MARITIME

Efficiency matters!

Tanker Operator Conference

Dr. Jan-Henrik Hübner

Hamburg – October 8th, 2014

Four good reasons to strive for energy efficiency…

Compliance

- Ensuring compliance with **existing regulations**
- Ensuring compliance with **upcoming regulations**

Costs

- Reduced **bunker costs**
- Reduced **OPEX**

Transparency

- Effective **performance management**
- Effective **reporting**

Competitiveness

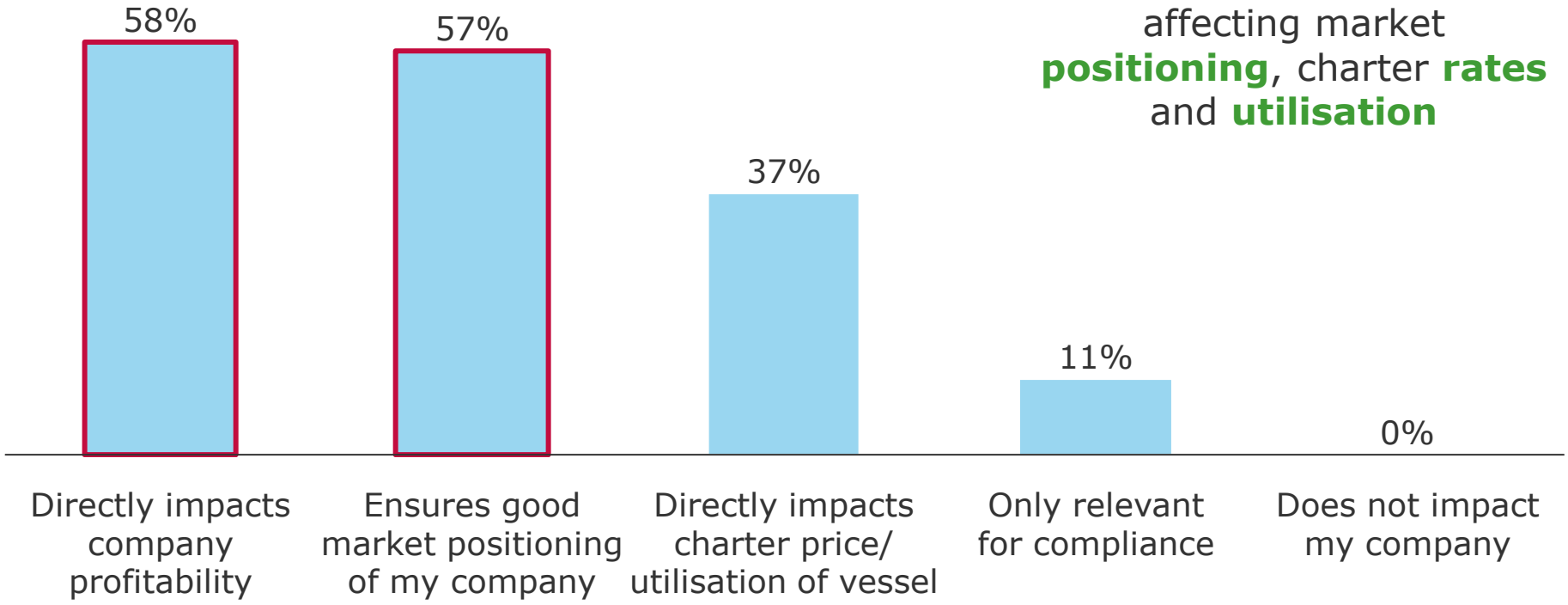
- Attractiveness for the **charter market**
- Competence and **reputation** in energy and cost mgmt.

…are widely acknowledged by the shipping industry, …

Total 85 participants

How does energy efficiency impact your company?

Multiple answers possible



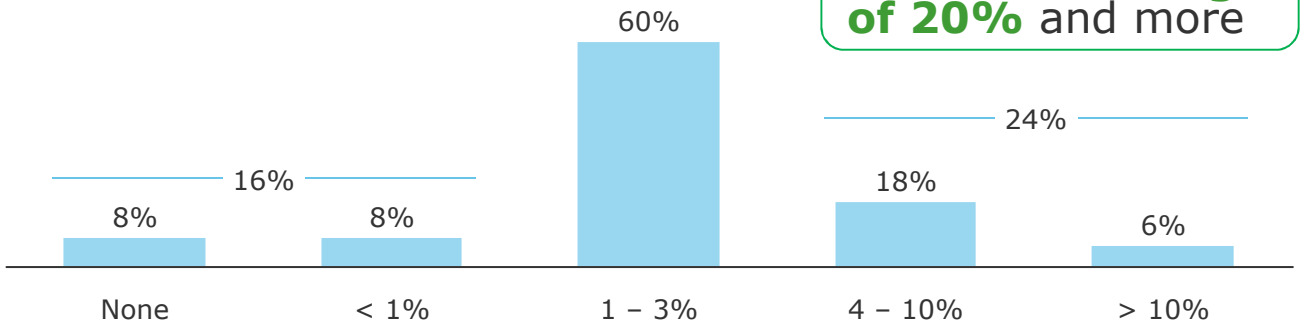
Energy efficiency has gained **importance** in the **(charter) market,** affecting market **positioning**, charter **rates** and **utilisation**

…but actual ambitions were low and implementation struggles

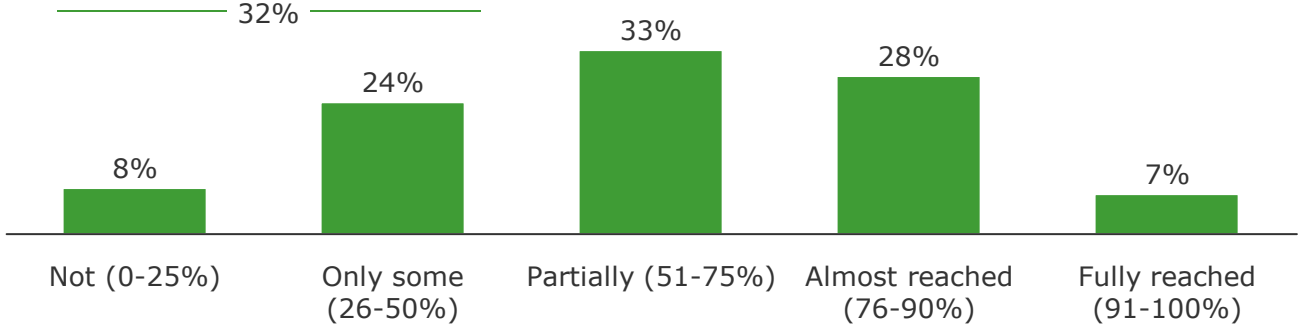
Total 85 participants

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

Market leaders claim **fuel savings of 20%** and more



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



- Many shipping companies had **low ambitions** with respect to energy management
- Many shipping companies **struggle** with **imple-mentation**

Follow the market leaders: key success factors for effective energy management

1. **Acknowledge the effort of implementation,** if you really want to improve your company's energy performance
2. **Stretch for far-reaching measures** beyond weather routing and engine settings, collaborate along the value chain
3. **Anchor energy management in the organization** by assigning clear responsibilities
4. **Support crews and shore staff to adapt** to the new world, behavioural change is key
5. **Introduce smart dashboards** for daily performance management of energy consumption, only what get's measured get's done

5 Deep dive: performance management

Performance Management is a proven instrument to significantly improve the way vessels are operated

You **want to change** the way your vessels are run?	Monitor it!
You have **no time and budgets** for another big implementation project?	Use the processes and data that are already collected!
You do not know **what to do with** the tons of **data** you collect every day?	Take pre-defined performance dashboard!
You do not know w**hether you are "good"** compared to others?	Benchmark yourself!

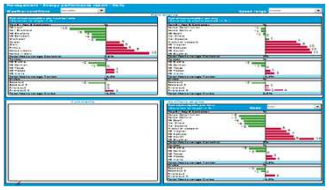
Efficiency matters!

The ideal reporting system has only one data entry interface that provides all required reports

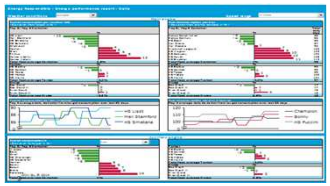
One input mask on board, where applicable fully automated

- Capturing all data required for on board monitoring and onshore reporting
- User friendly interface
- Automatic reading of sensors

Top management



Energy responsible



Superintendent

...

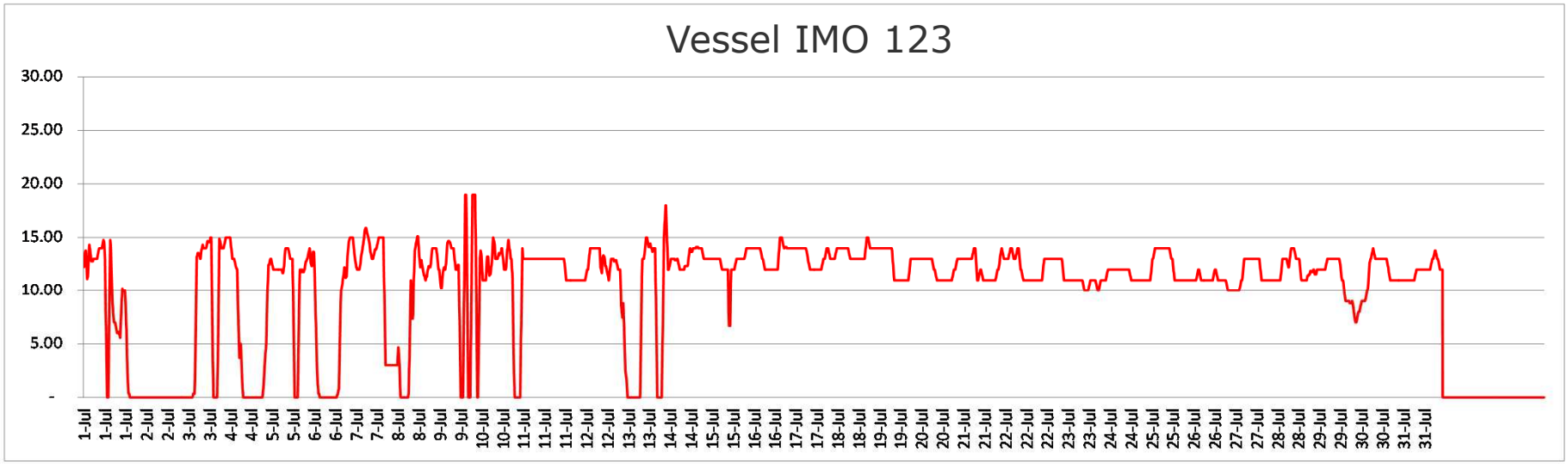
Data collection	Data transfer & processing to database	User customized dashboards with key KPIs

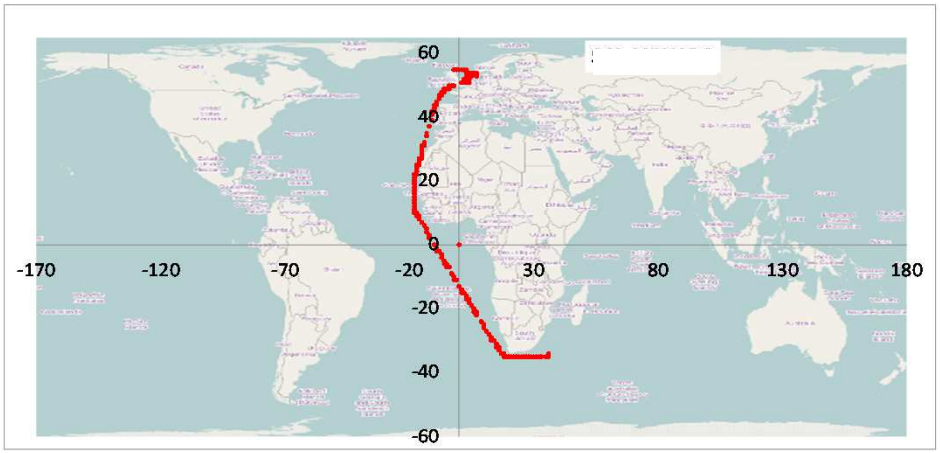
DNV GL's ECO Insight: Better ship performance management based on transparency and expert advice

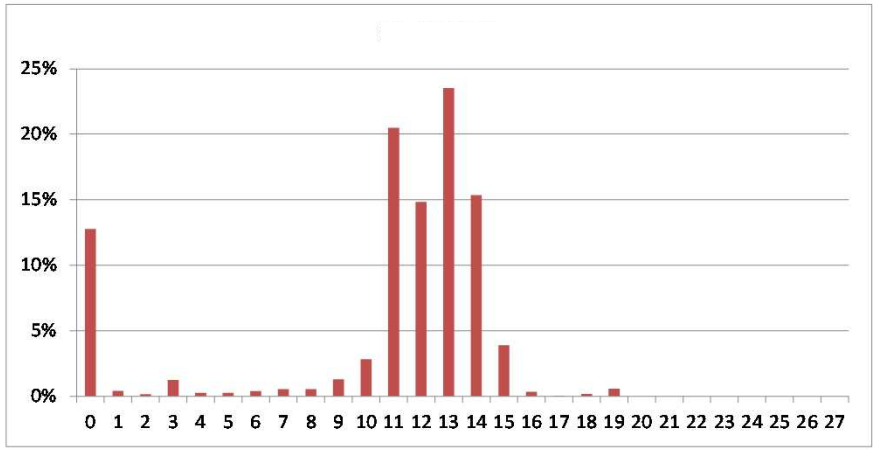
ECO Insight

- **Dashboards** to shorebased staff on voyage-, hull & propeller- and engine & systems performance
- **Transparency** on vessels performance, **benchmarks** within own fleet and (via AIS data) vs. market
- Based on **vessels' reported data** (automatic, noon- and event-reports,…), combined with **external data** and **DNVGL engineering analyses**

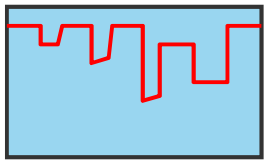
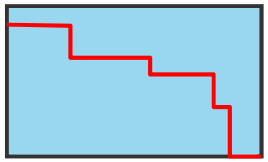
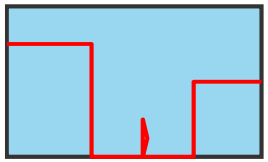
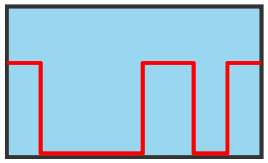
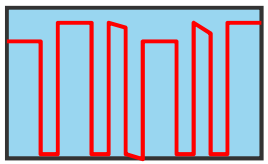
Using AIS as supporting tool for performance management: speed pattern of a chemical tanker







Using AIS as supporting tool for performance management: other noticeable speed patterns

Speed profile archetypes		What is it
High speed variability		Speed up/down during sea passage for weather or other unclear reasons
Decreasing speed profile		Too high starting speed, slowing down later on to match arrival time in port
Early arrivals (anchorage)		Poor voyage planning results in unnecessary early arrival at next port
Long port stay time		Overstay in port due to poor productivity/ coordination with terminal operator
Too high pro-forma speed		Poor pro-forma scheduling, resulting in higher than necessary speed

Making use of AIS technology: 5 key areas where tanker operators can benefit

Fleet

- How do partners & competitors run their vessels – which vessels used, which ports/terminals called with which timing?
- How many off-hire & lay up days do others have?

Port operations

- Which ports/terminals have short turnaround times?
- Which have free capacity?
- Will the targeted berth be available on time?

Voyage operations

- How do partners & competitors perform in terms of voyage performance – how does that affect their fuel bill?

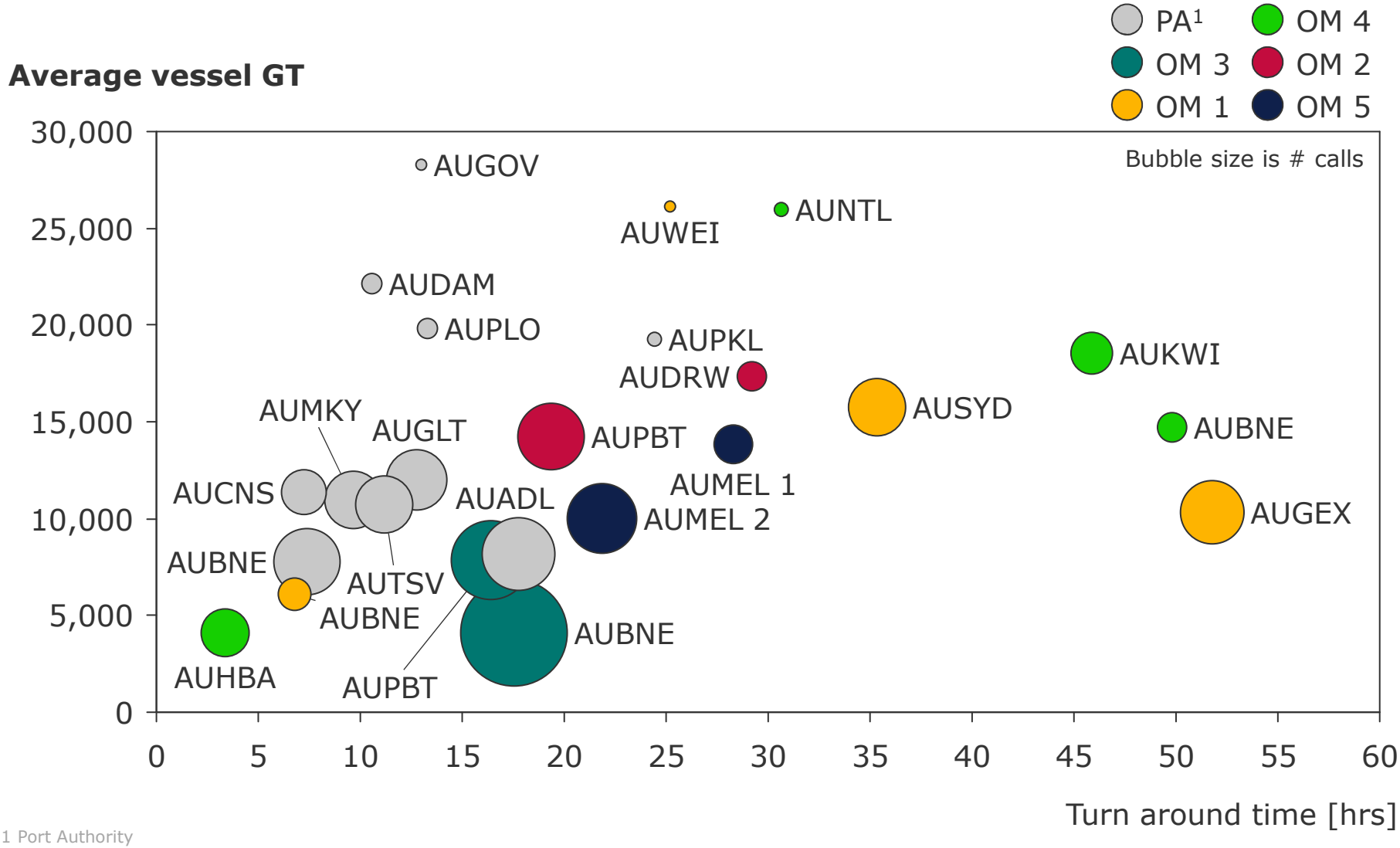
Overall operations

- What is the operational cost breakdown of other players?
- How much time do others spend in port and in waiting position compared to us?

Bunker operations

- Which bunkering footprint do partners & competitors have?
- How efficient do others bunker?

Making use of AIS technology:
PT turnaround times of Australian liquid bulk terminals in 2013



1 Port Authority

Energy efficiency in ship design - how to measure if vessels are really ahead of competition?

EEDI – Energy Efficiency Design index

Comparing vessels under INDIVIDUAL DESIGN conditions

- \+ Adopted by IMO, defined calculation for most segments
- \+ Known and accepted in the industry
- \- Punishment of fast vessels operated at slow speed

CPTCM – Bunker costs per 1000 cargo miles

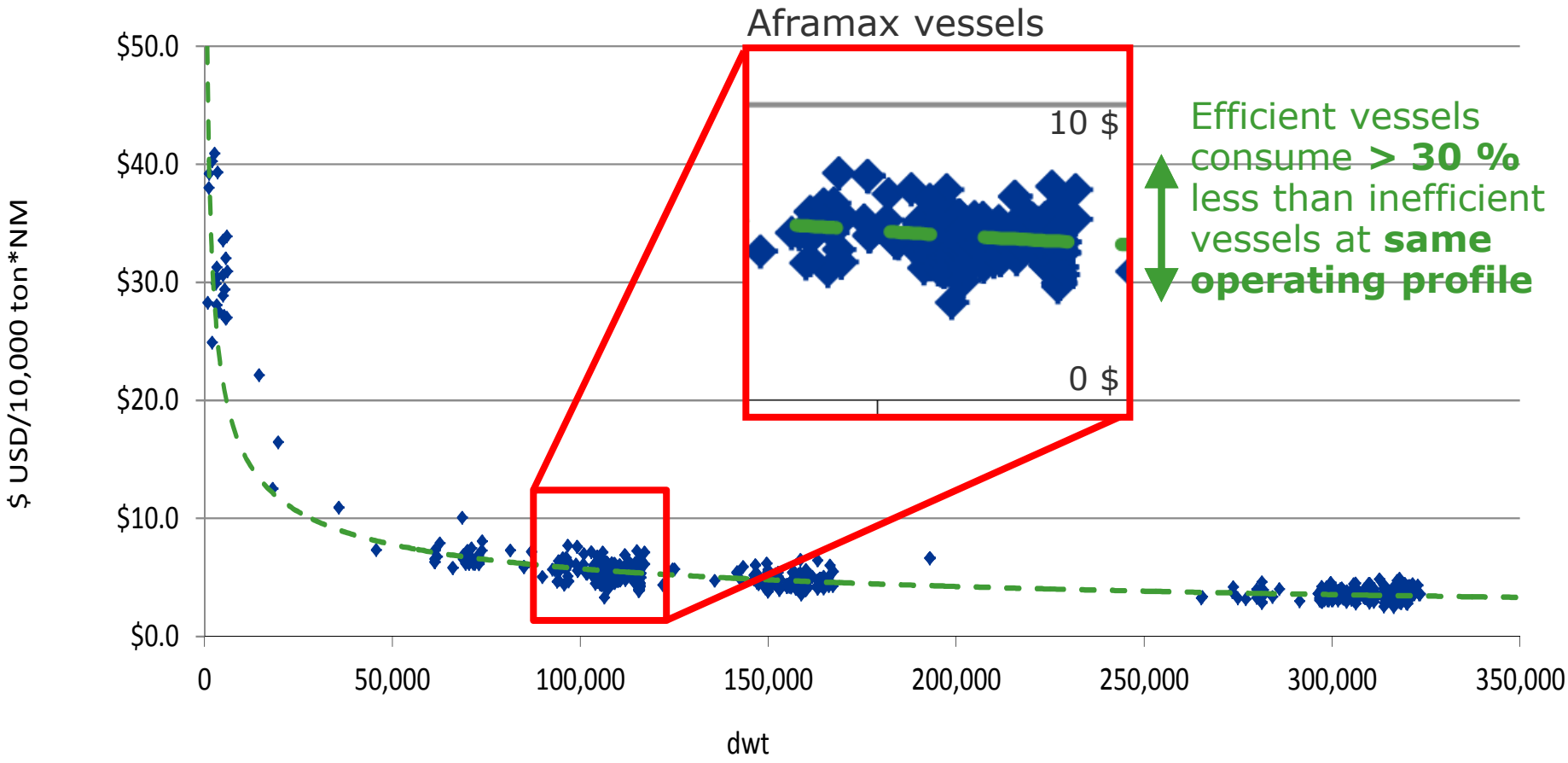
Comparing vessels under COMMON OPERATING conditions

- \+ Near to actual consumption under today's slow steaming profiles
- \+ Fair comparison from operator/ charterer perspective
- \- Missing of formal and common rules for calculation

Bunker cost per 10,000 cargo miles reveal that actual efficiency differences between vessels are significant

Bunker costs in USD/dwt/10,000 NM[1]

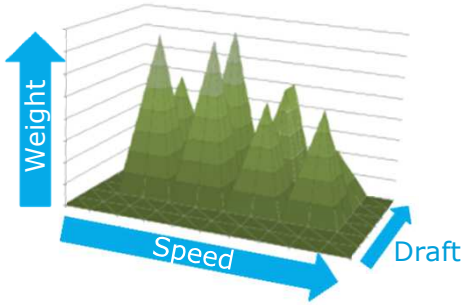
WORLD CRUDE OIL TANKER FLEET

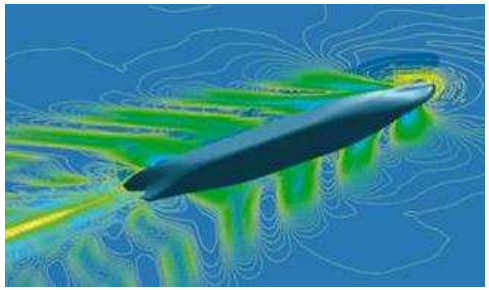


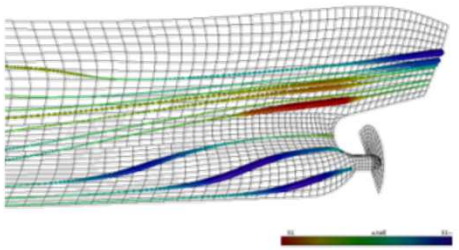
1. Modelled by DNV GL based on data from IHS Fairplay

Parametric hull optimization reaching maximum fuel efficiency and lowest fuel consumption

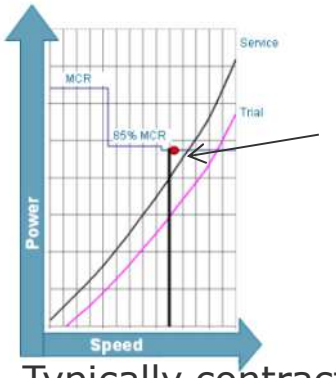
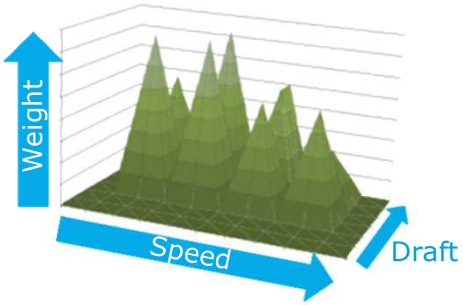
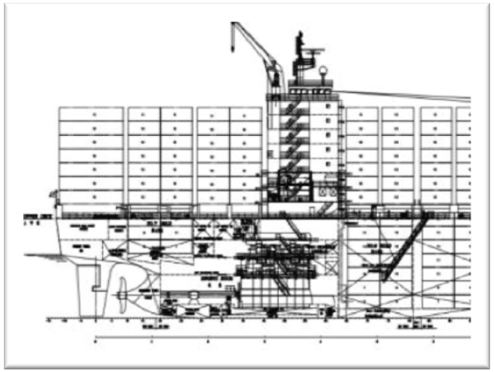
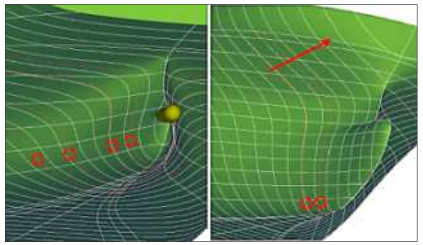
1. **Operational profile & constraints**
2. **Global hull optimization**
3. **Propulsion optimization**







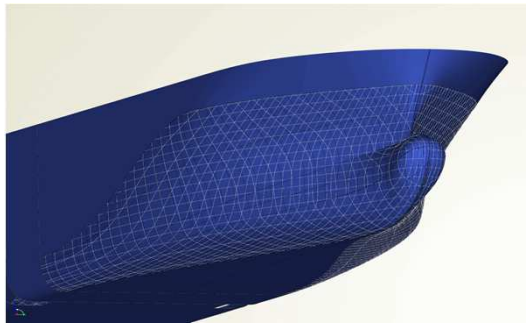
1 Operational profile and freedom for modification lay base for efficiency gains

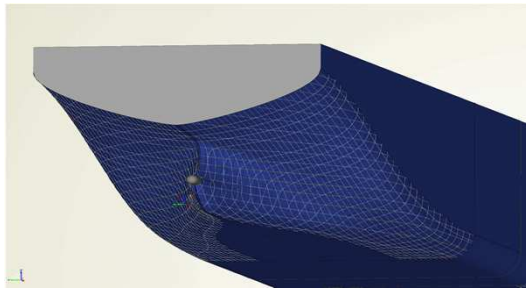
Typical starting point	Task	Results
Profile		
 Design point satis-faction Typically contracted performance	**Derive operational profile**, e.g. from concept ▪ **Speed-draft combinations** that dominate operation ▪ **Time share** for each combination	 Realistic operational profile
Constraints		
 Concept design	**Identify degrees of freedom** for line modification ▪ **Displacement** target ▪ **Stability** requirement ▪ **Propeller** diameter ▪ **Vibration** avoidance ▪ **Concept** driven hard points, such as engine foundation, rudder arrangement	 Agreed geometry limitations = *Hard points*

2 Goal-oriented, systematic modification of the hull creates the most attractive line design

Parametric modelling

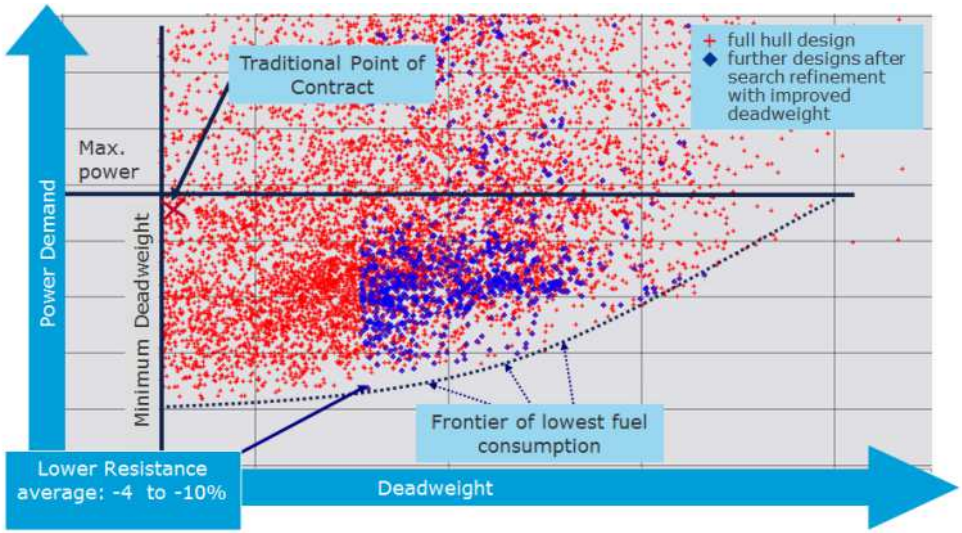
- **Automatic variation of geometry** with **full constraint satisfaction** (displacement, stability, propeller…) enables formal optimization





Systematic (formal) optimization

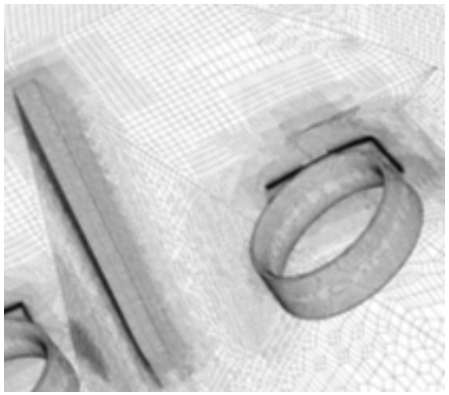
- Generation of **100 to 1000 initial designs**
- Creation and testing of **>20,000 design variants for the operational profile**

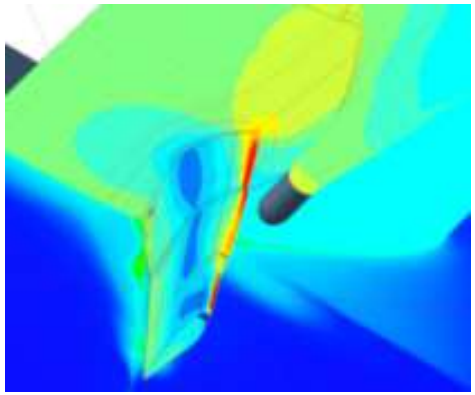


- **Expert selection** among the designs **along the "frontier of lowest fuel consumption"**

1: Algorithmic parameter choice as well as expert refinement

3 Elevating propulsion efficiency by wake field optimization yields peak performance





Grid refinement

- **High resolution grid definition** at aft body **for** the **selected** globally optimized **design**

RANSE CFD optimization

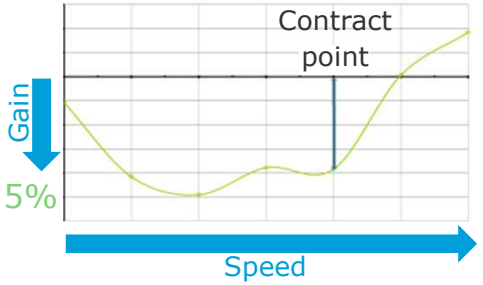
- Systematic parametric **aft body modification based on RANSE CFD**
- Optimization of **wake field for optimum propulsion** making way for the most efficient propeller design

Result

- **Lowest possible fuel consumption** reached through
  - **best hull**
  - **optimum wake field**

  tailored to the **relevant operational profile**

Improvement over the entire profile

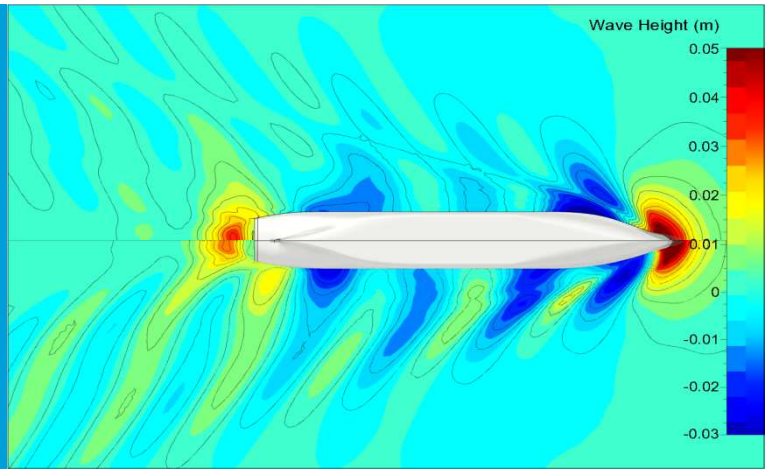


Client case study: 12,000 m³ LEG tanker

SITUATION AND CRITICAL ISSUE

Hull optimisation for an LEG carrier

Owner ordered 12,000 m³ LEG carrier at Chinese yard. Building contract obliges yard to run state-of-the-art parametric hull optimisation for the specific operating profile



DNV GL SOLUTION

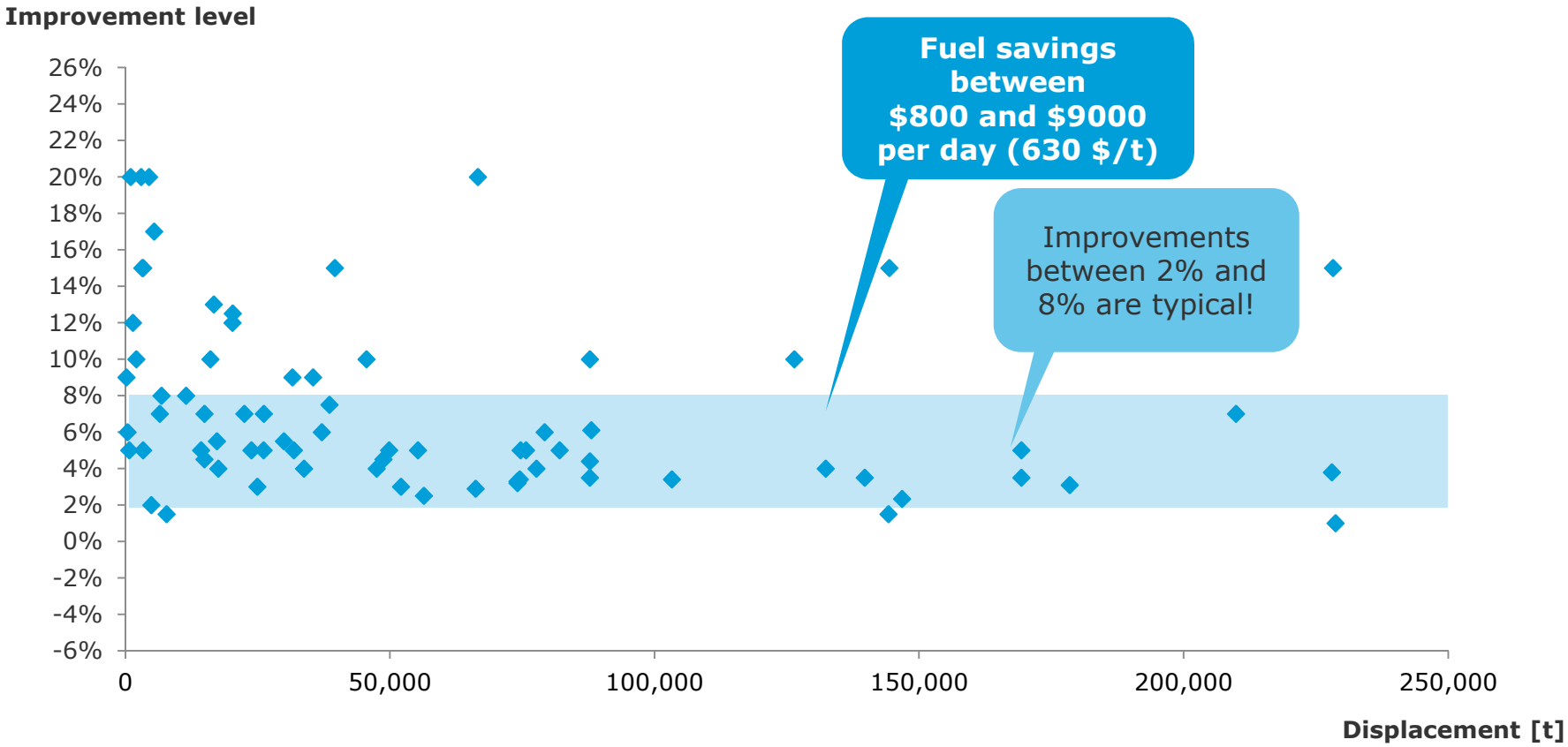
- Joint definition of **operating profile** and design constraints with owner and yard
- **Parametric computational fluid dynamic** (CFD) **design optimization** with ~ 18.000 designs based on the yard's baseline design
  - Global optimisation of the hull
  - Viscous optimisation of the aft body
  - Assessment of the optimal propeller diameter

VALUE DELIVERED

- **10% improvement in hull resistance** compared to yard baseline
  - > 10% in scantling condition
  - > 10in design condition
  - 3% in ballast condition
- **2-3% improvement** from larger **propeller** diameter as transom edge could be raised

Parametric line optimization results in tangible fuel savings of typically 2 to 8%

Recent Project Results



Summary

- **Energy efficiency becomes a real differentiator –** cost saving and increase in competitiveness are the main drivers
- **Significant potential is still untapped in operations –** initial ambitions were typically low and consequently resulted in even lower realization
- **Five key success factors for effective implementation –** market leaders have demonstrated how to get 20% savings
- **Performance management –** only what gets measured gets done, plain text in e-mails is the past
- **New opportunities from AIS technology –** there is more to learn than just the own speed patterns
- **30%+ difference in fuel efficiency –** make sure your vessels are on the high side
- **Design optimization –** no newbuild without parametric CFD optimization of the hull lines

Efficiency matters!

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