Energy efficient operation – what really matters
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# Definitions and Glossary

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<th>Description</th>
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<tr>
<td>AIS</td>
<td>Automatic Identification System</td>
</tr>
<tr>
<td>EBITA</td>
<td>Earnings Before Interest, Taxes and Amortisation</td>
</tr>
<tr>
<td>ECA</td>
<td>Emission Control Areas</td>
</tr>
<tr>
<td>EEDI</td>
<td>Energy Efficiency Design Index</td>
</tr>
<tr>
<td>ETA</td>
<td>Estimated Time of Arrival</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FOC</td>
<td>Fuel Oil Consumption</td>
</tr>
<tr>
<td>HFO</td>
<td>Heavy Fuel Oil</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Organization</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
</tr>
<tr>
<td>LSHFO</td>
<td>Low Sulphur Heavy Fuel Oil</td>
</tr>
<tr>
<td>MDO</td>
<td>Marine Diesel Oil</td>
</tr>
<tr>
<td>MGO</td>
<td>Marine Gas Oil</td>
</tr>
<tr>
<td>QHSSE</td>
<td>Quality, Health, Safety, Security, Environment</td>
</tr>
<tr>
<td>RPM</td>
<td>Revolutions per minute</td>
</tr>
<tr>
<td>SEEMP</td>
<td>Ship Energy Efficiency Management Plan</td>
</tr>
<tr>
<td>SFOC</td>
<td>Specific Fuel Oil Consumption</td>
</tr>
<tr>
<td>TEU</td>
<td>Twenty-foot Equivalent Unit</td>
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</table>
EXECUTIVE SUMMARY

Objectives
“What matters to actually increase energy efficiency in ship operation?” was the overarching question behind the 2015 DNV GL Energy Management Study. Based on increased regulatory pressure and charter markets taking energy efficiency into account more and more, the topic is on every shipping company’s plate. But it is obviously treated in very different ways as our daily advisory practice shows. We wanted to know, what did successful players do differently? What worked well? Where does the industry struggle? What are the success factors? What are the plans going forward? Or in short: What matters really?

Approach
The study was conducted as a web-based survey with 35 questions addressing all key aspects of energy management and took a side view on fuel prices and Emission Control Areas (ECAs). Eighty respondents shared both their own and their company’s views on these aspects. The represented shipping companies are headquartered in 24 countries. More than 50 of the companies act as ship or fleet manager, more than 40 as owner and nearly 20 as operator. All major vessel segments are covered well with more than 30 survey participants each from container, tank and dry-bulk segments and about ten from cruise, offshore and MPV. Beyond the questionnaire-based survey, several analyses, e.g. on the implementation of vessel speed related measures, have been done by use of Automatic Identification System (AIS) data.

Results
Most respondents name several reasons as to why energy efficiency is important to them, nobody feels unaffected. The direct cost impact is the key driver for energy efficiency, followed by the market need to disclose environmental footprint. Overall, energy efficiency is named as a key topic of high importance by 76% of the participants.

Ambition levels for energy saving targets are low overall. Still, 28% of participants do not have a quantitative saving target; the average is as low as 2.8%. Looking at qualitative targets implementation of performance management and fostering of awareness and capabilities for behavioural change are top of the list.

Ship Energy Efficiency Management Plan (SEEMP) and energy management seem to be purely compliance driven initiatives for about at least 40% of participants. The others have at least made some efforts towards more energy efficiency since 2013.

Nine energy saving measures have been addressed (and partially implemented) by more than 50% of the responding shipping companies. Most of them are operational or managerial, just one of them is technical. “Performance monitoring and reporting” as an enabler made it to the fourth rank among the measures that have already been addressed. Especially interesting is the enabler “awareness and/or incentives”. It moves up from the fifteenth rank of the measures already implemented in 2014 to the first rank of the measures planned to be implemented in 2015. It’s a clear indication that many shipping companies struggle with implementation. Looking at the major contributors to energy savings realized, “slow steaming” outpaces all other measures.

The responsibility for energy management appears unclear in many shipping companies. Not even a third of all companies have a dedicated energy manager or team. Most companies have assigned the task to “everybody”, which often actually means “nobody”.

Energy performance management seems to be a common theme throughout the shipping industry. It has been ranked highest of all enablers for energy management with respect to implementation and contribution so far. Three quarters of respondents have implemented it – to various degrees – to monitor implementation and the impact of measures, and to promote the achievements on the (charter) markets. Looking at the various angles of performance
management, “voyage performance” receives the most attention, but “engine & systems” and “hull & propeller” are also focal points for more than half of the respondents. Fully or partially manual data gathering is still prevailing; the same applies for generation of reports. Superintendents are said to regularly review energy related data in about half of the shipping companies. Others distribute the reports in the company or use data reactive for root cause analyses. The most successful companies implemented both; an IT-based performance management system and a performance management culture.

A look at the target achievement provides a mixed picture. Nearly one third of respondents fully or at least largely achieved targets made for 2014. One fourth did not achieve energy related targets at all or only to a small degree. Little less than half achieved their targets to 25 to 75%. In combination with the targets set came a worrying result: Low ambitions, not even met.

Particularly interesting is the view on success factors to realize actual fuel savings. Forty per cent address “awareness, capabilities and behaviour”. For 29% of respondents, “tracking savings through performance management systems” is viewed as a key enabler, too. This hint on the importance of enablers “awareness” and “performance monitoring”, i.e. the call for a combination of carrot and stick, is shone through the entire set of survey results.

Beyond the survey focus on energy efficient operations we questioned the participants on the bunker price expectations towards the end of 2015. Estimates on heavy fuel oil (HFO) price range from 250 - 700 USD/t. The average HFO price estimate is 425 USD/t, about 25% higher than today at the time of the survey.

Another side aspect was what strategies shipping companies have to deal with the requirements of ECAs. So far nearly all shipping companies, irrespective of whether they’re operating limited or high shares in ECAs, switched to low sulphur fuel oil: 91% of shipping companies bought time for investment decisions on scrubbers and/or alternative fuels like LNG. Just 6% have installed a scrubber to date. Looking ahead the picture changes. Approximately a quarter of shipping companies considers installing scrubbers and respectively switching to alternative fuels as LNG.

**Implications**

Since last year’s energy management survey in 2014 the industry has made some progress. Awareness of the problems has increased across the board. The respondents have understood that they struggle and why they struggle. Some shipping companies - but still only a minority - have started effective actions; others still need to take that step.

Just one third of shipping companies has achieved the energy related targets in 2014. This is a call for action to take the single biggest cost position and its affect on each shipping company’s bottom line more seriously. For an operator 5% savings in a 40% cost position equate to two percentage points EBITA (Earnings Before Interest, Taxes and Amortisation). For an owner or a manager there are hardly any better ways to differentiate than by superior energy efficiency.

“People make the difference” is the golden thread through this year’s study. Although nine common measures have been addressed in more than half of all shipping companies, many of them still do not realize the expected savings. They struggle with implementation, which is a human aspect. The combination of carrot and stick – awareness, capabilities and motivation on the one hand, and performance management on the other - seems to be the key success factor.
2
OBJECTIVES - WHAT MATTERS?

“What matters to actually increase energy efficiency in ship operation?” was the overarching question behind the 2015 DNV GL Energy Management Study. Based on increased regulatory pressure and challenging charter markets taking energy efficiency into account more and more, the topic is on every shipping company’s plate. But it is obviously treated in very different ways as our daily advisory practice shows.

Regulatory pressure on shipping companies increases more and more. Ship Energy Efficiency Management Plan (SEEMP) and Energy Efficiency Design Index (EEDI) came into force in 2013. More sea areas are being declared as Emission Control Areas (ECA). Following the North and Baltic Sea and North America, Hong Kong seems to be the next to come, potentially followed by the Turkish Strait and the Mediterranean Sea, Singapore and Japan. Furthermore the requirements in the ECAs get tougher over time, as, for example, the sulphur limits in the North and Baltic Sea were lowered from 1.0% to 0.1% since January 2015. Starting off with charging shipping companies for air emissions, the European Union (EU) has adopted a Regulation on monitoring, reporting and verification of CO₂ emissions, which will take effect from January 2018 onwards. All these regulatory measures will increase the cost of burning fuel and, hence, stimulate a move towards more energy efficiency.

Alongside regulation, shipping markets put pressure on achieving greater energy efficiency. Depending on segment and perspective, as well as bunker price of course, fuel makes up for 25 to 50% of total costs in shipping. It is the largest cost position. While this has been largely ignored on charter markets prior to the shipping crisis (at a time, when availability of tonnage was more important than the costs to operate the tonnage), the picture has changed. Since about 2011 shipping markets (charter as well as Sale & Purchase) began to slowly but surely factor in fuel efficiency in charter rates and prices. Examples from retrofitting of vessels show that 25 to 30% of the cost advantage gained is being passed on to the owner as a mark-up on the charter rate. Even if operational measures appear less tangible than technical measures, energy efficient operation and management can be a positive differentiator for ship owners and managers.

With bunker costs being the major cost position in shipping, the bunker price is a key driver. From 2000 to 2008 the price of heavy fuel oil (HFO) only increased. A quadrupling in price was followed by a fair amount of volatility. The current HFO price is just a little higher than half of peak levels. The question is how this affects shipping companies’ efforts to act on energy efficiency. Will they be reduced as the cost pressure is released a bit?

In our daily advisory practice we see shipping companies that have realized savings of 10 to 15% and more, while others have achieved hardly anything. All have SEEMPs in place. All are compliant. But obviously some do significantly better than others. This raises questions which we addressed in our 2015 DNV GL Energy Management Study:

What did and do successful players do differently? What worked well? Where does the industry struggle? What are the success factors? What are the plans going forward? Or in short: What matters?
OBJECTIVES – WHAT MATTERS?
3

APPROACH – INDUSTRY INSIGHT

A broad and deep industry insight on energy efficient operation was our aim. To cover all segments, regions and players of various positions along the shipping value chain, we invited about 700 professionals in charge of energy efficiency including ship owners, manager and operators to participate in the survey.

A web-based questionnaire with 35 closed and open questions was to be answered. The questions addressed all key aspects of energy management and took a side view on fuel prices and ECA zones:

- Relevance of energy management
- Target setting
- Approach towards energy management
- Energy saving measures
- Organizational anchoring
- Performance management
- Target achievement
- Challenges and success factors for implementation
- Fuel price development
- ECA strategies

80 respondents shared both their own and their company’s views on these aspects. The represented shipping companies are headquartered in 24 countries. More than 50 of the companies act as ship or fleet manager, more than 40 as owner and nearly 20 as operator (see Figure 1).

The container, tanker and dry-bulk segment is represented by more than 30 survey participants each. Cruise, Offshore and MPVs are represented by about 10 participants each. Some other segments are covered by individual participants (see Figure 2).

The survey covers shipping companies with fleets from below 10 to above 150 vessels. About two thirds of the participants work in mid-sized shipping companies between 11 and 100 vessels (see Figure 3).

Beyond the questionnaire-based survey, several analyses, e.g. on the implementation of vessel speed related measures, have been done by use of Automatic Identification System (AIS) data.

Which area of shipping are you working in?

![Figure 1 - Role of shipping companies represented in the survey](image)

Take away

- 2015 energy management survey with good industry coverage
- More than 50 ship or fleet managers, 40 owners and nearly 20 operators participated
- About half of the participants work in integrated shipping companies
Which vessel segments are you operating in?

- Container, tanker and bulk segment represented by more than 30 survey participants each
- Cruise, Offshore and MPVs represented by about 10 participants each
- Some other segments covered by individual participants

![Vessel segments represented in the survey](image)

**Take away**
- Container, tanker and bulk segment represented by more than 30 survey participants each
- Cruise, Offshore and MPVs represented by about 10 participants each
- Some other segments covered by individual participants

How many vessels does your company have in the fleet?

- ≤ 10: 14
- 11 - 25: 20
- 26 - 50: 16
- 51 -100: 15
- 101 - 150: 6
- > 150: 9

![Fleet sizes represented in the survey](image)

**Take away**
- Survey covers shipping companies with fleet from below 10 to above 150 vessels
- About two thirds of participants work in mid-sized shipping companies between 11 and 100 vessels
4
RESULTS – WHAT LEADING PLAYERS DO DIFFERENTLY

4.1 RELEVANCE OF ENERGY MANAGEMENT

With regulatory pressure and a share of 25 to 50% of total costs together with a charter market, which started to differentiate rates based on energy efficiency, there should be enough reasons to have energy efficiency high on the agenda. But what did the respondents say?

Most respondents name several reasons as to why energy efficiency is important to them, nobody feels unaffected. More than 80% of nomination fuel costs are the key driver for efficiency, followed by environmental footprint with 58% (see Figure 4).

Interestingly many respondents seem to underestimate the share of fuel costs in total shipping costs. Just 30% assume the share to be 25% or more. Most others seem to take a more narrow perspective and disregard the bunker costs that their charterers have.

Still, for more than three quarters of respondents realizing energy savings is a key topic of high importance. A further 16% regard it as relevant, but admit that other topics have higher priority. No survey participant regards fuel efficiency as unimportant (see Figure 5).

<table>
<thead>
<tr>
<th>How does energy efficiency impact your company?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts costs</td>
<td>80%</td>
</tr>
<tr>
<td>Impacts our “eco” footprint</td>
<td>58%</td>
</tr>
<tr>
<td>Important to ensure utilization of vessels</td>
<td>41%</td>
</tr>
<tr>
<td>Impacts charter rates</td>
<td>40%</td>
</tr>
<tr>
<td>Is “mandatory” due to clients’ requirements</td>
<td>35%</td>
</tr>
<tr>
<td>Does not impact my company</td>
<td>0%</td>
</tr>
</tbody>
</table>

Figure 4 - How energy efficiency impacts shipping companies

N = 80, multiple answers possible

Take away
- Most respondents name two or three reasons why energy efficiency is important for them, nobody feels unaffected
- Cost is the key driver for efficiency, followed by market requirements to disclose the environmental footprint
How important is it for your company to realize energy/bunker savings?

- High importance, it is the key topic: 76%
- Importance, but other topics have higher priority: 16%
- Only little importance: 8%
- No importance: 0%

Figure 5 - Importance to realize energy savings

Take away:
- Realizing fuel savings is a key topic of high importance for three quarters of the participants.
- 16% regard it as relevant, but admit that other topics have higher priority.
- No survey participant regards fuel efficiency as unimportant.
4.2 TARGET SETTING

High importance calls for ambitious targets. Is this actually the case for the 80 shipping companies who responded?

Looking at the respondents’ replies the ambition level for energy savings targets is low (see Figure 6). The share of companies with no quantitative target defined decreased from 44% in 2013 to 28% in 2015, but is still high. Nearly one third of shipping companies did not set themselves an explicit saving target. Only about one third of participants aims for energy savings of 5% or more. The average value of all respondents is fairly stable at 2.8%.

Compared with our experience from numerous energy management advisory projects the numbers appear fairly conservative. Energy savings above 10% have been achieved regularly by proper implementation of managerial and operational measures (even if the big lever of slow steaming is excluded) in combination with organizational anchoring and working on staff awareness and capabilities. Also, the implementation of few technical measures (e.g. bow and propeller retrofit) has yielded more than 10% savings in numerous cases.

What quantitative energy targets, in % of fuel reduction, have you defined?

<table>
<thead>
<tr>
<th>Year</th>
<th>0%</th>
<th>0.1% - 1.9%</th>
<th>2.0% - 4.9%</th>
<th>5.0% - 9.9%</th>
<th>10.0% - 14.9%</th>
<th>≥15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>44%</td>
<td>13%</td>
<td>17%</td>
<td>20%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>2014</td>
<td>32%</td>
<td>14%</td>
<td>27%</td>
<td>18%</td>
<td>7%</td>
<td>3%</td>
</tr>
<tr>
<td>2015</td>
<td>28%</td>
<td>14%</td>
<td>28%</td>
<td>22%</td>
<td>7%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Figure 6 – Quantitative energy saving targets

Take away
- Ambition levels for energy saving targets, average target is fairly stable at 2.8%
- Share of companies with target “0%” decreased from 44% in 2013 to still high 28% in 2015
- Just about one third of respondents aims for 5% energy saving or more
Asked about other - qualitative rather than quantitative - targets, shipping companies define implementation of performance management and behavioural change as targets for 2015. More than half of the companies with qualitative targets want to implement performance management in 2015. One third of companies wants to foster awareness and capabilities for behavioural change (see Figure 7). These targets coincide with increased inquiries and project work by DNV GL on performance management systems and culture, as well as energy related training over a period of nine to 12 months.

What qualitative targets did you define?

Performance management (equipment and culture) 53%
Awareness, capabilities and behaviour 33%
Measure implementation (retrofit) 13%
Measure implementation (voyage performance) 7%
Measure implementation (vessel performance) 7%
Management system 7%
Other environmental targets 20%

Figure 7 – Qualitative energy saving targets

Take away
- More than half of companies with qualitative targets want to implement performance management in 2015
- One third of companies wants to foster awareness and capabilities for behavioural change
4.3 APPROACH TOWARDS ENERGY MANAGEMENT

How did shipping companies approach energy efficiency in operations? Who decided on a compliance driven approach initially? Who approached the topic with the ambition to actually realize savings?

Even if we did not ask the questions above directly, the answers to the question on whether the SEEMP has been updated compared to the first version (dated January 1st 2013 or earlier) tells a lot. Forty-one per cent of shipping companies have not updated the SEEMPs in a period of two and a half years (see Figure 8). This is interesting, because all owners should have followed the plan-do-check-act cycle as defined by the IMO. Obviously 41% have treated the SEEMP as a compliance driven paper exercise so far. This finding resonates well with the status we currently observe at shipping companies who call us for energy management projects.

Where updates have been made, they typically refer to new/further measures and new energy saving targets. Thirty-six per cent have introduced new measures, 27% new targets, 7% new key performance indicators (KPIs) and 40% made various changes (see Figure 9).

If you have updated your SEEMP, what changes have you made?

<table>
<thead>
<tr>
<th>Changes to SEEMPs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various updates</td>
<td>40%</td>
</tr>
<tr>
<td>New measures</td>
<td>36%</td>
</tr>
<tr>
<td>New targets</td>
<td>27%</td>
</tr>
<tr>
<td>New KPIs</td>
<td>7%</td>
</tr>
</tbody>
</table>

Figure 9 - Changes made to SEEMPs

Take away
- 59% of the participating shipping companies have updated their SEEMPs during the last 2.5 following the required plan-do-check-act cycle
- For 41% of shipping companies the SEEMP still seems to be a paper exercise

If you have updated your SEEMP after the first version has been sent to the fleet (01.01.2013)?

Take away
- New measures, new targets and new KPIs are the key areas of updates made to SEEMPs since 2013
- Most updates refer to new/further measures and new energy saving targets
- 40% of the shipping companies that updated their SEEMPs addressed various aspects
4.4 ENERGY SAVING MEASURES

Operational, managerial, technical energy saving measures – what are shipping companies doing to increase efficiency? How do they select measures? What are the plans going forward?

In our daily advisory practice with numerous energy management projects every year we see our clients implementing all types of measures. Technical measures, i.e. retrofitting of bow, propeller, main engine, consumers etc., play an important role. They are very tangible. Something technical gets modified, usually adjusted to today’s speeds and engine loads, and efficiency increases almost automatically. From project experience about 50% of achievable savings originate from technical measures.

The other 50%, however, are achieved with operational and managerial measures. Operational measures are related to the practices of how the crew runs the ship. Regular hull and propeller cleaning may serve as an example. Managerial measures, in turn, relate to the interface ship/shore or even require interaction with partners along the value chain, such as ports. While the technical measures are very tangible, operational and managerial measures benefit from having low or even no financing requirements. Some decisions support the idea that tools might be needed. Otherwise it’s “just” about changing practices.

When we asked the shipping companies how they select energy efficiency measures, most seem to have had technical measures in mind (see Figure 10). The selection of measures is mainly driven by financial considerations (payback period 80%, vessel age 70%, investment 66% and ongoing costs of a measure 34%). But nearly half of the participants names “availability of information” as a driver for the selection of measures, which indicates further improvement potential at relatively low effort.

Particularly interesting are the results to the question “what measures have been implemented so far, and/or are planned to be implemented in 2015?” (see Figure 11).

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

- Payback period: 80%
- Vessel age: 70%
- Investment costs: 66%
- Availability of information: 49%
- Costs of applying the measure: 34%
- Market acceptance: 16%
- Other: 5%

Figure 10 – Criteria for measure selection

Take away
- Selection of energy efficiency measures is driven by a thorough cost-benefit assessment
- Nearly half of the participants name “availability of information”, indicating further potential
What are the energy saving measures that are...?

![Figure 11 - Ranking of measures (planned to be) implemented](image)

**Take away**

- Nine simple energy saving measures have been addressed by more than 50% of shipping companies, most of them being operational measures.
- Awareness shows nearly lowest implementation so far but is planned as no. 1 for 2015, which indicates that implementation is challenging.
Nine typical energy saving measures have been implemented by more than 50% of respondents, most of them being operational measures, some technical. Hull and propeller cleaning, slow steaming and improved hull coating have been addressed by more than three quarters of responding shipping companies to date. “Awareness” shows nearly the lowest implementation so far but is planned as number one with 28% for 2015. This is a clear indication that shipping companies struggle with implementation of measures and acknowledge the need to address the human factor.

A correlation between measures implemented so far and degree of target achievement indicates that “awareness”, “hull and propeller cleaning”, “hull coating” and “speed pattern optimization” have the highest positive effects.

Asked about the major contributors to energy savings in 2014, “slow steaming” outpaced all other measures by far. Sixty-eight per cent of respondents named it as one of the top three contributors (see Figure 12). More frequent “hull and propeller cleaning” made it to second rank with 44%, “voyage planning optimization” was third with 28%.

What are the top three measures that contributed most to fuel reduction of your fleet in 2014?

<table>
<thead>
<tr>
<th>Measure</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow steaming</td>
<td>68</td>
</tr>
<tr>
<td>Hull and propeller cleaning</td>
<td>44</td>
</tr>
<tr>
<td>Voyage planning optimization</td>
<td>28</td>
</tr>
<tr>
<td>Performance monitoring and reporting</td>
<td>21</td>
</tr>
<tr>
<td>Hull coating</td>
<td>20</td>
</tr>
<tr>
<td>Speed pattern optimization</td>
<td>18</td>
</tr>
<tr>
<td>Advanced weather routing</td>
<td>16</td>
</tr>
<tr>
<td>Propulsion retrofitting</td>
<td>16</td>
</tr>
<tr>
<td>Trim &amp; draft optimization</td>
<td>14</td>
</tr>
<tr>
<td>Awareness and/or incentives</td>
<td>9</td>
</tr>
<tr>
<td>Engine performance optimization</td>
<td>8</td>
</tr>
<tr>
<td>Engine optimization</td>
<td>6</td>
</tr>
<tr>
<td>Engine room system optimization</td>
<td>6</td>
</tr>
<tr>
<td>Port Optimization</td>
<td>5</td>
</tr>
<tr>
<td>Hull retrofitting</td>
<td>5</td>
</tr>
<tr>
<td>Establishment of energy responsible</td>
<td>3</td>
</tr>
<tr>
<td>Shore power</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
</tr>
</tbody>
</table>

*Figure 12 – Top 3 contributors to energy saving*  
*N = 80, 3 answers possible*

**Take away**

- Slow steaming is the clear no.1 in savings effect in 2014, followed by hull and propeller cleaning and voyage planning optimization
- Performance monitoring ranked as strongest contributor of the “enablers”
optimization" follows with 28%. At number four with 21% “performance monitoring and reporting” is the highest ranked “enabler”. Looking at the plans for 2015 the ranking of expected contributions does not deviate much. Expectations are highest for speed, voyage and hull related measures.

AIS data provide additional insight on the execution of slow steaming and speed variability. Figure 13 below shows the average speeds of container vessels of 8,000 TEU and more on the Far East – Europe trade on the Indian Ocean. Since the shift of schedules to slow steaming in 2010/11 the westbound head-haul speed is fairly stable around 18.2 knots with some seasonality. January to May averages are 18.3 knots in 2013, 18.4 knots in 2014 and 18.9 knots in 2015. The backhaul speed is stable around 15.4 knots. Although the bunker price drop of nearly 50% in 2014 has not resulted in schedule changes (yet), a slight increase in speed variability due to more frequent use of catch-up speeds and a resulting overall speed increase of 2 to 3% can be observed.

Another interesting insight gained by use of AIS data is related to the measure speed pattern optimization. Due to the steepness of the speed-power curves of vessels, speed variability results in excess consumption compared to constant speed or better constant RPM (revolutions per minute). Figure 14 below displays the speed pattern of several legs of an 8,500 TEU container vessel on the Trans-Pacific trade. Regularly we see the vessel starting at fairly high speeds of 24 to 25 knots on the eastbound head-haul leg followed by a gradual slow down to 17 knots. On the westbound back-haul leg the effect is smaller but still visible. No need to say that the full theoretical savings potential of more than 100,000 USD per leg from sailing a fully constant speed/RPM will not be practically achievable, but even if just 10% of it can be saved by better voyage and speed planning and alignment with the port, the annual savings potential would be about 200,000 USD per vessel. Smart tools based on AIS technology and proper processes within the shipping company and in interaction with ports would allow for harvesting of this potential.

Slow steaming pattern irrespective of fallen fuel prices

Take away
- Despite falling fuel prices the westbound head-haul speed is fairly stable around 18.2 knots with some seasonality, back-haul around 15.4 knots
- Slight increase in speed variability head-haul due to more frequent use of catch-up speeds and a resulting overall speed increase of 0.5 knots
A third aspect in which AIS data reveals interesting speed-related insight refers to the ship-shore interface. If vessels arrive before the intended berths are cleared (not necessarily before estimated time of arrival), they need to wait on anchor in dedicated areas outside the port. In a perfect world each hour spent there could be transposed to slower average sailing speed with corresponding bunker savings. In practice some of this potential can be realized by better communication between, ship, operations department and port in combination with just-in-time procedures. For an exemplary analysis of waiting times of container vessels approaching Singapore see subsequent Figure 15. Our work experience with shipping companies and ports as well as AIS data analytics show that waiting times are a major issue in some ports – bearing significant improvement potential.

Savings potential from reduction of speed variability

**Speed development of an 8,500 TEU container vessel**

- Starting high, slowing down - head-haul legs sometimes start at 25 knots and slow down to 17 knots
- Reduction of speed variability can sometimes save significant money on the long legs
Communication is key to reducing waiting times

Take away
- Average anchoring time of vessels between 7,000 and 17,000 TEU fairly stable when approaching Singapore port
- Anchoring time of smaller vessels more volatile and on average 5 hours vs. 3 hours at larger vessels
4.5 ORGANIZATIONAL ANCHORING

Who is in charge of energy efficiency? Nobody, everybody, every captain? How is the ambition for more energy efficiency anchored in the organization of shipping companies? Is there a winning set-up?

When we enter into new energy management diagnostics with our clients, we see very different approaches of anchoring energy efficiency. The minimum solution is typically to add this responsibility to the bottom of the long list of tasks of the person in charge of quality, safety, security and environment (QHSSE). Management system and SEEMP requirements can be fulfilled this way. But does this help to actually increase efficiency? Hardly. Successful shipping companies have implemented a dedicated energy manager or even energy management team comprising skills such as analytics, judgement and vigour. Beyond them, caring about energy efficiency 100% of their time, every employee on-board as on-shore has a role related to energy management. This starts with the management who needs to set the agenda and underline the importance of energy efficiency in word and action continuously. It spans over fleet manager and superintendents as well as the operations department, who need to follow up on efficiency related KPIs on a regular basis, take decisions (e.g. scheduling, maintenance, technical upgrades) with the impact on consumption in mind and support crews in their operation. Fleet personnel with crewing and training should implement energy efficiency in their processes and standards (e.g. training curriculum). Crew on board, officers as well as ratings, deck staff as well as engine staff, have multiple levers in hand to make a difference towards better energy efficiency day-to-day.

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

![Figure 16 - Responsibility for energy management](N = 80)

<table>
<thead>
<tr>
<th>Role</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Manager</td>
<td>29%</td>
</tr>
<tr>
<td>Every Captain/Chief Engineer</td>
<td>18%</td>
</tr>
<tr>
<td>All Superintendents</td>
<td>18%</td>
</tr>
<tr>
<td>A selected Superintendent</td>
<td>9%</td>
</tr>
<tr>
<td>No dedicated person</td>
<td>9%</td>
</tr>
<tr>
<td>Other</td>
<td>19%</td>
</tr>
</tbody>
</table>

Take away
- Organizational anchoring of energy management seems weak in many shipping companies
- Not even a third of all shipping companies has a dedicated energy manager (or team)
- Most companies have assigned the task to “everybody”, which often actually means “nobody”
Following the survey results (see Figure 16), actual anchoring of energy management seems weak in many shipping companies. Not even a third of all shipping companies has a dedicated energy manager (or team). Most companies have assigned the task to “everybody”, which often actually means “nobody”. Looking at the correlations between chosen organizational anchoring and target achievement this becomes evident: Those who have a dedicated energy manager, are more successful than others. Those who assign the responsibility for energy management to every captain/Chief engineer or all superintendents are clearly less successful in realizing savings.

When asked about the means to ensure that office staff and crew actually implement energy saving measures the respondents name both stick and carrot (see Figure 17). Monitoring of performance and activities and shore based training are the most commonly used ways to ensure implementation of energy saving measures. Balance of support and control is handled differently depending on company culture. Looking at the correlation between means chosen and target achievement, information material and audits seem to be the basics with the highest positive effect overall, whereas performance management especially helps to realize the last percentages towards full target achievement.

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

- Performance monitoring: 78%
- Shore based trainings (senior officers): 56%
- Audits: 36%
- Ship board trainings (junior officers/ratings): 28%
- Info material on board: 28%
- Other: 8%

Figure 17 – Initiatives supporting implementation of measures

N = 80, multiple answers possible

Take away
- Monitoring of activities and shore based training are the most commonly used ways to ensure implementation of energy saving measures
- Balance of support and control handled differently depending on company culture
4.6 PERFORMANCE MANAGEMENT

The chapter on target setting revealed: With 53% “implementing performance management” is the number one qualitative energy efficiency target of shipping companies for 2015. Why this? As it is just an “enabler”, not a saving measure by itself, the high score may surprise.

Asked about implementation of performance management and the reasons behind it (see Figure 18) “monitoring of implementation and impact” of measures has been named by 64% of the companies participating. One third uses performance management for external communication (active 19%, passive 13%). One quarter has not implemented performance management yet. It seems “implementation” is a quite undefined term. Having set up an IT system providing all relevant reports in perfect granularity and frequency does not necessarily mean that performance is actually managed. Living a performance management “culture”, regularly challenging and supporting subordinates to improve efficiency, is as challenging as the implementation of data collection, processing and report generation. From our experience in advisory projects we estimate that just about one third of shipping companies which have implemented the IT backbone also created a performance management culture.

Most shipping companies look at voyage performance (79%), followed by engine & systems (63%) and hull & propeller (55%, see Figure 19). In line with its share of achievable savings “voyage performance” receives the largest amount of attention in performance management. Engine & systems and hull & propeller are also a focal point for more than half of the respondents.

Are you using any means of performance management to achieve your energy management goals?

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, performance management is essential to monitor implementation and impact of measures</td>
<td>64%</td>
</tr>
<tr>
<td>Yes, we use performance management to market our own achievements</td>
<td>19%</td>
</tr>
<tr>
<td>Yes, as many clients are asking us to facilitate numbers and trend analyses</td>
<td>13%</td>
</tr>
<tr>
<td>Yes, but for other reasons than above</td>
<td>3%</td>
</tr>
<tr>
<td>No, but we are planning to install performance management</td>
<td>15%</td>
</tr>
<tr>
<td>No</td>
<td>10%</td>
</tr>
</tbody>
</table>

Figure 18 – Use of performance management and reasons behind it

N = 80, multiple answers possible

**Take away**

- Main goal of performance management seems monitoring of implementation and impact of measures
- 25% of shipping companies have not yet implemented energy performance management at all
In line with the focus areas of performance management listed above the KPI fuel oil consumption (FOC) per day is the most common performance metric (70% of respondents). Still 41% use the FOC in relation to the distance sailed. Engine and system performance is reflected in the specific fuel oil consumptions (SFOC) of main and auxiliary engines (53% and 26% respectively). Just 23% of respondents name other relevant KPIs, e.g. looking to monitor measure implementation.

Gathering and recording of data on board is still largely a manual exercise (see Figure 20). Fully or partially manual data gathering is still prevailing. Just 13% of respondents admit to having a fully automated data collection system based on sensors.

Asked about how data collected for energy performance management is used, superintendents seem to be the primary users (see Figure 21). Fifty-one per cent of companies state that the superintendents said to regularly review energy related data. Others distribute them in the company and/or use them for root-cause analyses. The preference is still to prepare reports manually rather than automatically.

Irrespective of the reportedly high use of energy related data, the observation about the difference between data or report availability and living a performance management culture describes the reality we see in many shipping companies. Still we are faced with shipping companies that transfer noon reports and all related data as plain text in e-mails. Usability on shore side is extremely limited and superintendents follow up rather occasionally than regularly and systematically. Other shipping companies have automated data gathering, processing and report generation to a high degree and made energy performance discussions part of their daily or weekly routines. All possible approaches in between can be found, whereas the development towards a more systematic approach is ongoing.
How is energy management relevant data (e.g. fuel consumption, engine load, auxiliary usage) recorded on board?

<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully manual</td>
<td>46%</td>
</tr>
<tr>
<td>Partially automated, partially manual</td>
<td>40%</td>
</tr>
<tr>
<td>Fully automated via sensors</td>
<td>13%</td>
</tr>
<tr>
<td>No energy data collection</td>
<td>1%</td>
</tr>
</tbody>
</table>

Figure 20 – Data recording on board N = 80

**Take away**
- Recording of energy data on board still largely a manual exercise, partially supported by automated data gathering
- Just 13% of respondents state to have a fully automated data collection system based on sensors

How are you using the data collected for energy management?

<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review by superintendents on a regular basis</td>
<td>51%</td>
</tr>
<tr>
<td>Manually prepared reports distributed to defined part of the company</td>
<td>45%</td>
</tr>
<tr>
<td>Automatically generated reports/dashboards are distributed in the company</td>
<td>31%</td>
</tr>
<tr>
<td>Reactive use in case of deviations to target values, charter contracts etc.</td>
<td>29%</td>
</tr>
<tr>
<td>Other</td>
<td>8%</td>
</tr>
</tbody>
</table>

Figure 21 – Processing and users of energy management data N = 80, multiple answers possible

**Take away**
- Superintendents seem primary users of energy related data
- Others distribute energy related data in the company and/or use them for root-cause analyses
- Reports still preferred to be prepared manually than automatically
4.7 TARGET ACHIEVEMENT

The chapter on target setting revealed: Ambitions with respect to energy management are mixed between participants. Approximately one third of respondents set themselves no quantitative energy saving target, a target between 0 and 5% and a target of 5% and more. How does the actual target achievement look?

The picture differs between 2013 and 2014 (see Figure 22). In 2013 nearly 40% of shipping companies hardly or largely achieved energy related targets while just about 20% were in the middle. This “all or nothing” target achievement in 2013 appears to be driven by different approaches towards energy management (compliance or result-oriented).

Looking at 2014 the respondents draw a more mixed picture. Nearly one third of respondents fully or at least largely achieved targets made for 2014. Some even realized above 10% savings. One fourth did not achieve energy related targets at all or just to a small degree. Little less than half of respondents achieved targets of 25 to 75%, with many of them realizing 3 to 4% fuel savings.

Overall an alarming picture: Low ambitions, not even met. Knowing about actual cost savings achieved with an effective energy management approach, the assessment seems justified that most shipping companies still leave major potential untapped.

To what degree did you reach your targets in 2013/2014 (from 0% - 100%)?

<table>
<thead>
<tr>
<th>2013</th>
<th>0% - 25%</th>
<th>26% - 50%</th>
<th>51% - 75%</th>
<th>76% - 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>38%</td>
<td>10%</td>
<td>16%</td>
<td>36%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2014</th>
<th>0% - 25%</th>
<th>26% - 50%</th>
<th>51% - 75%</th>
<th>76% - 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>21%</td>
<td>24%</td>
<td>30%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 22 - Target achievement 2013 and 2014

Take away
- “All or nothing” target achievement in 2013 appears to be driven by different approaches towards energy management (compliance or result-oriented)
- More differentiated responses for 2014 based on 2013 experience?
- Still one quarter of companies not achieving energy saving targets at all or to small degree only
4.8 CHALLENGES AND SUCCESS FACTORS FOR IMPLEMENTATION

What are the challenges? Where and why do shipping companies struggle? What are the success factors that can be learned from the most successful players?

When asked about the challenges encountered, the respondents name scarce resources and people topics (see Figure 23). “Lack of financial resources”, “Lack of time for implementation” and “Topics with higher priority” are listed among the top five challenges (46%, 39% and 35% of companies respectively). While the first presumably refers to technical/retrofit measures, the latter apply to all types of measures. Similarly high scored as scarce resources are skill and will of staff with “Education of staff/lack of experience” (40%) and “Resistance to change by crew/office staff” (40%). They are the key challenges for most operational and managerial measures.

Activation of awareness, capabilities and behaviour is clearly marked as a key lever in realizing significant fuel savings (see “word cloud” display of free text answers in Figure 24). Forty per cent of all free text replies to the question on key success factors for fuel savings address “awareness, capabilities and behaviour”. With 29% of respondents “tracking savings through performance management systems” is viewed as a key enabler, too. “Voyage planning/execution” and “vessel performance optimization” are on the ranks with 22% and 18% respectively.

What challenges have you encountered when implementing energy saving measures?

![Figure 23 - Challenges for implementation](image)

Take away
- Lacking financial resources are the key challenge for technical/retrofitting measures
- Lacking capabilities and buy-in of crew and office staff are the key challenges for most operational and managerial measures
The hint on the importance of enablers “awareness/training/motivation” and “performance monitoring”, i.e. the call for a combination of carrot and stick, shone through the entire set of survey results. The question on qualitative targets, the question on key measures for 2015, the question on obstacles for implementation and the question on key success factors – everywhere there are indications to address these topics more than before.

This is in line with observations made during energy diagnostic projects. Formally many relevant aspects (especially measures) are addressed, boxes are check-marked. But still shipping companies struggle with implementation due to resistance to change among ship and shore staff, partially lacking skills and absence of a performance management culture. Addressing these challenges is effort best spent.

To your best knowledge what is key to realizing significant fuel savings?

**Take away**
- It’s all about people!
- Awareness, capabilities and behaviour are recognized as the key levers to realize significant fuel savings
- Tracking savings through performance management systems is viewed as key enabler, too
4.9 EXCURSE: FUEL PRICE DEVELOPMENT

Bunker is the largest cost position in shipping. Fuel makes up for 25 to 50% of total costs, depending on segment and perspective, as well as on the bunker price of course.

From 2000 to 2008 the price of heavy fuel oil (HFO) continued to rise. The 200 days moving average quadrupled from about 150 USD/t to about 600 USD/t in summer 2008 with a peak of more than 700 USD/t. A few months later it dropped to just above 150 USD/t as a result of the world financial crisis, until spring 2014 when we saw a sharp rise again to about 650 USD/t, followed by a drop to about 350 USD/t in spring and summer 2015.

We asked participants what bunker price development they expect towards the end of 2015. Estimates on the HFO price range from 250 – 700 USD/t. The average HFO price estimate is 425 USD/t, about 25% higher than today (see Figure 25). This assumption is not backed by the crude oil market, though. Both current crude prices, as well as futures for year end 2015, range at about 60 USD/barrel. With a value just below 400 USD/t the median of the responses is closer to the crude oil markets futures.

While we asked about the expectation for HFO, the actual average fuel price for shipping companies is higher due to the consumption of marine gas oil (MGO) and marine diesel oil (MDO), as well as low sulphur (LS) HFO in ECAs. Traditionally we see a mark-up of about 300 USD/t for these more environmentally friendly fuels. With more ECAs being established and requirements being tightened, this automatically means increasing average bunker prices irrespective of crude and heavy fuel oil price development. Naturally short sea shipping with high time shares in ECAs is affected more severely than globally operating vessels.

Please quote an expected fuel price at the end of 2015 [USD/t HFO]?

![Figure 25 - HFO price expectations](image)

Take away
- Estimates on HFO price range from 250 – 700 USD/t
- Average HFO price estimation for end of 2015 is 425 USD/t (about 25% higher than today’s price)
- Median is just below 400 USD/t
4.10 EXCURSE: ECA STRATEGIES

AIS analytics show that in 2014 nearly 5,000 bulk carrier, 2,000 container vessels and about 1,600 tankers were trading (to some degree) in the ECA and SECA zones of the North and Baltic Sea and North American waters. They have been affected by the tightening of the sulphur cap from 1.0% to 0.1% since January 1st 2015. Many of these vessels have been calling ECAs/SECAs only to a small share of their annual operating hours. Others have been trading in these areas nearly all of their time. Figure 26, container vessels used as example, displays clearly that among the small sub-segments many vessels have high time shares in ECAs/SECAs, while large vessels operate outside these areas most of their time. The pictures look similar for the bulker and the tanker segment. One would expect the shipping companies’ strategies towards ECAs/SECAs to strongly depend on the time share.

Owners of feeders and handysize vessels, which trade more than 50% or even 75% of the year in ECAs/SECAs, should have a higher openness for technical solutions such as scrubbers and alternative fuels compared to owners whose vessels trade in ECAs/SECAs only limited time.

To explore the ECA strategies in more detail, we fed a few questions on this topic into the survey.

Number of container vessels which operate a certain percentage of time in ECAs/SECAs in 2014

<table>
<thead>
<tr>
<th>Share of annual hours in ECA</th>
<th>Feeder</th>
<th>Handy</th>
<th>Sub Panamax</th>
<th>Panamax</th>
<th>Post Panamax</th>
<th>New Panamax</th>
<th>ULCV</th>
</tr>
</thead>
<tbody>
<tr>
<td>75%-100%</td>
<td>226</td>
<td>255</td>
<td>194</td>
<td>492</td>
<td>365</td>
<td>421</td>
<td>25</td>
</tr>
<tr>
<td>50%-75%</td>
<td>85</td>
<td>76</td>
<td>4</td>
<td>23</td>
<td>29</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>25%-50%</td>
<td>36</td>
<td>24</td>
<td>137</td>
<td>377</td>
<td>332</td>
<td>400</td>
<td>24</td>
</tr>
<tr>
<td>&gt; 0-25%</td>
<td>60</td>
<td>135</td>
<td>12</td>
<td>41</td>
<td>90</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Figure 26: Time shares in ECAs/SECAs of vessels from various container sub-segments

**Take away**
- Among the smaller vessels about half of those, who have called an ECA/SECA in 2014, spends more than 50% of the year in ECAs/SECAs
- Large vessels do not spend a significant share of the year in ECAs/SECAs
Short term reactions to increasing ECA requirements are hesitant. Nearly all shipping companies, irrespective if operating limited or high shares in ECAs, switched to low sulphur fuels oil. Ninety-one per cent of shipping companies bought time for investment decisions on scrubbers and/or alternative fuels like LNG. Just 6% have installed a scrubber yet (see Figure 27).

Looking ahead the picture changes. In expectance of increasing bunker prices - today the prices of low sulphur fuel oils are about as high as the price of HFO a year ago - shipping companies look at alternative solutions. Roughly one quarter of shipping companies considers installing scrubbers and switching to alternative fuels as LNG.

Asked about the relation between implementation of ECAs and energy management initiatives two thirds of respondents decline any effect. Just one third states that the implementation of European SECA zones in North and Baltic sea influenced their energy efficiency initiatives. Some stress the effect of higher costs of low sulphur fuels which result in more pressure to increase efficiency. Others have adjusted ship operation and management with differentiated speeds and changed routing.

Overall the increasing pressure from ECA requirements just seems to be an additional argument for more energy efficient operation, but not a game changer for energy management.

Figure 27 - Strategies towards ECAs

What is your strategy for the Emission Control Areas zones and are there additional ones you are planning to apply in the future?

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Current</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch to low sulphur fuel oils (e.g. MGO, MDO, LSHFO)</td>
<td>39%</td>
<td>91%</td>
</tr>
<tr>
<td>Installation of scrubber</td>
<td>6%</td>
<td>25%</td>
</tr>
<tr>
<td>Switch to alternative fuels (e.g. LNG)</td>
<td>0%</td>
<td>24%</td>
</tr>
<tr>
<td>Other</td>
<td>8%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Take away
- Just 6% have installed a scrubber yet
- Going forward approximately one quarter considers scrubbers respectively LNG
- With 91% of respondents using low sulphur fuel oil in ECAs, shipping companies bought time for investment decisions on scrubbers and/or alternative fuels like LNG
5
IMPLICATIONS AND OUTLOOK

Let us start the outlook with a look back to last year’s energy management study and the outlook given back then. Advanced measures, change and performance management were the key topics. Has the industry achieved a lot in these dimensions since then? How much further are we today?

No real leap ahead, but at least the awareness for the problems has increased in the industry. The respondents have understood that they struggle and why they struggle. Some have started effective actions; others still need to take that step.

Still a long way to go
Two and a half years after the SEEMP became mandatory for all vessels and seven years after the HFO price first exceeded 600 USD/t there is still a long way to go. Only a minority of shipping companies have set themselves ambitious targets for energy efficient operation. Only a minority of shipping companies have achieved their targets entirely or at least largely. Many others have chosen the compliance driven approach and realized hardly any savings. This is a call for action to take the single biggest cost position in shipping and its effect on each shipping company’s bottom line more serious. For an operator 5% savings in a 40% cost position equal to two percentage points EBITA. For an owner or a manager there are hardly any better ways to differentiate than by superior energy efficiency – of the vessels and of their operations. Even if the effects are bigger in times of higher bunker prices, the topic should be tackled as soon as possible. The next rise in bunker prices may come quicker than implementation of effective energy management progresses.

It’s all about people
“People make the difference” is the golden thread through this year’s study. Nine common measures have been addressed in more than half of all shipping companies. Still many of them do not realize the expected savings. They struggle with implementation, which is a human factor. The combination of carrot and stick – awareness, capabilities and motivation on the one hand and performance management on the other – is the key success factor. And again commitment is required. A fleet circular may support awareness, but it rarely creates buy-in. The IT-side of a performance management system alone is less than half the way towards effective performance management. Topics can get burned in the organization, if not planned and executed well. Most shipping companies deal fairly well with technical challenges but struggle on the people side. This is a severe challenge, as about half of the achievable energy savings are related to ship and shore staff’s behaviour.

Some tools to support
Even if people make the difference, some tools are helpful to support decisions. Data gathering, processing and report generation in course of a comprehensive performance management approach are obvious examples. In combination with AIS data a wide field of practical applications for advanced vessel and voyage management opens up. Central 24/7-fleet support rooms controlling, coordinating and supporting all vessels of a fleet are being implemented in leading shipping companies. But also implementation of operational and managerial energy saving measures requires tools, e.g. for optimized voyage planning, advanced weather routing and trim optimization in combination with load planning. These decisions support the need for tools more and more, either hosted by the shipping companies directly or as a service from external providers.

A year ahead
As the 2015 DNV GL energy management study has reported on an increased awareness for challenges and key success factors for energy efficient operation, may the next study report on ambitious targets and successful implementation in more than one third of the shipping companies.
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