

WPs 2.1, 2.2

Retail refrigeration

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WP 2.1 and 2.2 Retail refrigeration

Road map

Further updates and new technologies added (e.g. adiabatic condensers)

Edited and improved document

Peer review by IIR/CIBSE

Add in further stores and assumptions



WP 2.1 and 2.2 Retail refrigeration

Additional stores identified to be modelled:

Medium - Seaham: 2,788 m² (sales area)

Small - Darlington: 723 m²

(Large - WSM: 3,977 m²)

**Both better level of monitoring than
WSM**

Aim

Validate model using better data

**Determine whether options identified
vary between store sizes**

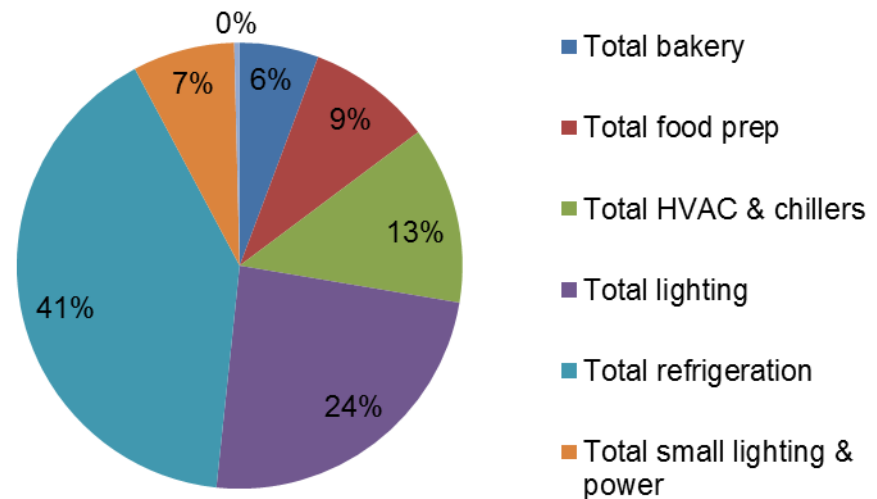
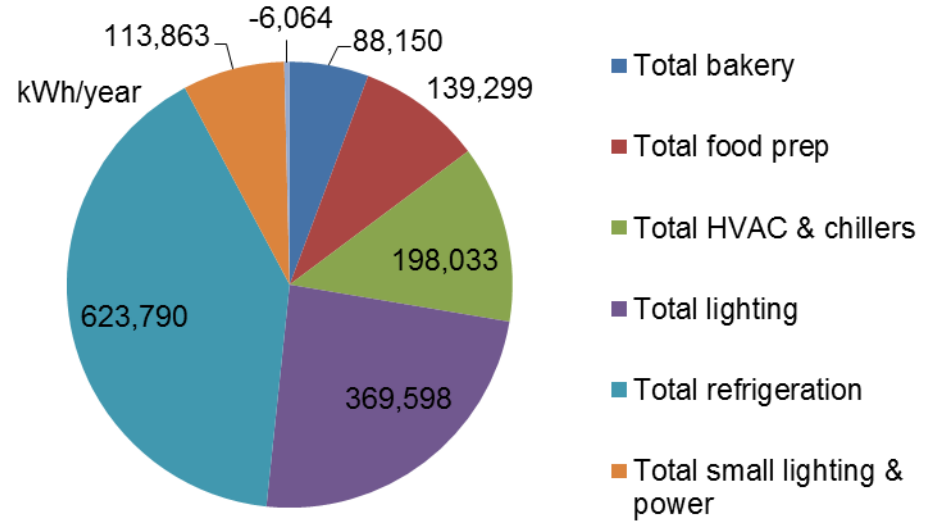


WP 2.1 and 2.2 Retail refrigeration

Seaham (medium)

8 years old

SEC= 548 kWh/m²

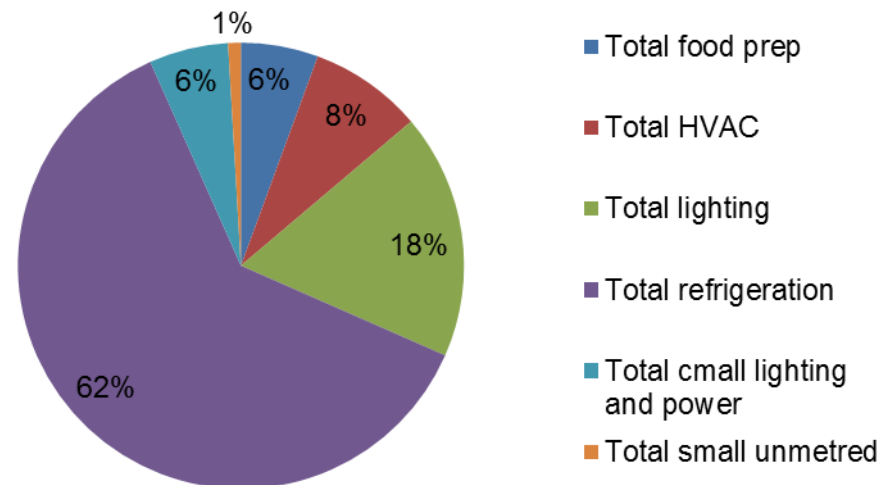
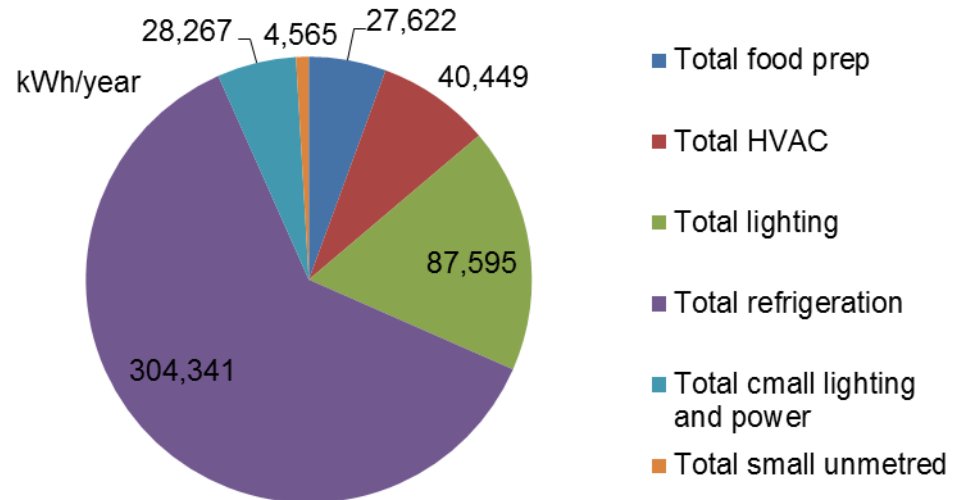


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Darlington Neasham Road (small)

4 years old

SEC= 681 kWh/m²



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Proof of concept prototype:

Chilled multi-deck (remote)

George Barker Leo cabinet (standard ASDA cabinet)

Already has EC fans, LED lights, large evaporator, optimised air flow design features

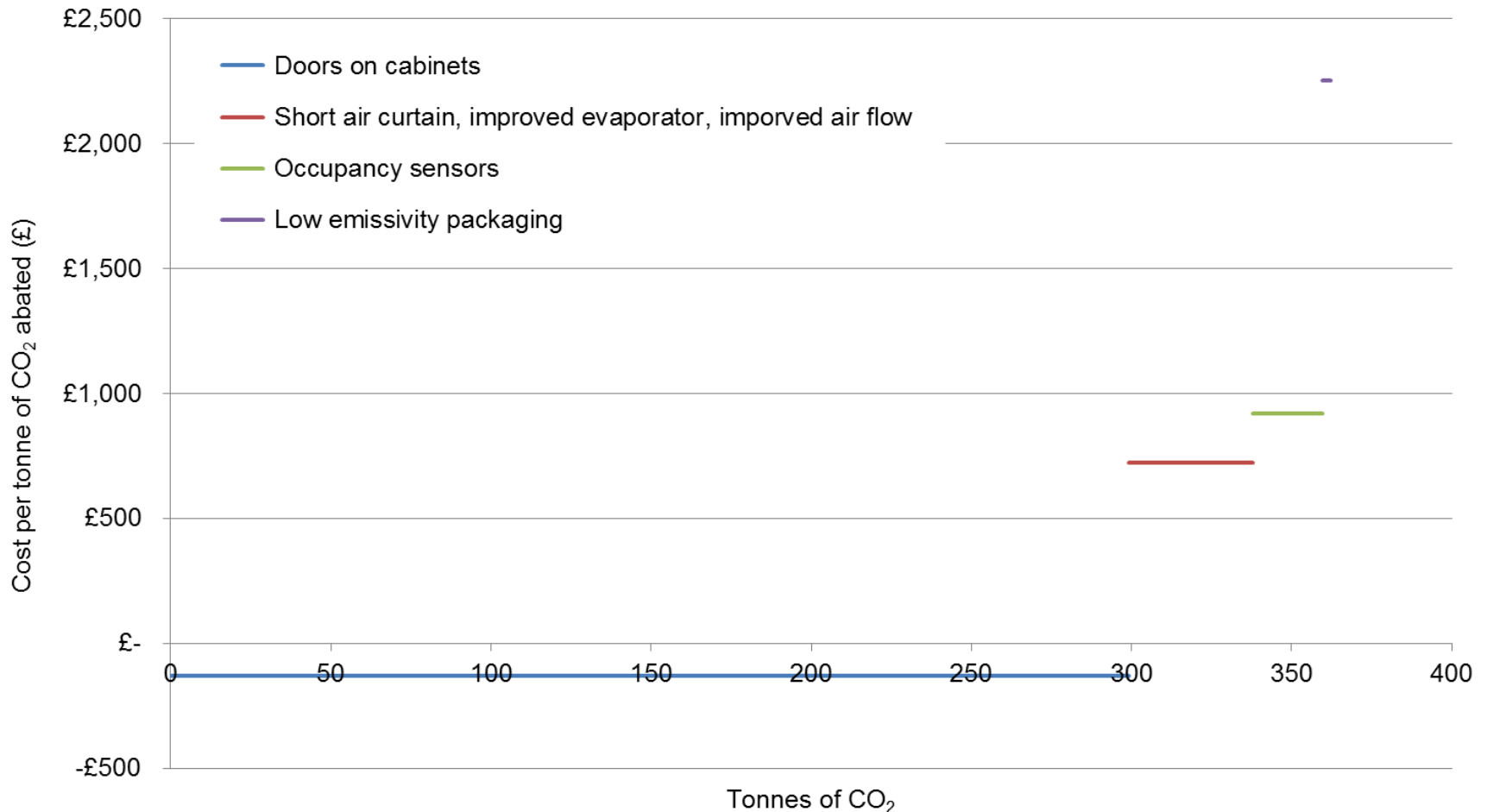
1. Baseline test (EN23953)
2. Doors + higher lighting (good fitting doors) → test
3. Air cell (low temperature range), new high efficiency evaporator, optimised fans and air flow → test
4. Occupancy sensors (lights) → test
5. Low emissivity packaging → test



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MAC for cabinet technologies

Savings for whole supermarket (indirect) = 29.8%
Savings for multi-deck cabinets (indirect) = 49.3%



WP 2.1 and 2.2 Retail refrigeration

Proof of concept
prototype

Refrigeration system –
calculate savings

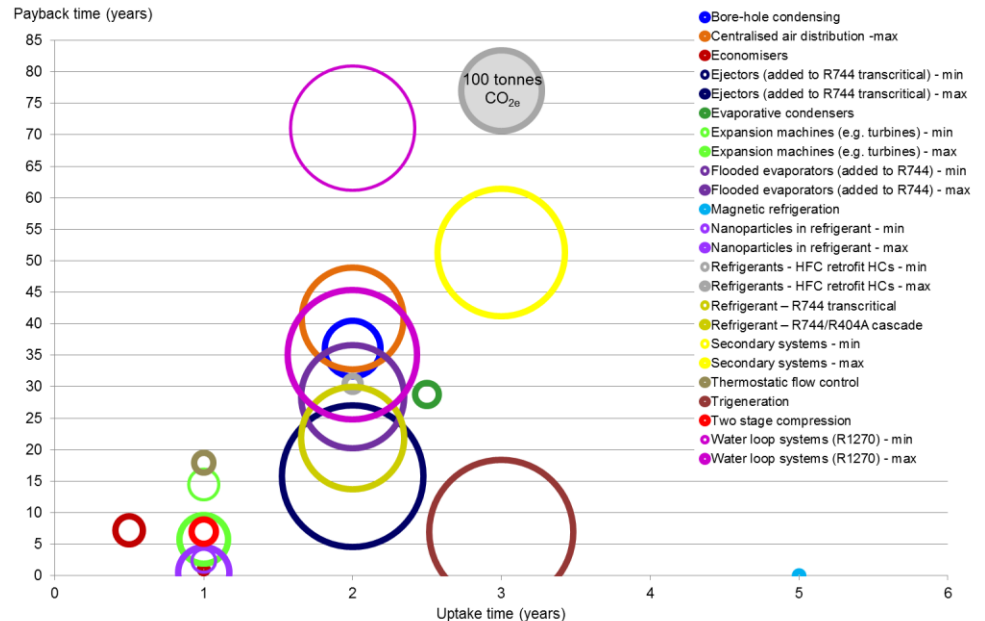
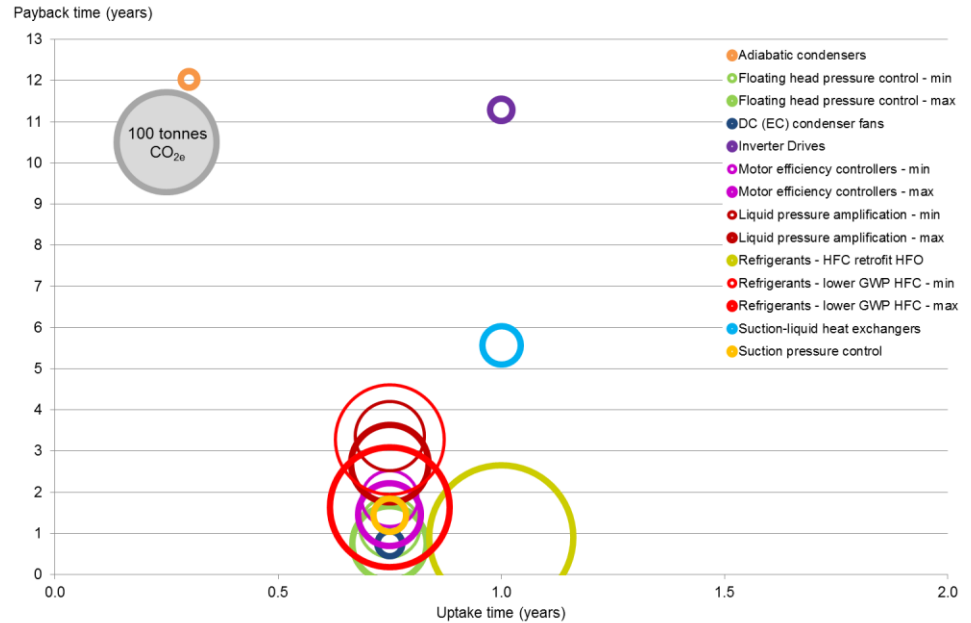
- Refrigerant change
- Suction pressure control
- LPA
- MECs
- Trigeneration

Saving ~48% of total carbon

MD indirect = 19.2%

+ direct = 44.2%

+ other refrigeration indirect = 47.5%



WP2 Deliverables- papers

1. FOSTER A., ORLANDI M., BROWN T., EVANS J. (2015). Use of phase change materials in retail display cabinets to reduce the effect of defrosts. The 24th IIR International Congress of Refrigeration, 2015, Yokohama, Japan.
2. FOSTER A., CAMPBELL R., DAVIES T., EVANS J. (2015) a novel passive defrost system for a frozen retail display cabinet with a low evaporator. The 24th IIR International Congress of Refrigeration, 2015, Yokohama, Japan.
3. EVANS, J.A. and FOSTER, A.M (editors). (2015). Retail refrigeration. Edited book (Blackwell Publishing).
4. EVANS, J.A. (2015). Emerging refrigeration and freezing technologies for food preservation. In: Innovation and future trends in food manufacturing and supply chain technologies. Woodhead Publishing
5. HAMMOND E.C. and EVANS, J.A. (2014). Application of vacuum insulation panels in the cold chain – analysis of viability. International Journal of Refrigeration. Volume 47, November 2014, Pages 58–65.
6. FOSTER, A., MCANDREW, P. AND EVANS, J. Novel aerofoils used for reducing energy consumption and improving temperature performance for multi-deck refrigerated display cabinets. 3rd IIR International Conference on Sustainability and the Cold Chain, London, 2014.
7. FOSTER, A., ORLANDI, M. AND EVANS, J. (2014). Use of heat pipes to improve temperature performance of a chilled refrigerated display cabinet. 3rd IIR International Conference on Sustainability and the Cold Chain, London, 2014.
8. EVANS, J., MAIDMENT, G.G., BROWN, T., HAMMOND, E. AND FOSTER, A.M. (2016) Supermarket energy use and greenhouse gas emissions – technology options review. Proc IOR.
9. GE, Y.T., TASSOU S.A., FOSTER A., EVANS J., MAIDMENT, G.G. (2016) Modelling and Evaluation of Supermarket Energy Use and Emissions with Various Technology Options. Proc IOR.
10. **EVANS J., MAIDMENT G., BROWN T., HAMMOND E., FOSTER A. Carbon reduction opportunities for supermarkets. 4th IIR International Conference on Sustainability and the Cold Chain, Auckland, 2016.**