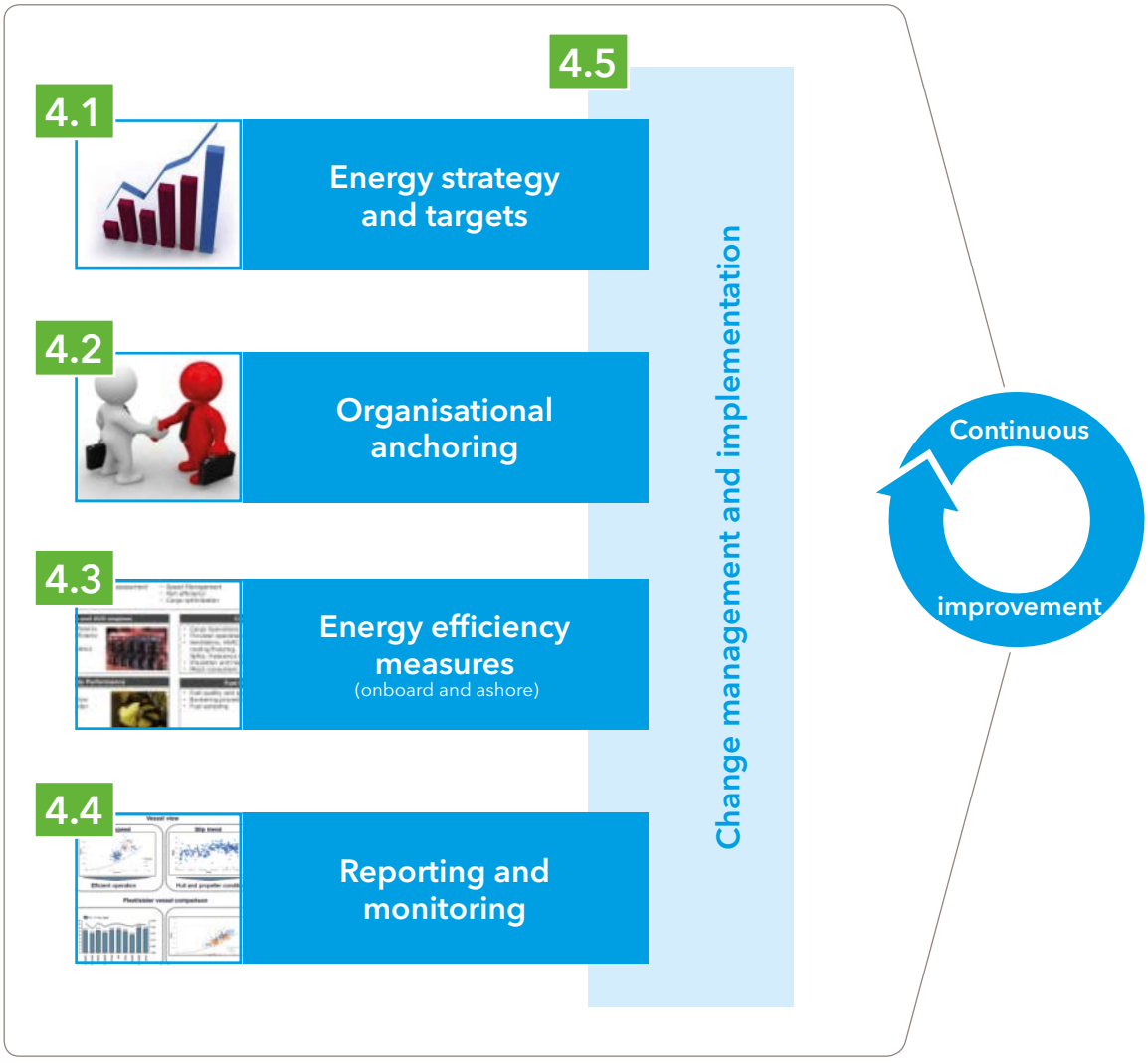


Figure 3 – Energy management components

4.1 ENERGY STRATEGY AND TARGETS

Even though energy efficiency ranks high on the agenda and directly impacts the profitability of shipping companies – either through reduced costs, better market positioning, higher charter rates or improved utilisation – the need for compliance was the major driving force behind the establishment of energy management / SEEMPs. Saving costs only ranks second, reduced emissions comes in third and strengthening market position in fourth place.

Companies have rather low fuel reduction targets, with most aspirations averaging between 2 and 3%. The majority of shipping companies has only been able to realise savings of between 1 and 3%, reflecting low target ambitions and little success in realising the defined targets. Considering that industry leaders claim savings of 10% and higher, significant savings potential remains untouched. But efforts to achieve this untapped potential in future will require higher efforts during selection and implementation of efficiency measures.

Relevance of energy management
For more than half of the respondents, energy management is the most important topic within the company. An additional 46% say that it is among the top priorities. Only very few state that it has no importance for the company [Figure 4].

As Figure 5 illustrates, the importance of energy management is not solely driven by the influence on profitability (58%). More than half of the respondents also emphasise the impact energy efficiency has on market positioning. Even more interesting, 37% of the respondents state that good energy management leads to better charter rates and higher vessel utilisation.

This provides evidence for energy management's additional value to businesses apart from legal compliance and the mere benefit of cost reduction. Accordingly, the charter market has started to factor in the energy efficiency of ships, valuing the design and/or the operational excellence and thus the ship's actual (energy) performance. This trend will further continue and makes energy performance key for business success in future.

How are energy/bunker savings positioned within your company?

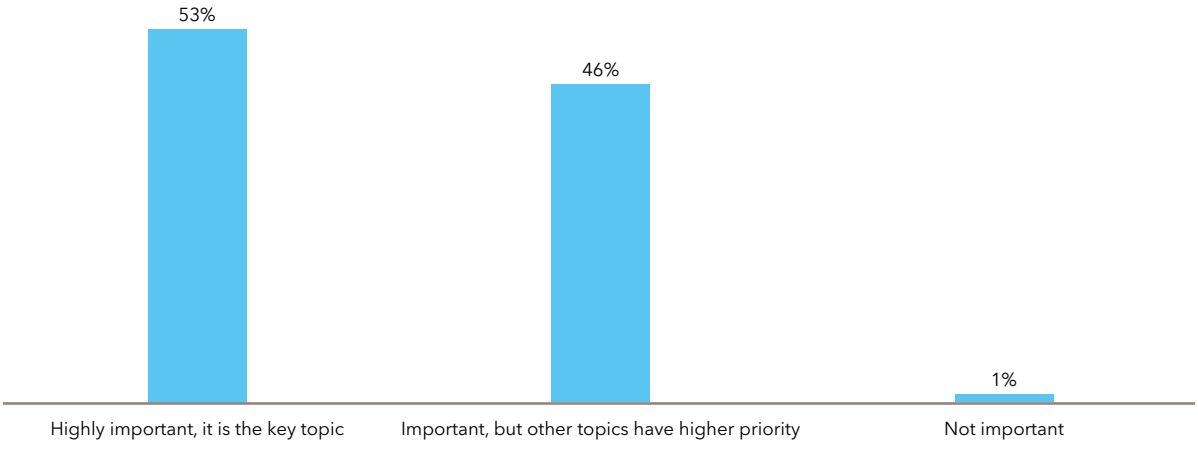


Figure 4 – Relevance of energy/bunker savings

How does energy efficiency impact your company?*

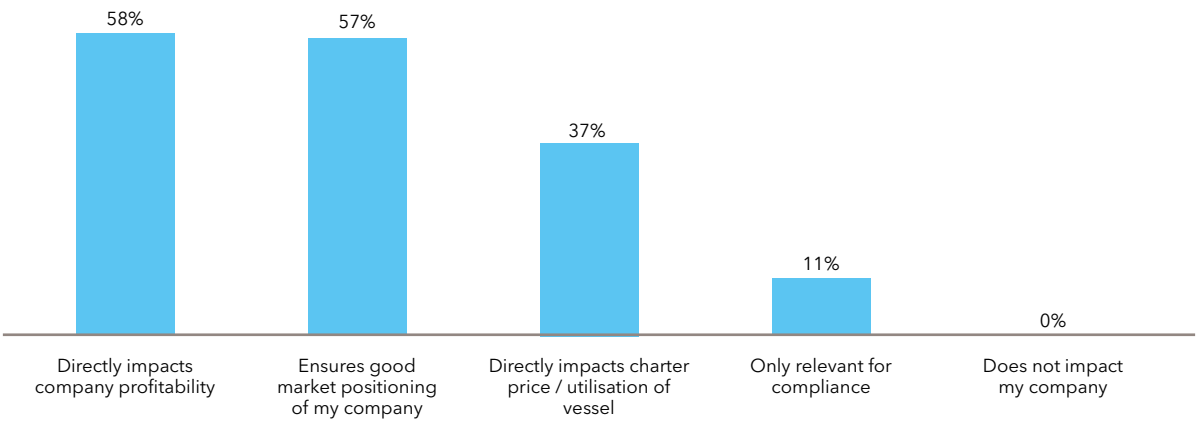


Figure 5 – Impact of energy efficiency on shipping companies *Multiple answers possible.

Drivers for implementing energy management
The initial driver for establishing the SEEMP and/or energy management has been regulatory pressure, at 74% [Figure 6]. This is followed by 59% who declare cost savings as one of their reasons, and then 57% of the respondents aim to reduce emissions.

Market-focused goals – such as strengthening market position and branding (32%), trade flexibility (20%), becoming an innovator or having a first mover advantage (17%) – have largely not had an influence on establishing the SEEMP or energy management concepts.

Increased transparency (e.g. to prepare for speed claims, to track implementation or to be able to continuously improve) has only been the goal for 13% of the respondents. This underestimates the benefits of increased transparency, e.g. enhancing internal and external trust, improving reputation and being able to manage the performance of the fleet more effectively. Timely and detailed knowledge about energy drivers, current consumption and influencing factors is key to protecting against potential bunker claims and to providing the information charterers, logistic companies and investors are asking for. This information demand will further increase, with the first shipping companies already achieving full transparency today.

These observations indicate that companies prioritise short-term necessities for keeping their business model intact over building long-term competitive advantages. Considering that only a few have really invested in establishing excellence in energy performance as a key differentiator, the entry barrier for being a leader in energy performance is still low. In future, the hurdle will further increase, with more and more companies investing in energy management.

However, with 47% of the companies naming reduced emissions as a main objective for energy management, it seems that environmental aspects have gained more relevance for the shipping industry. This is most likely driven by mounting institutional/regulatory pressure and the increasing market demand for sustainable shipping.

Setting fuel saving targets
Even though energy management enjoys a high priority within almost all shipping companies, asking about energy targets show that shipping companies have in many cases not formulated explicit targets. The answers vary greatly from "No defined targets" to "Compare M/E, D/G fuel consumption to the sea trials in order to have no more deviation than 5%". The majority remains very vague, stating goals like "Saving fuel" or "Fleet-wide emissions reductions based on prior years' performance".

Those companies that have defined specific quantitative targets aim to reduce their bunker consumption by an average of 2–3% annually. Quantitative goals range from a 0.1% annual fuel reduction to cutting energy consumption by 15% within a timeframe of three years.

What was your company's goal when developing the SEEMP / establishing energy management?*

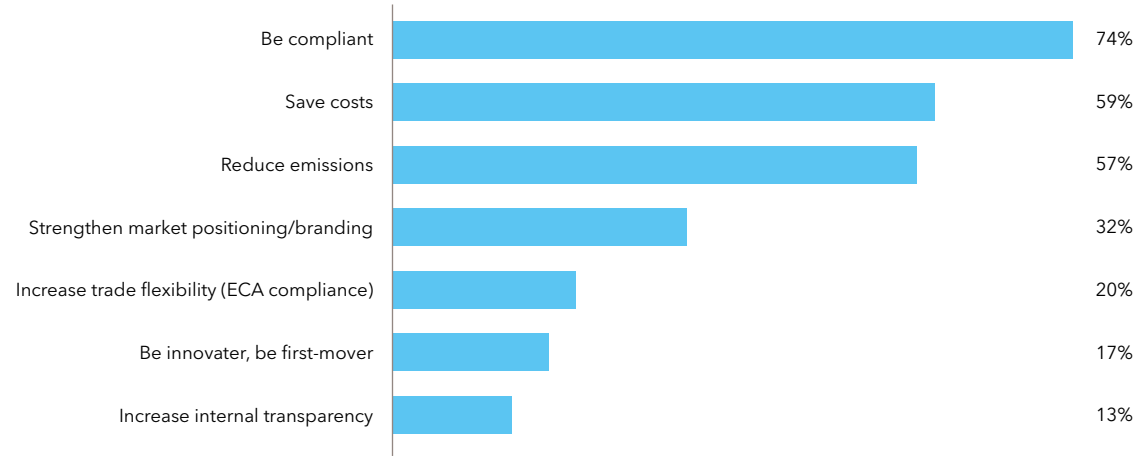
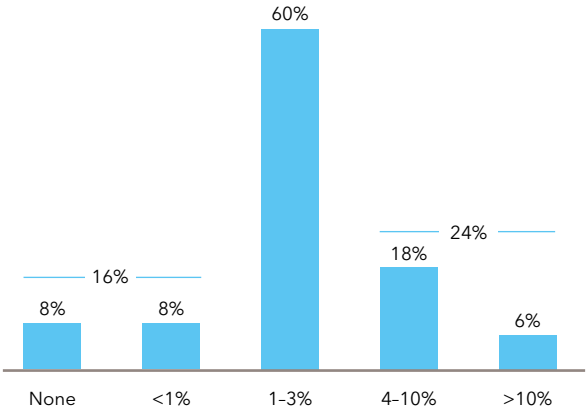


Figure 6 – Drivers for establishing SEEMP / energy management *Multiple answers possible.

How much fuel reduction did you experience (estimate) since your company implemented the SEEMP / energy management?



From 0–100%, to what degree did you reach your targets for 2013?

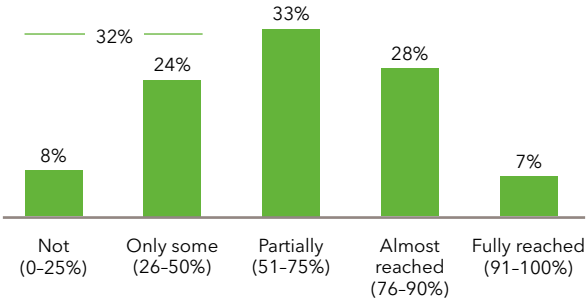


Figure 7 – Fuel savings realised and target achievements

A reason why so many companies struggle to quantify their targets might be the difficulty to define consistent and reliable baselines. In many companies, the availability of energy-related data is poor. Data points are often missing, inaccurate or unreliable. Moreover, data is often stored in formats requiring manual processing for an appropriate analysis, e.g. free-text e-mails or multiple (self-programmed) Excel sheets (for details see 4.4).

Industry leaders claim to have reduced their energy consumption by 10% or more. This was driven by slow steaming in the first years, but recently it has been retrofitting, operational excellence as well as the establishment of performance monitoring systems which have granted these achievements. Compared to the industry leaders, it seems that the majority of the shipping industry has only reached out for the "low-hanging fruits" with average saving targets between 2 and 3%. Consequently, a large potential to be harvested remains, but this will require greater effort during the selection and implementation of measures.

Achievement of targeted savings

Even though the industry already formulated – if at all – rather moderate saving targets, the majority of respondents struggle to achieve them. Most of the companies only achieved savings between 1 and 3% [Figure 7]. A few companies (16%) even state that they have realised no savings (8%) or savings below 1% (8%). At the same time, 24% seem to have invested in energy management and achieved savings of 4–10% or even more. As a result, they belong to those companies that have managed to stand out and establish energy management as a competitive advantage.

Rather low savings are also a result of the low target achievement rates. Only a few (7%) have fully reached their defined targets. Additionally, 28% managed to almost reach them. The majority partially reached them (i.e. missed their target by 25–49%) and a further 32% state that they have missed their target completely or only attained them to a degree of below 50%.

So far the industry has struggled to reach the moderate targets of 2–3%. It seems that companies either overestimated the impact of selected measures or that in many cases they struggle with implementation. Considering the results of industry leaders, achieved through a combination of managerial, operational and technical measures, a large potential remains untapped. The next year or two will show who is able to identify impactful measures and can ensure realisation of those through consistent implementation.

4.2 ORGANISATIONAL ANCHORING

In almost every company, energy management receives substantial attention and is regularly tracked by top management. The ultimate responsibility, however, is anchored at different positions within the various organisations. Those who have anchored energy management strongly at a proper level in the shore organisation seem to be better positioned to achieve their targets. Those who have handed over the ultimate responsibility to onboard staff or single individuals as an additional responsibility seem to struggle to achieve their targets.

Involvement of top management
In 44% of the companies, top management regularly follows up on energy management. An additional 42% state that the executive level is continuously involved in energy-related subjects [Figure 8]. These two categories sum up to a total of 86% of the participants having their leaders actively involved in the matter.

It is not only the relevance of energy management for companies' profitability that made the topic important for top management, this importance is also attributable to the relevance energy management has for external stakeholders. These stakeholders – e.g. charterers and logistics companies – more and more factor in energy efficient performance as criteria when making their decisions. For top management it is therefore crucial to know how to best represent their company and vessel performance to strengthen their market position.

How is the top management involved in energy management?

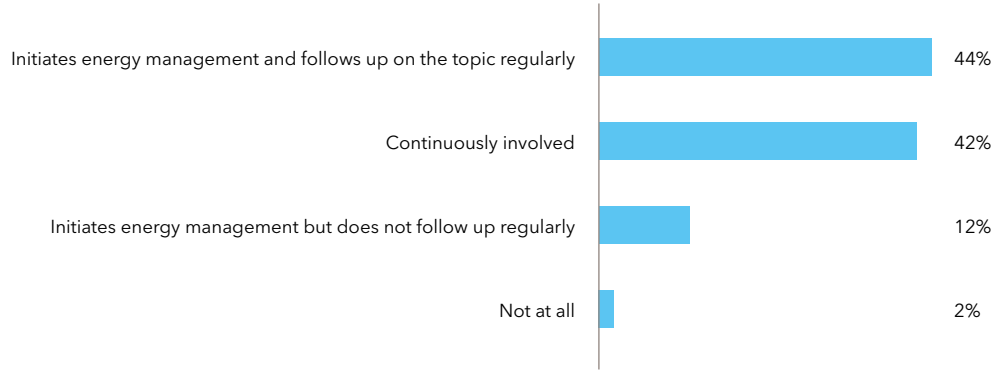


Figure 8 – Top management involvement

Who has the key responsibility within your organisation for energy management?

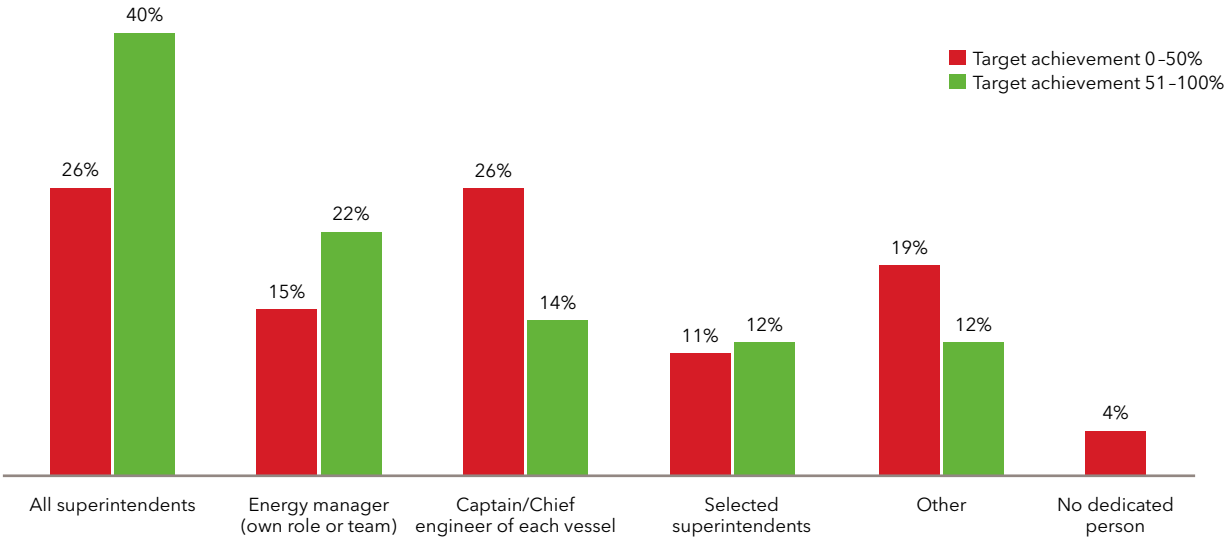


Figure 9 – Allocation of energy management responsibility

Delegation of responsibility

The majority (40%) of companies with target achievements above 50% have allocated the ultimate responsibility for energy management evenly to all their superintendents. Additionally, 22% employed an energy manager or an energy management team. None of these companies is lacking a defined person for energy management [Figure 9].

At the same time, companies who have target achievements below 50% have evenly allocated the responsibilities either among superintendents or to captains and chief engineers (each 26%). 30% assigned the responsibility to single individuals in addition to their daily tasks (selected superintendent at 11% and others [e.g. fleet managers] at 19%). Only 15% have assigned an energy manager or energy management team, while 4% are missing a dedicated person [Figure 9].

Establishing energy management requires dedicated resources to handle the high workload that comes with developing measures and assuring their implementation. In many cases, individuals (e.g. selected superintendents, fleet managers) are strained with the workload if they have to handle these tasks for the entire fleet in addition to their routine work. This is also reflected by the fact that the group of companies with higher target achievement rates to a greater extent has allocated the task evenly to all superintendents or to an energy manager.

Onshore control of energy management (implementation) supports easier realisation of energy targets. The relevance of energy management needs to be continuously communicated to convince the staff to accept the organisational, behavioural and procedural changes. In addition, the responsible person at shore can act as an information hub to ensure that lessons learned and best practices are leveraged across the entire fleet.

4.3 ENERGY EFFICIENCY MEASURES

The implementation of well-known measures such as slow steaming / eco speed, optimised voyage planning and weather routing, has ensured the realisation of most energy savings so far. To generate further, significant savings, it will be necessary to apply measures that call for either stronger efforts (e.g. virtual arrival and performance-based steering of energy consumption) or higher investments (e.g. retrofits and software solutions). Additionally, more drastic behavioural changes are required next to better cooperation between different stakeholders, e.g. crews, charterers, managers, owners and ports, and implementation monitoring to ensure the success of these more elaborate and advanced measures.

Selection and implementation of measures
The main selection criteria for energy efficiency measures have been operating and investment costs. Significant cost pressure and limited access to financial resources explain the importance of these factors [Figure 10]. More than half of the companies value measure-specific information that is available, while a third of the sample relies on market acceptance.

When selecting energy efficiency measures, what are major decision criteria?*

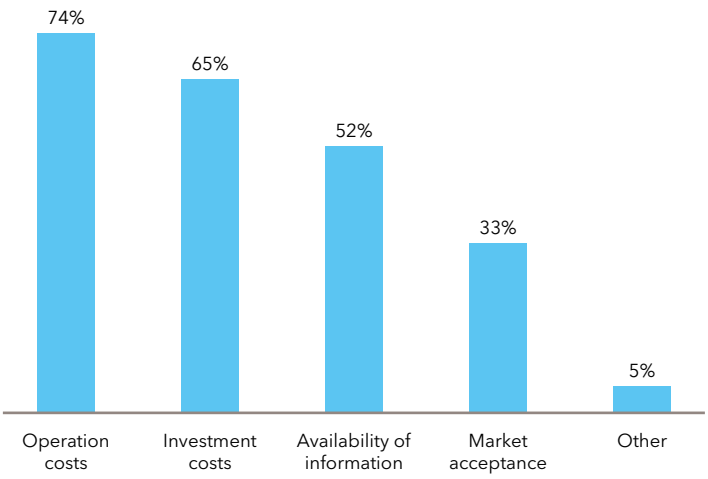


Figure 10 – Selection criteria for energy efficiency measures
*Multiple answers possible.

Optimised voyage planning, hull and propeller cleaning and weather routing are the three most popular measures, closely followed by slow steaming / eco speed [Figure 11]. Few shipping companies have yet invested in retrofitting of either energy efficiency devices (28%), the propeller (12%) or hull (11%). Some companies have already factored in the need for some kind of familiarisation with energy management either through awareness and/or incentive activities (41%) or through establishing a dedicated role for energy management (27%).

At 91%, hull coating is the measure which has the highest implementation rate. Hull and propeller cleaning (88%), auxiliary engine optimisation (86%), slow steaming / eco speed and retrofitting of energy efficiency devices, each at 83% [Figure 11], also show prove high implementation rates. It appears that companies are struggling with the implementation of virtual arrival, engine de-rating, frequency controlled fans and pumps, trim and draft optimisation, and establishing an energy manager. All other measures have an implementation rate above 65% [Figure 11].

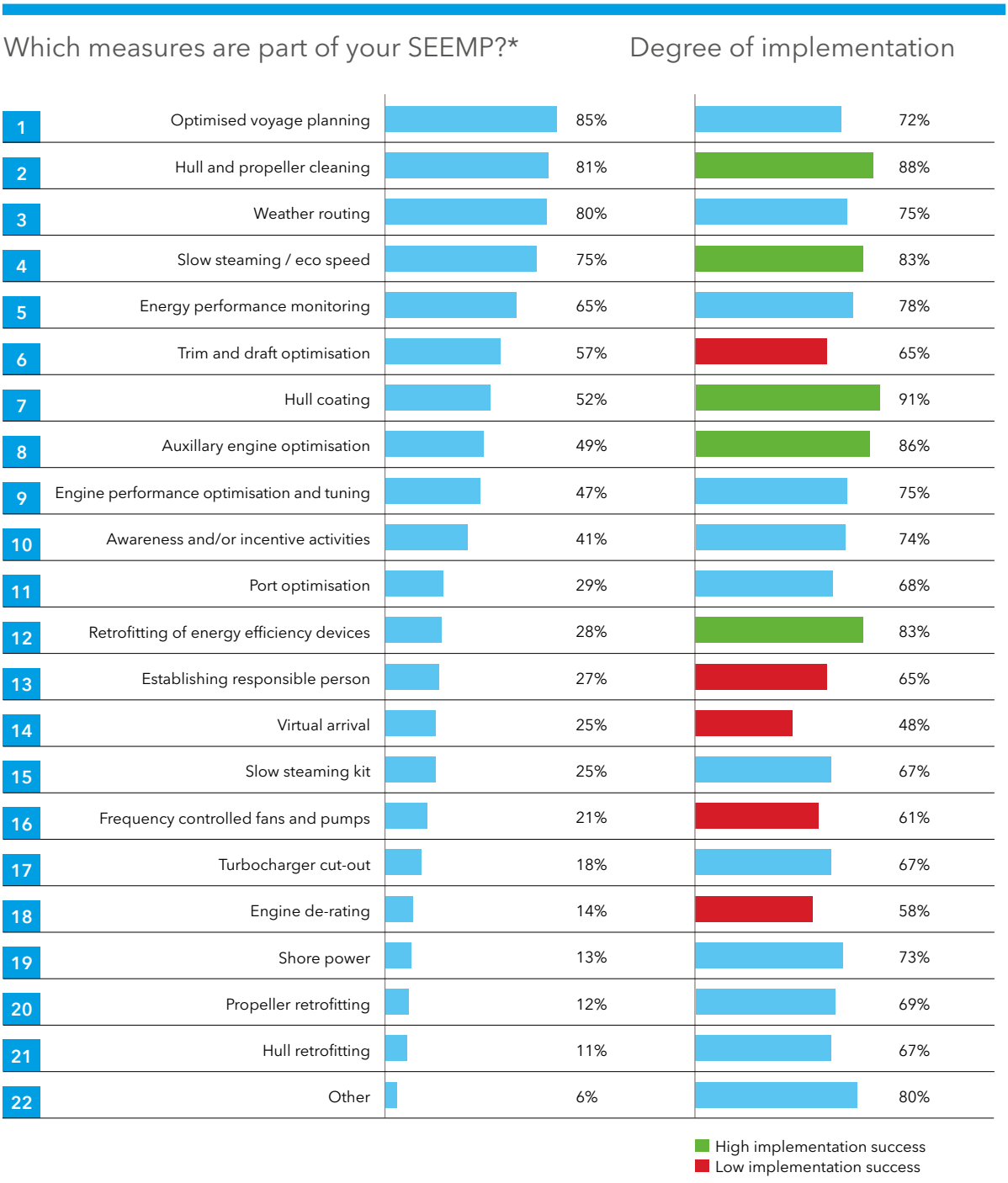


Figure 11 – Selected measures and implementation status

Shipping companies prioritise operational measures with low investment cost that are in many cases part of the routine anyhow. More complex measures (e.g. virtual arrival) requiring the involvement of different internal and external stakeholders as well as measures which require higher implementation efforts and/or costs (e.g. retrofitting, engine de-rating) have only been selected by a few companies. Limited access to financial sources, missing trust in impact and success rates of measures as well as little guarantee for claimed fuel reductions may have their impact.

Varying implementation success across the selected measures and the fact that aspired targets (qualitative and quantitative) in many cases could not be reached highlight that implementation poses a major challenge.

Impact of measures

The top three measures ranked by impact on fuel savings are slow steaming, hull and propeller cleaning and hull retrofitting, closely followed by optimised voyage planning and propeller retrofitting [Figure 12]. Even though widely selected by 49% of the respondents [Figure 11] and largely implemented among them (86%) [Figure 11], only 6% consider auxiliary engine optimisation as having a large contribution to the overall reduction of energy consumption [Figure 12].

Especially those measures that impact speed, distance or resistance (slow steaming, hull and propeller cleaning and retrofitting, voyage planning and weather routing) contribute most. This is driven by the large impact speed, distance and hull resistance have on the main engine consumption.

The rather low impact of auxiliary engine optimisation on the overall savings reflects the fact that the contribution of auxiliary engines to the overall consumption is less than 10%. However, the optimisation of auxiliary engines requires thoughtful behaviour from all crew members (from efficient port operations, reduced energy consumption in the galley to switching off lights) and thus has a positive impact on awareness for energy consumption, which many companies struggle with (see chapter 4.5).

Of those that have implemented a measure, how many think this measure belongs to the top three savings contributors?*

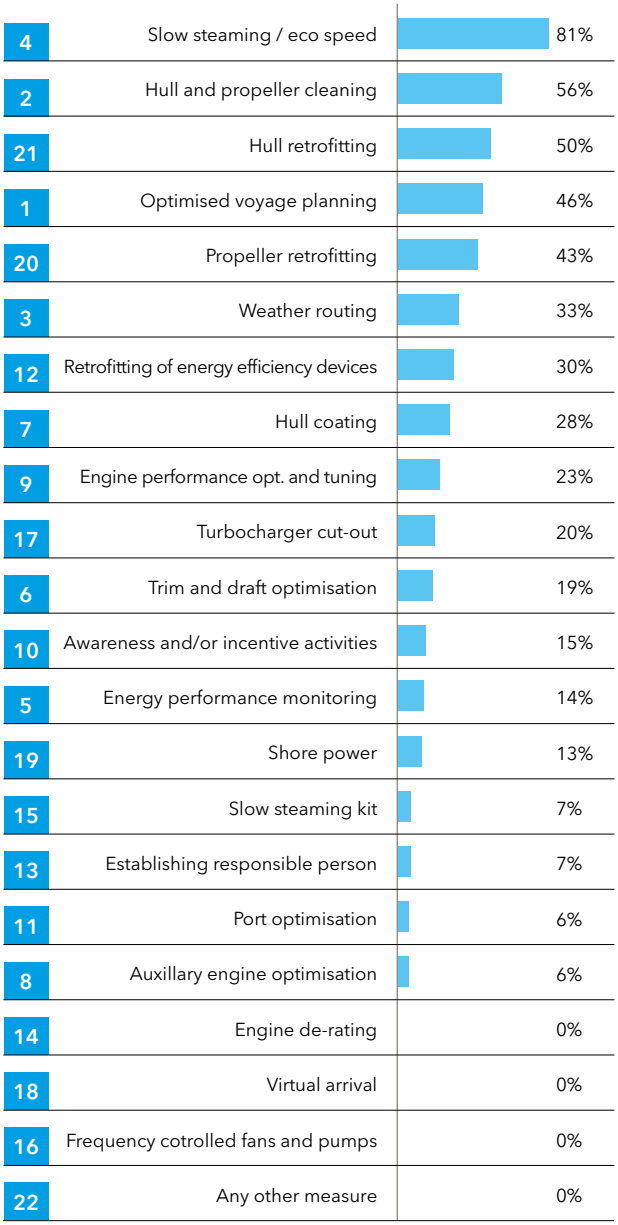


Figure 12 – Impact of implemented measures
*Multiple answers possible.

4.4 REPORTING AND MONITORING

Regardless of selected measures, decision-makers require transparency for both the implementation status and the impact of individual measures on energy consumption. Moreover, efficient performance monitoring and management enable companies to realise targeted savings. This calls for relevant, reliable and timely data.

Many companies rely on manual data transfer between ship and shore, which increases the risk of inaccuracy and incompleteness of data and causes inefficiencies, i.e. workload. This limits the ability to effectively analyse and prepare meaningful reports on time. Shipping companies aiming for greater energy efficiency need to invest in efficient performance management solutions to obtain transparency throughout their operations and to be able to proactively improve ship performance immediately.

The most popular method for data transfer between ship and shore is still manually prepared e-mails [Figure 13]. Only 19% use integrated systems to synchronise/transfer data. System-generated e-mails are the third most popular method, as they allow for easy tailoring to different onshore data interfaces. Study responses show there is currently no software solution established as the industry standard for monitoring and reporting. The replies given on companies' systems vary from in-house developments and tailoring of current in-house solutions to commercially available systems such as Kyma, Marorka, NS5, M.A.C., etc.

Using manually prepared data – without any data checks – increases the risk of (human) error during data entry and transfer, potentially leading to missing data entries or inconsistent, if not even incorrect data and resulting in inefficiency and additional workload. Best-in-class companies use integrated systems which perform data validation and plausibility checks before the data is stored. Moreover, an integrated system enables the organisation to conduct timely analyses in an efficient way, providing insights which can be used to improve performance. Trend analyses and sister vessel or trade comparisons can easily be

How is energy-management-related data transferred to shore?*

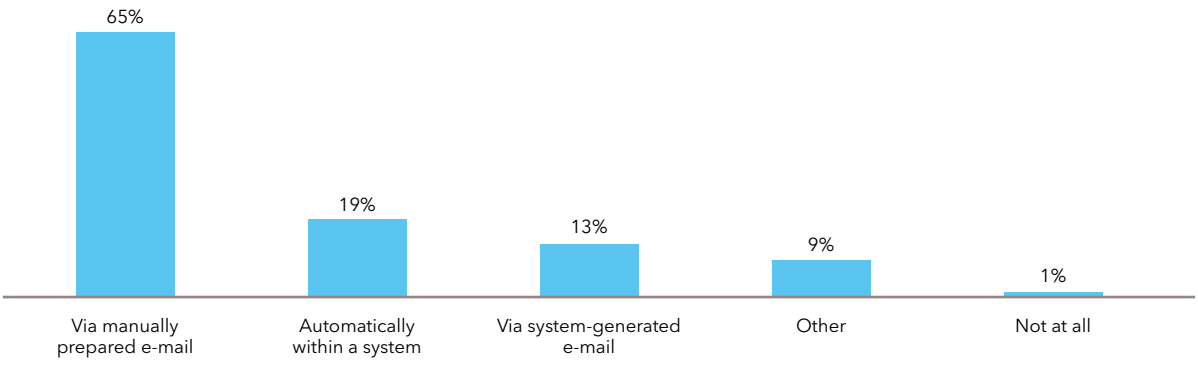


Figure 13 – Ways of transferring data *Multiple answers possible.

generated and create transparency for all parties involved. Ideally, these reports are generated automatically and show the most important KPIs specifically tailored to each stakeholder group.

The most common way for monitoring implementation of measures are reports prepared by the crew or during regular vessel audits (61% and 51%, respectively). Some companies even compile special reports prepared by a dedicated person for implementation tracking [Figure 14].

Although many companies monitor the implementation of measures through reporting, they are still faced with the challenge of achieving the aspired targets. One reason is that many companies only monitor the consumption (FOC/NM) but do not have defined KPIs that track the implementation of single measures, e.g. running hours of auxiliary engines, number of trainings conducted, and application of the correct trim. Secondly, even though FOC/NM is monitored, tracking against defined targets or benchmarks is not done in many cases. Trends are not analysed and "warning" systems indicating performance issues are missing. The establishment

of a smart monitoring concept allows for the proper implementation of tracking. It should consist of a clear implementation plan, defined targets and a monitoring scheme that allows for the easy identification of deviations from the plan.

How do you monitor the implementation of measures?*

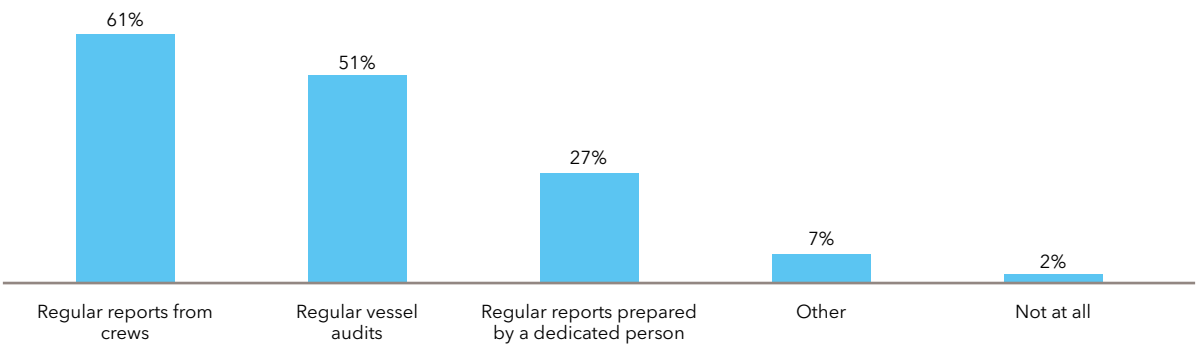


Figure 14 – Monitoring and ensuring implementation *Multiple answers possible.

4.5 CHANGE MANAGEMENT AND IMPLEMENTATION

Formulating reasonable energy management ambitions and selecting appropriate energy-saving measures is only the starting point for establishing energy management. In fact, implementation is what turns energy management into a success story. The results show that most of the companies face challenges during implementation: with the education of staff, changing employee behaviour and aligning changes with existing processes and procedures.

Those companies that have undertaken activities to educate and motivate staff have realised higher savings on average. However, the majority of companies have not conducted such activities (successfully). Little involvement of crew, low efforts in training and communication and limited interaction with staff during implementation have hindered ownership of onshore and onboard staff for energy targets. Thus, changes in behaviour have not been made.

Implementation challenges

The lack of staff education/expertise in applying new technologies poses a major challenge for efficient energy management, as it presents a problem for 49% of respondents. Furthermore, a third of the companies are suffering from change resistance and alignment issues on their way to more efficient operations [Figure 15]. Hence, many businesses are challenged by the process of promoting behavioural and organisational change among employees as well as integrating these changes within the current organisational structures.

To stimulate changes in employee behaviour, proper change and implementation management is required. Effective leadership, employee encouragement, communication of changes and their underlying rationale, as well as appropriate trainings, involvement of staff and incentives need to accompany the implementation.

What challanges have you encountered when implementing energy management / SEEMP?*

Figure 15 – Challenges in implementing energy-saving measures *Multiple answers possible.

Crew involvement
When developing SEEMPs, many companies (44%) gave their crews the ability to provide ideas but did not actively involve them in discussions. Furthermore, 37% decided to proactively involve either selected crew members in workshops or all of them at crew conferences, and 15% did not consider crew involvement during the selection of measures at all.

The benefit of active crew involvement is improved transparency for implementation challenges and reduced expected resistance. Involving the crew also has a positive impact on change behaviour, as it creates commitment among crew members.

How much was the crew involved in defining energy-saving measures (for the SEEMP)?

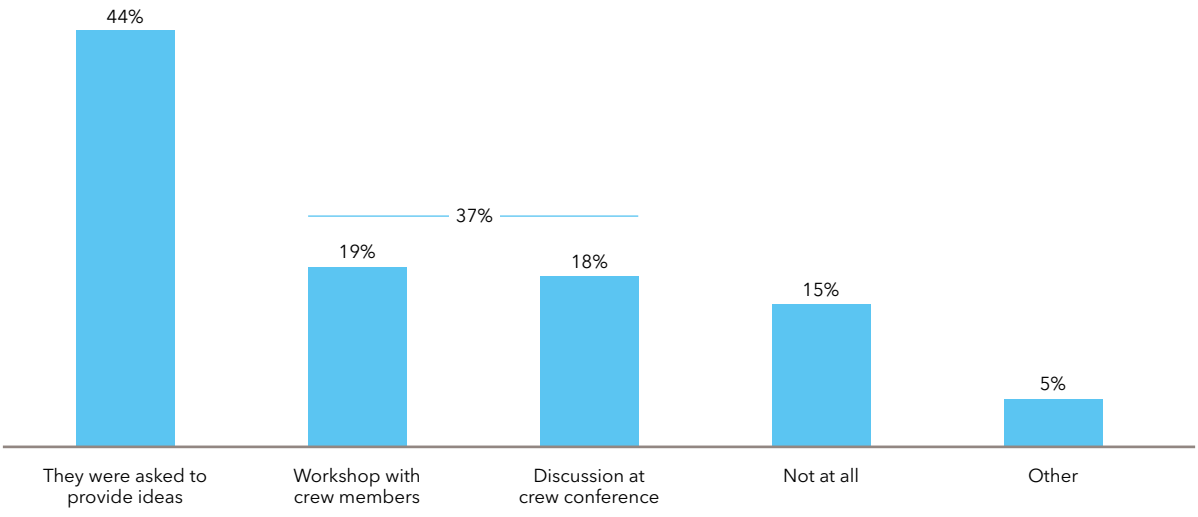


Figure 16 – Crew involvement during SEEMP design

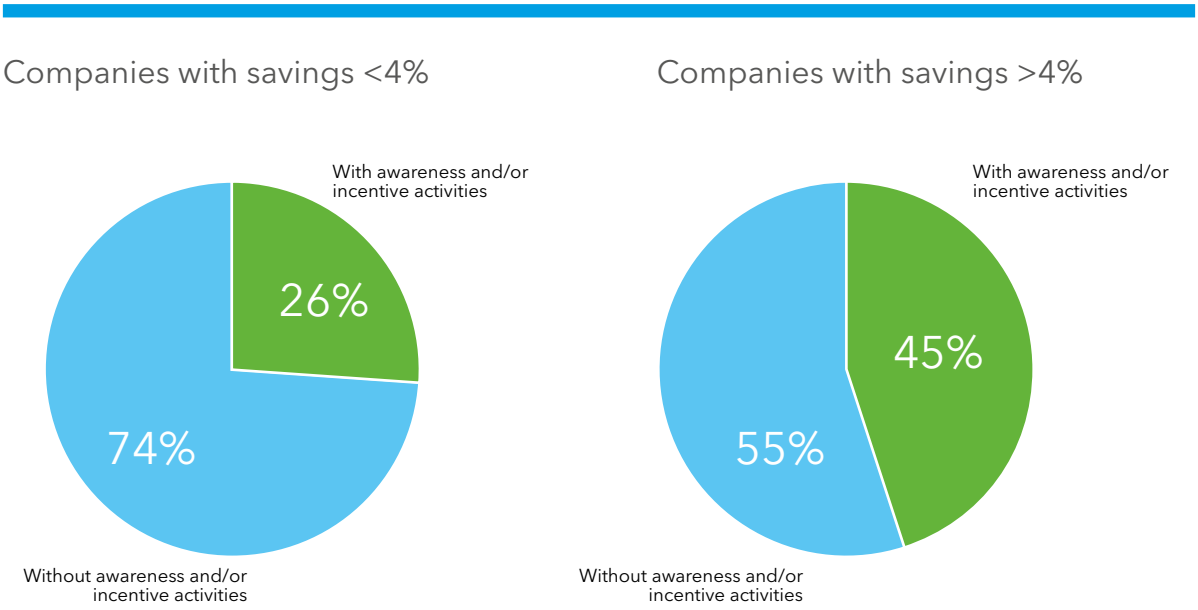


Figure 17 – Influence of awareness and/or incentive activities on savings

Impact of incentives and awareness activities
To underline the importance of managerial capabilities, it should be noted that among companies achieving more than 4% in savings (right side of Figure 17), 45% have conducted awareness and/or incentive activities, while only 26% of the companies that have realised savings of 4% or less (left side of Figure 17) have done the same.

Companies' biggest challenge is appropriate change and implementation management. Even though many companies have already installed change activities such as trainings, communication and incentives, further efforts are required to ensure the realisation of the targeted savings.

Are the measures defined in your SEEMP aligned with your management system/procedures?

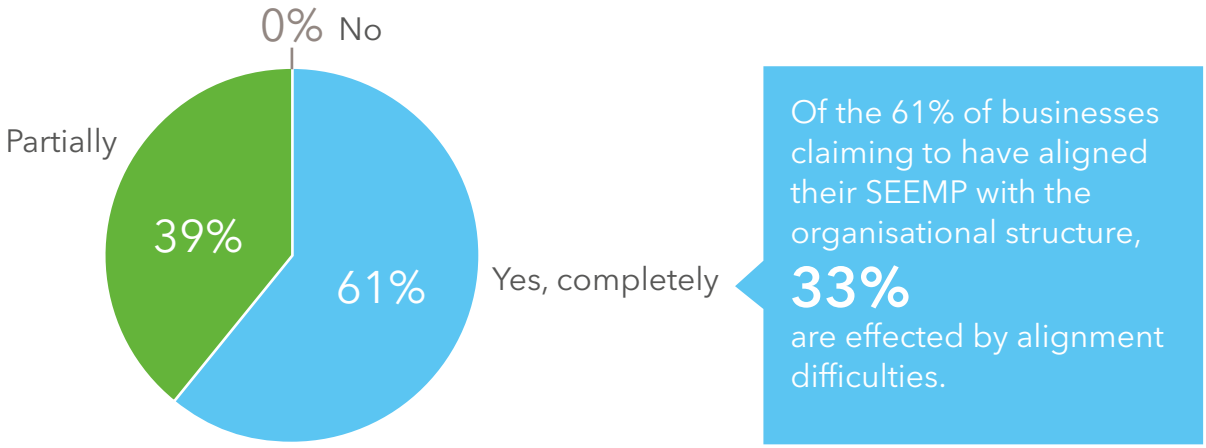


Figure 18 – Alignment between SEEMP and existing management systems/procedures

Integration with current management systems
Among the respondents, 61% declare to have integrated their SEEMP into existing management systems or procedures, while 39% state that they have only partially aligned them. But the integration has been a challenge for many: about 30% of companies – and that ratio is the same between those that have partially or fully integrated the SEEMP into systems and procedures – have been or are still challenged by this task [Figure 18].

Harmonised and lean processes are the starting point for every change process. This is in many cases an ongoing challenge, as continuously new regulations and client expectations are formulated that shipping companies need to adhere to. Often this results in a patchwork of documents, sometimes even providing contradicting information. To prevent this, the alignment process needs to be closely coordinated and monitored across the organisation.

How du you ensure that your office staff and crew actually implement/apply the defined energy-saving measures?*

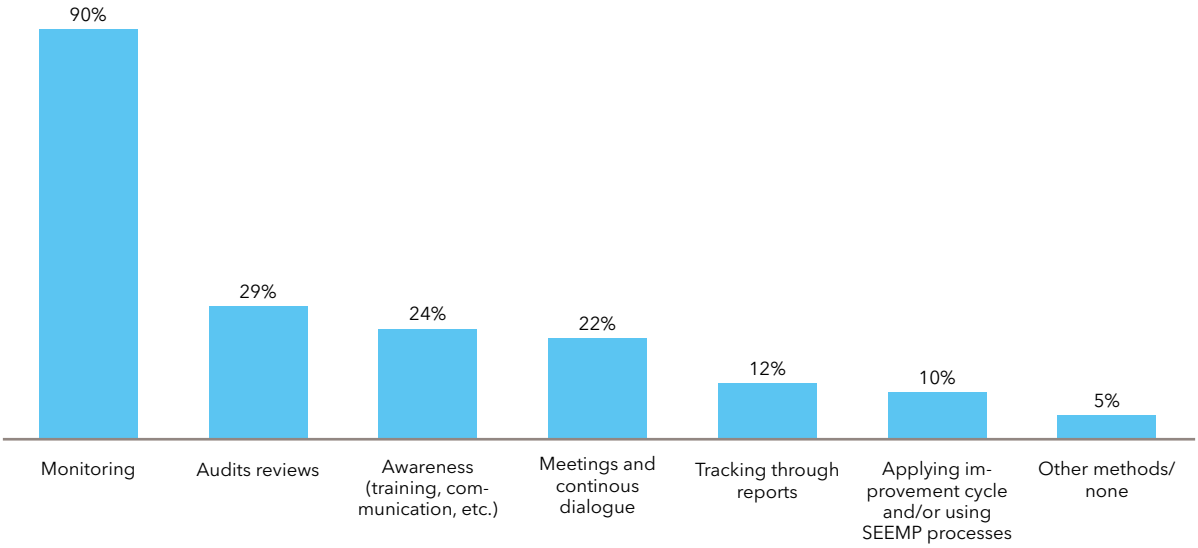


Figure 19 – Implementation tracking *Summerised from statements.

Monitoring implementation

Almost every company (90%) conducts "monitoring" to ensure that office staff and crews implement the measures and actually apply them during their daily routine [Figure 19]. Further analysis of the statements provided by the respondents reveals that "monitoring" in many cases means reviewing FOC/NM or crew meeting results. Only in very rare cases does monitoring consist of measure-specific KPIs that are tracked against a defined plan. For this purpose, performance and measure-specific KPIs need to be formulated, communicated and understood. Onboard audits or (management) reviews, which rank second when it comes to ensuring the implementation of SEEMP measures, can then be used as a method for future follow-up measures, developing further improvements or understanding challenges.

Awareness activities such as training, communication or incentives only rank third among companies' methods to ensure successful implementation and explain the difficulties companies experience during implementation. Additionally, interactive communication, e.g. through continuous information/knowledge transfer, has only been picked up by 22%.

Interactive methods such as training and communication activities receive relatively little attention with respect to SEEMP implementation. Instead, companies prefer to rely on data analyses. Without adequate feedback channels and trainings, it is difficult to understand the challenges the office staff and crew have with new processes and procedures. Only close interaction between the crew and the person responsible for energy ensures removal of obstacles and transfer of lessons learned across the fleet. Incentives further stimulate staff change.

5 IMPLICATIONS AND OUTLOOK

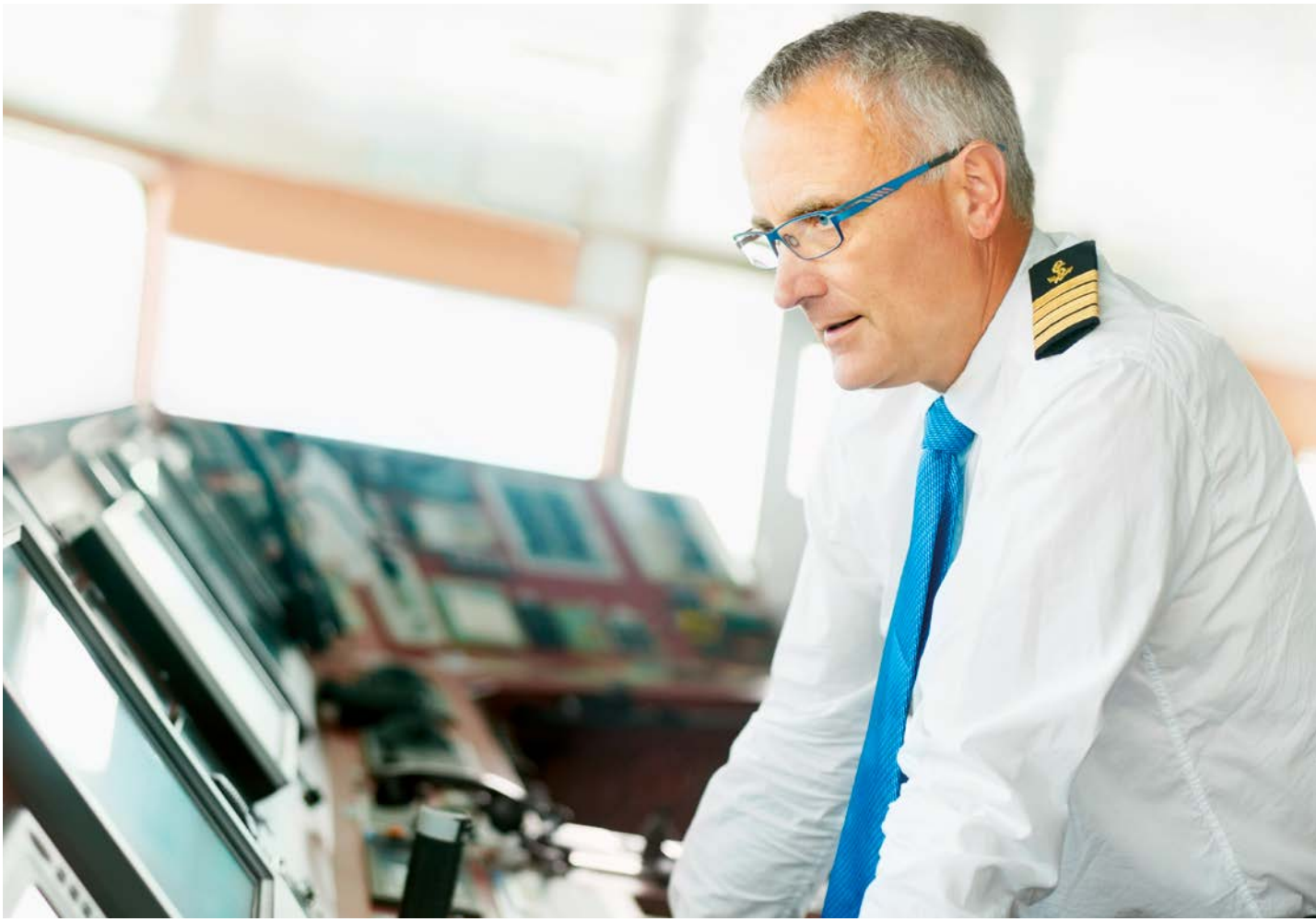
The importance of improving energy performance will further increase with new tonnage designed for current operational profiles and significantly lower fuel consumptions per transported capacity. Increasing bunker prices and stricter regulations will establish more pressure. Until now, only very few companies have managed to position themselves as experts for energy management. These companies have already today achieved energy savings that surpass 10% and enjoy better charter rates and higher utilisation of their fleet. For those who have not realised significant savings yet, it will be crucial to select impactful measures, motivate drastic changes in employee behaviour, stimulate better cooperation between charterer, manager, owner and port, and professionally monitor performance to ensure success of more elaborate and advanced measures.

Achieving ambitious targets by leveraging more advanced measures – The easy-to-implement, well-known measures have by now largely been implemented. Further significant savings can only be realised with the implementation of more intricate measures requiring cooperation between various stakeholders or by undertaking significant investments. These measures require proactive information exchange across the organisation and with other stakeholders (e.g. information on schedule changes), transparency for energy drivers and real-time performance. Showing competence – through applying advanced measures and increasing transparency for energy performance – grants easier access to financial resources to allow for retrofitting the existing fleet, among others.

Conducting professional change management activities – Successfully implementing measures means to a great extent changing behaviour of both onshore and onboard staff. So far little has been done to manage this process professionally. Therefore, change management activities such as communication and trainings, incentive schemes and close steering of energy management activities through dedicated resources need to be established. These activities need to start when selecting measures in order to also consider feedback from those who will actually apply the measures: the crew. Training activities should be initiated as early as possible to familiarise the crew with the changes prior to implementation. In addition, incentives further improve staff commitment. Energy management is not a onetime effort, and the capabilities and time required for these activities should not be underestimated.

Establishing effective performance management – Performance management means continuous transparency for energy performance and being able to identify obstacles on the way to realising the targets. For this, reporting daily average FOC/NMs is not sufficient. In fact, it means defining a few measurable and meaningful KPIs with which the implementation status and current performance can be monitored. Only by comparing the actual performance of these KPIs against targets and benchmarks, and visualising trends, creates the required transparency. Once a comprehensive performance management system is in place, shipping companies can act upon irregularities immediately. Poor data quality and delay in data transmission or presentation of performance KPIs ultimately translates into excess fuel consumption. Full transparency ensures the ability to communicate the benefits generated by individual measures to the market.

Bearing this in mind, the majority of the shipping industry needs to challenge its existing approach. The next year or two will determine who is willing and/or able to master energy management and turn it into a competitive advantage, and who will struggle to remain competitive. Companies which invest in holistic energy management concepts will be the ones shaping the market. Those who do not invest in energy management are going to face a challenging future.



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