Knowing Engine Performance

Beat Güttinger, Head of Tekomar

Greener Shipping Summit 2018, Athens
Performance optimisations on Ships

Engine optimisation options

**Retrofit Modifications**
- Design changes of hull
- Modification of propeller
- Re-tuning of main engine

**Dynamic Propulsion / Routing Optimisation**
- Slow steaming
- Weather routing
- Dynamic trim optimization
- Berth availability

**Operational Propulsion Efficiency**
- Hull cleaning
- Propeller polishing
- Main engine adjustments and maintenance

**Ancillary System Efficiency**
- Auxiliary engine adjustments and maintenance
- Auxiliary consumer optimisation
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Engine re-tuning

- Standard MCR Tuning
- Part load opt. engine control parameter
- Turbocharger cut off
- 10% de-rated
- Exhaust bypass / variable turbine

Δ SFOC [g/kWh]

Power [% of MCR]
- Injection timing, injection equipment → low firing pressure
- Clogged filters on TC air intake → low scavenge air pressure
- High SAC water temp or SAC condition → high scavenge air temperature
- Clogged air side of SAC → pressure drop across SAC / low scavenge pressure
- Inefficient or damaged engine room fans → Low engine room pressure
- Worn nozzle rings → Low TC efficiency
- Clogged economizers → high exhaust gas backpressure
Engine adjustments and maintenance

Keeping engine adjustments and maintenance in order

- Assures optimum of engine performance
- Saves significant amounts of fuel
- Stretches maintenance intervals and consequently additionally reduces cost

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**Fuel savings.**
Up to 3 tons per vessel, per day.

**Cost savings.**
Up to $1000 per vessel, per day.

**Efficiency gains.**
Up to 2-3 hours analysis time.

**Competitive pricing.**
Payback time is typically less than 3 days.
But what is the condition of my main and auxiliary engines?

Typical means of judging (main-) engine performance

- Fuel consumption per day / per voyage – statistical judgment
- Comparing some (all relevant?) parameters with shop trial – C/E judgment
- Performance run under defined condition and compare it with shop trial reference – both ISO corrected – thermodynamic analysis
Requirements to make a correct thermodynamic analysis

- Sensors in good order
- Accurate performance data (taken under performance run condition)
- Comprehensive data collection – all performance relevant data
- Reference data for exactly the equipment you have on board
- Normalized data for reference and actual measurement
- Reference for every load in entire load range → 10-100% engine load
Thermodynamic approach...

- Deviation of a thermodynamic parameter from reference can be quantified...
- ... calculated into potential fuel oil savings
- For deviations a quantified advice can be given
- Power can be estimated accurately
Tekomar XPERT for Engines
Engines performance analytics solution - New client application release 3.0

- Made for technical management of vessels (e.g. superintendent, C/E)
- Structured engine performance analysis independent of maker and type of equipment
- Instant diagnostics and advice for improvement
- Save 2-3 hours analysis time per engine
- Save up to 3 Tons per vessel/per day
- Save up to 1000 $ per vessel/per day
- KPI for fuel oil saving potential and behavior
- Fleet overview
- State of the art intuitive UI Design
Tekomar XPERT

Software features

Engine diagnostics and advisory software

Easy installation on computer (no board attendance required)

Data input/ import:
- Manual data input by crew or
- Data import from third party devices or monitoring systems

Evaluation of engine performance:
- Actual engine performance is compared to shop test reference values (baseline performance)

Diagnostics with advisory:
- Instant quantification of fuel oil saving potentials and advice about how to improve performance, including specific measures -adjustments and maintenance (on board))

Comparison of fleet
- Comparison of equipment across entire fleet
- Data sharing with office through cloud solution.

Data input/import

Evaluation in graphs and trends

Diagnostics with advisory

Comparison of fleet
Tekomar XPERT product line

Engine performance diagnostics in mixed environment for all

Chief Engineer
Collect / import data
Evaluate performance
Follow recommendation

Tekomar XPERT for Engines
Client software

Tekomar DATABRIDGE

AMS / ECS

Sensors

DPI*

CocoS

Superintendent:
Check engine
Evaluation
Interact with C/E

Manual Input

Import

Tekomar XPERT for Fleets
Web portal

Technical Director:
Assess fleet performance
Benchmark fleets

Fleet Manager:
Compare vessels of
own fleet
Benchmark with
other fleets

3rd party
management information system

Main engine / Diesel Generator

* e.g. TCM-S Tekomar’s fully integrated DPI solution

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Engine performance diagnostics in mixed environment for all

**Chief Engineer**
- Collect / import data
- Evaluate performance
- Follow recommendation

**Superintendent:**
- Check engine evaluation
- Interact with C/E

**Fleet Manager:**
- Compare vessels of own fleet
- Benchmark with other fleets

**Technical Director:**
- Assess fleet performance
- Benchmark fleets

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Client software

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### Significant savings...?

<table>
<thead>
<tr>
<th>Model</th>
<th>Consumption</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>7K80MC-C</td>
<td>1.27t/day</td>
<td>27.9 K$</td>
</tr>
<tr>
<td>7RTA84T-B</td>
<td>3.64t/day</td>
<td>29.7 K$</td>
</tr>
<tr>
<td>6S42MC</td>
<td>0.4t/day</td>
<td>1.6 K$</td>
</tr>
<tr>
<td>6S80ME-G9</td>
<td>0.72t/day</td>
<td>4.3 K$</td>
</tr>
</tbody>
</table>
Knowing engine performance is important…!

- Compared with reference conditions it means knowing savings potential
- Consequentially the actions are clear to bring it back to optimum performance
- To judge ship performance
  - Get your C/E hooked to engine performance
  - …provide him the right tool and…

… the potential will turn into real savings
You are not alone…

5600 engines, 1400 vessels, 60 customers