

The Railenergy logo features the word "Railenergy" in a bold, red, sans-serif font. To the left of the text is a stylized graphic consisting of two overlapping, curved yellow and orange shapes that suggest motion or energy.

Railenergy

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.

- Process
- Power
- People

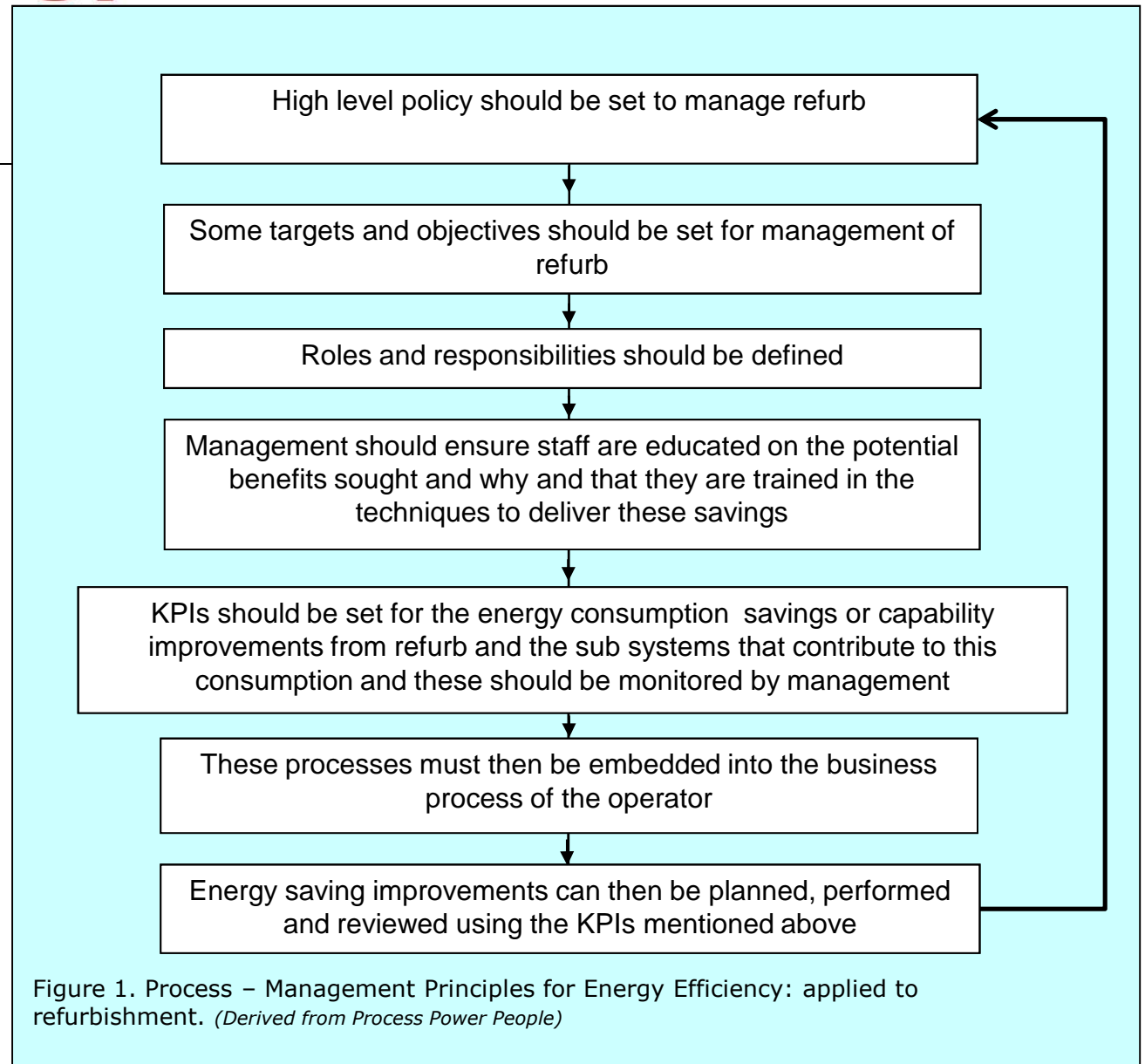


Figure 1. Process – Management Principles for Energy Efficiency: applied to refurbishment. *(Derived from Process Power People)*

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



<http://www.earthtechproducts.com/energy-saving-led-light-bulbs.html>

Window Films

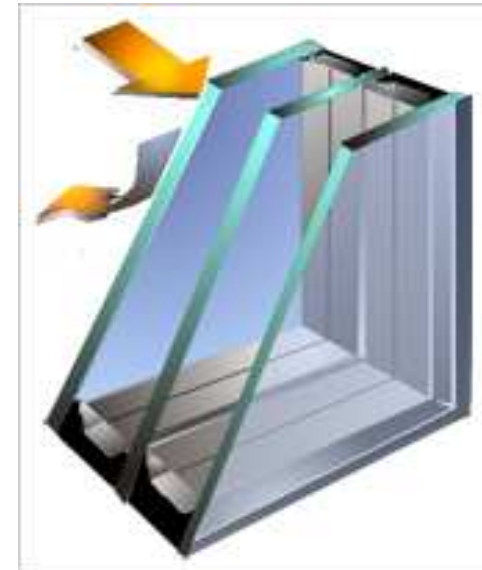
- 3M claim 35% of heat can be reflected
- UV protection up to 99%
- Could be supplied with anti scratch properties
- Pendolinos fitted in the UK

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

Triple Glazing

- According to Thermotech insulates ~60% better

Window	Insulating Value	Percentage Improvement
Existing double glazed casement Metal spacer, clear glass	R-2.0 (U 0.50)	-39%
Thermotech double glazed casement (211) 1 SuperSpacer™, 1 (low-e & argon)	R-3.3 (U 0.30)	-
Thermotech triple glazed casement (321) 2 SuperSpacer™, 1 (low-e & argon)	R-4.3 (U 0.23)	+39%
Thermotech triple glazed casement (322) 2 SuperSpacer™, 2 (low-e & argon)	R-5.3 (U 0.19)	+61%



*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

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Traction Systems Modifications and Engine Shut Down

- 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



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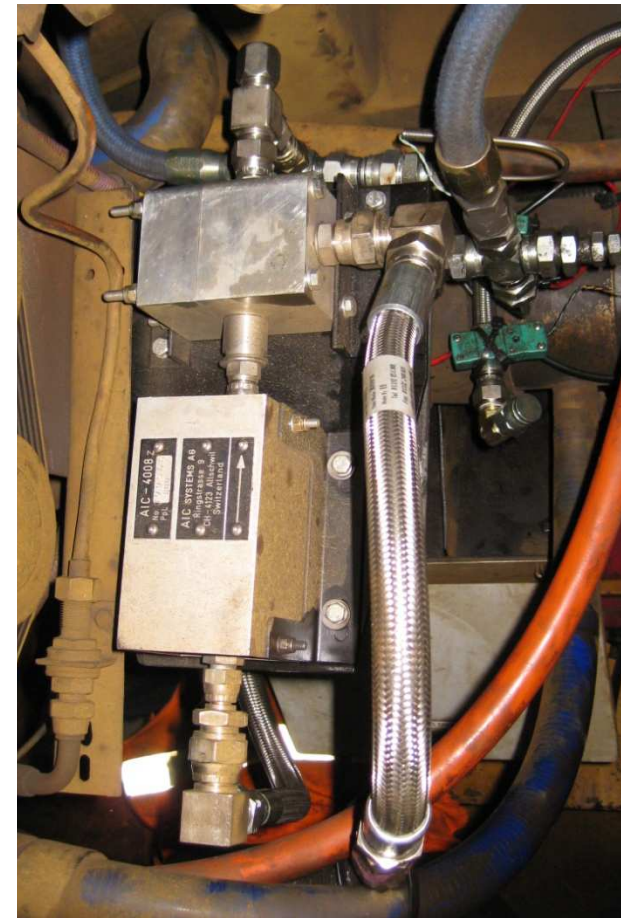
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Metering

- 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



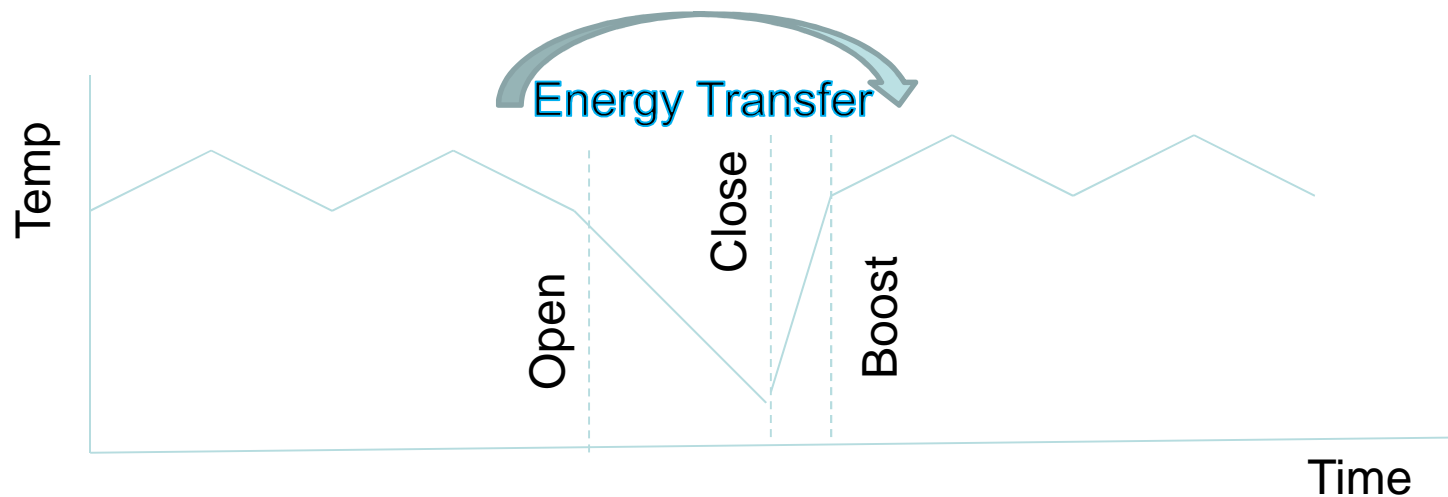
Auto Stabling Mode

- 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?**