Panel 3
Refurbishment of Rolling Stock

Railenergy Final Conference
Brussels
November 25th, 2010

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Overview

- Size of Pie
- Process and Approach
- Opportunities

- Main opportunities are around reducing consumption from:
  - Base Load
  - Installing metering to automatically collect and analyse energy consumption data
Size of Pie

- Trainer Project identified:
  - ~10% of Energy consumed is by parked trains
  - ~50% of this could be saved
- Most of these savings are estimated on reductions to base load
  - Assume same savings to be gained in service
  - Opportunity is 10%
- Metering is the tool to release savings from planning, operation and control of trains.
Some targets and objectives should be set for management of refurb

Roles and responsibilities should be defined

Management should ensure staff are educated on the potential benefits sought and why and that they are trained in the techniques to deliver these savings

KPIs should be set for the energy consumption savings or capability improvements from refurb and the sub systems that contribute to this consumption and these should be monitored by management

These processes must then be embedded into the business process of the operator

Energy saving improvements can then be planned, performed and reviewed using the KPIs mentioned above

Figure 1. Process – Management Principles for Energy Efficiency: applied to refurbishment. (Derived from Process Power People)
Opportunities

Modifications – Tangible and intangible
Tangible
Locking Windows in HVAC Compartments
Insulation Improvements

- Most vehicles contain this
- Some more than others
- Some train operators citing different U factors kW/m²K
- Can be implemented during overhaul
- Ensure good seals on windows and doors

*Est. saving 20% of HVAC energy consumption (parked or not)*

**Recommendation: UIC leaflet to specify U value for trains**
LED Lighting

- 3-13Watts LED vs 75-100Watts Bulb
- Last up to ten times longer
- Can be dimmed
- Reduce heating load for HVAC to deal with

Window Films

- 3M claim 35% of heat can be reflected
- UV protection up to 99%
- Could be supplied with anti scratch properties
- Pendolinos fitted in the UK

http://solutions.3m.com/wps/portal/3M/en_US/WF/3MWindowFilms/
Triple Glazing

- According to Thermotech insulates ~60% better

<table>
<thead>
<tr>
<th>Window</th>
<th>Insulating Value</th>
<th>Percentage Improvement</th>
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</thead>
<tbody>
<tr>
<td>Existing double glazed casement</td>
<td>R-2.0 (U 0.50)</td>
<td>-39%</td>
</tr>
<tr>
<td>Metal spacer, clear glass</td>
<td></td>
<td></td>
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<tr>
<td>Thermotech double glazed casement (211)</td>
<td>R-3.3 (U 0.30)</td>
<td>-</td>
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<tr>
<td>1 SuperSpacer™, 1 (low-e &amp; argon)</td>
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<tr>
<td>Thermotech triple glazed casement (321)</td>
<td>R-4.3 (U 0.23)</td>
<td>+39%</td>
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<tr>
<td>2 SuperSpacer™, 1 (low-e &amp; argon)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermotech triple glazed casement (322)</td>
<td>R-5.3 (U 0.19)</td>
<td>+61%</td>
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<td>2 SuperSpacer™, 2 (low-e &amp; argon)</td>
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Not cost efficient as a one off fleet fitment but
Can ‘fit on fail’

http://www.thermotechfiberglass.com/WhyTripleGlazed.htm
Intangible
Vary HVAC Settings Manually

- Higher interior temperature in Summer
- Lower interior temperature in Winter
- No figures but logical saving and easy to do
Possible to reduce fuel consumption by switching off engines in service eco cruise and when parked (TPE, 11% saving in fuel)

- Class 158/9 new gear boxes under consideration by vehicle owners
- Wärtsilä UD30V12 R3 (R2) LE upgrades
Metering

- Diesel Meter on trial in UK
- Virgin Trains metering using TMS
- FGW DAS
Door Auto Close

- Lvl 1 - Install Auto Close
- Lvl 2 – Set close timings based on demand
Ancillary Systems Shut Down

- Lvl 1 - manual systems shut down
- Lvl 2 - Automatic Systems Shut down
Auto Stabling Mode

- Able to remotely switch on HVAC, Lighting, etc
- Could be automated based on timetable
- Reliability/Availability benefits from knowing condition of train
Pulsed HVAC

- Store energy from Regen Braking using super cap, etc.
- Use stored energy to boost HVAC when train starts
- Use Cabin as the heat soak
Summary and conclusions

- There are many options during refurbishment to improve vehicles efficiency
  - Today is just a snap shot
  - UIC could support this with some work to develop better standards of insulation for trains
- Managers responsible for planning the refurbishment should ensure there are policy and procedures in place to ensure the options for improvement are considered and prioritised based on business case
- What changes will you plan into refurbishment and what savings do you believe they will deliver?