MARITIME

DNV GL’s ECO Solutions

Boosted fuel efficiency during design and operation

Petter Andersen

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Today

A Introduction

B Optimized ship design

C Fuel efficient operation
Performance Management: A lot to be gained

Fuel oil consumption/Nm during sea passage

- Industry leaders claim to have achieved 25% performance improvements post slow steaming
- Performance variances between vessels and fleets underscore the improvement potential
- Energy management teams are being established by operators and managers
- Performance management systems are being set-up

Source: DNV GL AIS Benchmarking workbench, world fleet averages full year 2013
Optimized ship design
- New design
- Retrofit of bulbous bow, bow thruster openings
Operational speed often deviates from design speed

% hours in each speed segment

Design speed, 22 knots
Hull lines optimization for new designs - reaching maximum fuel efficiency and lowest fuel consumption

- **ECO Lines provides the optimum hull form** in accordance to the concept’s demands and shipping’s target profile

- Uniquely DNV GL systematically loops through **>20,000 hull design variations** to identify the best possible hull **for the intended operation profile**

- **ECO Lines optimized ships**
  - **frequently** reach between **0.2 and 1 million USD annual fuel savings**
  - are on the **cutting edge** of today’s **technology**
Benefit Case – ECO Lines: Cruise Liner

SITUATION AND CRITICAL ISSUE

Hull line optimisation for new cruise liner design

For a new cruise liner the shipyard tried to push the current state-of-the-art further in order to make its offer to shipowners even more attractive.

DNV GL was contracted to optimize the design for the given operational conditions.

DNV GL SOLUTION

- DNV GL’s ECO Lines service was applied
- This includes parametric modeling of the ship hull shape and subsequent hydrodynamic analysis of more than 15,000 variants
- A substantial set of boundary conditions to conform with the design constraints made this project exceptionally complex

VALUE DELIVERED

- While maintaining the already outstanding performance of the hull at the design condition, a substantial improvement of almost 5% could be identified for the slower operating modes by taking advantage of a radical different bulb shape
- With the new design fuel expenses are lowered by more than 225,000 USD annually

For more information please contact: eco.maritime@dnvgl.com
CASE: Bow and aft thruster tunnels optimisation on a fast ferry

- Optimisation of bow and aft thruster tunnels is carried out on a fast ferry (design speed: 26 kn, Lbp: 211.3 m)
- The ship has 2 bow thrusters with grids, and 2 aft thrusters
- The hull is reproduced as is in CFD and the total resistance is assessed
- The contribution of each tunnel and grids to the resistance is also assessed
CASE: Bow and aft thruster tunnels optimisation on a fast ferry

Condition:
- Speed: 26 kn
- Draft: 6.5 m
- FOC: 32,500 tons (MGO)
  Based on AIS data 2014 & 2015

Benefit estimation after optimization:
- 900 tons annual fuel saving (2.8% savings)
- Cut the annual fuel bill by 540,000 USD
- Payback time: < 2 months

Potential savings per year: USD 540,000
Fuel efficient operation
- Trim optimization
- Performance management
What is the optimum trim?
MARITIME

ECO ASSISTANT 4.0

An ECO Solution for improved energy efficiency
Benefit case - Trim optimization - Roro

Evaluation of operational profile:
- Speed: design: 24 kn; operation: 16-17 kn
- Trim today: more or less even keel
- Sailing days: 350
- FOC/day: 40-50 tons
- FOC/year: 15 750 tons

Benefit estimation with trim:
- 160 t annual fuel saving (moderate assumption of 1% saving)*
- Cut the annual fuel bill by **96,000 USD**

*) Experienced saving potential for roro 2-4%
MGO: 600 USD/t
The “measuring effect” - CASE

Courtesy of Bastø Fosen
**On Board** – Reporting

- Simple for crew
- Manual and/or automatic data input
- Quality check of data input
- Voyage based workflow
- Easy to use and implement

**On shore** – Fleet performance dashboard

- Identify good/bad performing vessels
- Understand reasons
- Benchmark own vessels/against industry average
- Follow up KPI’s
- Emission reporting and documentation

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**DNV GL Fleet performance management**

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ECO Insight – fleet performance at a glance

- Detailed analysis and timelines for every vessel
- Comparisons within fleet
- Up to date market benchmarks
- Advanced analytics
- Customizable “My Dashboard” for entire teams and individual users
- Web access: anywhere, anytime
Fuel consumption

- Jan-March 2014
- Filtered for sailing condition
- Vessel 1 has a 20% higher FOC / nm than Vessel 2 (sister vessel)
- Vessel 1 has a 40% higher FOC / nm than world fleet (similar size, type)

- WHY?
Comparing sister vessels - FOC

**Energy consumption at speed - Vessel 1**

- Inconsistent data
- Expected curve

**Energy consumption at speed - Vessel 2**

- Consistent results
Hull degradation

Ranking of vessels

<table>
<thead>
<tr>
<th>Hull and propeller performance - Insail</th>
<th>Hull and propeller performance - Insail</th>
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<tr>
<td>0%</td>
<td>20%</td>
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- Insail
- Insight

Vessels measured power corrected by wind, sea state, swell and viscous effects

Power Rating (in %)

Vessel required power at relevant operating conditions acc. to vessel CFD model

Normalization to the same speed, draft, trim
Trim optimization

- Data from 2014
- Filtered for sailing condition
- Average trim difference - actual vs recommended: 1.15m
- Translation into savings potential: ~ 0.5 t/day
- Average 200 sailing days (55%) in 2014

- 100 t surplus FOC per vessel in 2014
A key to boosted fuel efficiency during design and operation

- Ensure the ship **design** is **fit for purpose**
- **Cost-benefit** evaluation of relevant vessel **retrofit** alternatives
- **Trim optimization** can be an effective means of improving fuel performance
- Ensure good **data quality** of all reported and measured vessel **performance data**
  - Simple access to fleet overview for **KPI monitoring** and follow up
  - Motivating **people** to change behavior is key to achieving a **more efficient** ship operation
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petter.andersen@dnvgl.com
+ 47 91 89 55 31

www.dnvgl.com

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