WP 2.4 : Sustainable Refrigerated Road Transport

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London South Bank University,
July 2, 2014
Overview

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Reasons to investigate refrigerated road transport (RRT)

- UK primary food distribution by refrigerated road transport (RRT) uses 40% more energy than comparable non-refrigerated vehicles.
- UK HGVs accounts for 2 Mtonnes of indirect CO₂ emissions from the engine alone.
- RRT units leaks up to 30% of their total refrigerant charge per year.
- Revised F-Gas regulations RRT units will now need to be leak tight.
Research Objectives/ Deliverables:

1. Examine different types RRT vehicle designs and the technologies currently used

2. Analyse existing maintenance and leakage records to:
   a) Identify problematic components/ sources of refrigerant leakage
   b) Suggest generic solutions for leak tight systems

3. Develop a predictive model to simulate a variety of scenarios of RRT systems to;
   a) Estimate respective direct and indirect carbon emissions
   b) Evaluate the effectiveness (in terms of energy intensity) of various designs – proportion of chilled vs. frozen
   c) Determine relative operational costs of various designs

4. Identify RRT samples and collect actual data using appropriate instrumentation and controls (IC)

5. Validate and optimise model

Project plan flow chart

Prelim Study & Data Analysis I → Develop Model → Data Collection & Analysis → Validate & Optimize Model

Report for Transport Industry → PhD Thesis
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<th>W.P.</th>
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<td>Prelim Study &amp; Data Analysis</td>
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Refrigerant Leakage in RRT units remains a common issue due to the greater vibrations and shocks experienced relative to stationary refrigeration systems.
Other Activities Completed

• Maintenance Routine site visit with a RRT service engineer
• Attended Commercial Vehicle Show & Multimodal Expo
• Site visit to Solomon’s Commercial Body Builders
• Site visit to Hubbard Transport Solutions
ENERGY SAVING OPTIONS

- Up to 50% energy savings can be achieved for refrigerated goods transport.

- Energy saving options may include:
  - modulating refrigeration power to meet part load requirements;
  - coordinating delivery logistics;
  - utilizing alternative refrigeration methods;
  - enhancing design features.
Next immediate steps

• Refrigerant Leakage Data Analysis

• Review existing models applied to analysis of RRT units
  Of interest are:

  a) Coolvan program- Mathematical model
  b) Dymola-Modelica language - Numerical model
  c) Commercial Transport Refrigeration Models such as:
    ✓ Mistral,
    ✓ ThermosysTM- Model for Heat Mode & Cool Mode
Summary

Sustainable Refrigerated Road Transport Project will:

- Review a holistic approach for reducing Transport Refrigeration CO$_2$ emissions
- Explore leak tight solutions
- Develop a model to investigate energy efficient solutions