Alan Foster, Akos Revesz, Christina Francis, Ed Hammond, Gareth Davies, Issa Chaer, Jolyon Thompson, Judith Evans, Maria Mavroulidou, Metkel Yebiyo, Mike Gunn, Graeme Maidment

WPs 2.1, 2.2, 2.3, 2.4, 2.5

London Underground
Hubbard Products Ltd
Asda
City Holdings Ltd
Islington Council
WP 2.1 and 2.2 Retail refrigeration

Proof of concept prototype:
Chilled multi-deck (remote)
George Barker Leo cabinet (ASDA cabinet)

1. Baseline optimised with EC fans, LED lights, large evaporator, optimised air flow
2. Doors → test currently sourcing
3. AirCell (low temperature range), new high efficiency evaporator, optimised fans and air flow → test completed confidentiality agreement
4. Occupancy sensors (lights) → test
5. Low emissivity packaging → test
EUED cross centre project
- Supermarket energy benchmarking project

Electrical energy consumption per year (kWh)

- Netto Supermarket
- ASDA
- ASDA (24hr)

Sales floor area (m²)
WP2.3 Data Centre Cooling, Waste Heat Recovery and Reuse

- Metropolitan Integrated Cooling And Heating – combined cooling and waste heat recovery
- A feasibility study funded by Innovate UK
- LU, Islington Council and LSBU
- Investigating costs and savings using a disused underground station
- Develop generic guidance/ benefits of LU waste heat recovery
- Other waste heat sources may also be used
Recovering Heat from Vent Shafts

Summer: Heat pump

Winter: Heat pump

Diagram showing heat recovery from vent shafts in summer and winter.
Comparison of conventional cooling and heating carbon emissions with MICAH
WP2.4 refrigerated road transport (RRT)

Background

Deliverables

- Develop a model to investigate real contribution of direct and indirect emissions
- Optimising system performance
Data analysis – summary journey report

(18/12/2015 08:15 h – 18/12/2015 11:15 h) Duration – 3 hours, Distance - 25 km

FRIDGE OFF + Transport

FRIDGE ON + Transport

Carbon footprint

- Wheels: 88%
- Other: 12%
- Leakage: 5%
- Fridge Power: 7%
Work Package 2.5 - Integrated cooling, heating and storage

**Deliverables**

- To investigate the interactions of underground railway tunnels and ground heat exchangers
- To investigate the potential indirect use of waste heat from the tunnels to heat buildings above ground.
Some investigations and results

Ground heat exchangers built between multiple running tunnels

GHEs’ heat extraction rate improved by 41 %
Upcoming Project: London Urban Sub-Terrain Energy Recovery - LUSTER

LUSTER will investigate the potential of heat energy recovery from urban sub-terrain structures, such as sewers, electricity cable tunnels and underground railway tunnels.

**Project lead:**
LSBU

**Project start:** September 2017

**Duration:** 18 months

**Academic partner:**
UCL

**Industrial partners:**
London Underground Ltd., Thames Water Ltd., REHAU, Energy Innovation Centre
Recognition

- Supermarket Road map completed – under review
- Data centre roadmap draft completed - under review
- Breakfast meeting at Houses of Parliament (Nov 2016)
- SIRACH, Cork, November 2016
- 3 papers at ASHRAE conference, Las Vegas, January 2017
- 2 papers at CIBSE ASHRAE Technical Symposium, Loughborough University, April 2017
- Annex 44 workshop in Beijing at 5th IIR Conference on Sustainability and the Cold Chain (ICCC2018) - April 2018 Conference