

Steve James

Food Refrigeration and Process Engineering Research Centre

Reducing Energy Without Compromising Quality or Safety ‘The defra project’

National Motorcycle Museum 3rd April 2009



Defra project

Started Defra funded project to:

“identify, develop and stimulate the development and application of more energy efficient refrigeration technologies and business practices for use throughout the food chain whilst not compromising food safety and quality”

In June 2006



The Partnership

- **Academic - FRPERC, London South Bank, Brunel & Sunderland**
- **Project officer - Christina Goodacre**
- **Steering Group - Stephen Reeson (FDF) Gary Shields (Dairy UK), Mike Lawrence (FETA), John Hutchings (FSDF), Brian Whittaker (CESA) and David Blackhurst (IoR)**

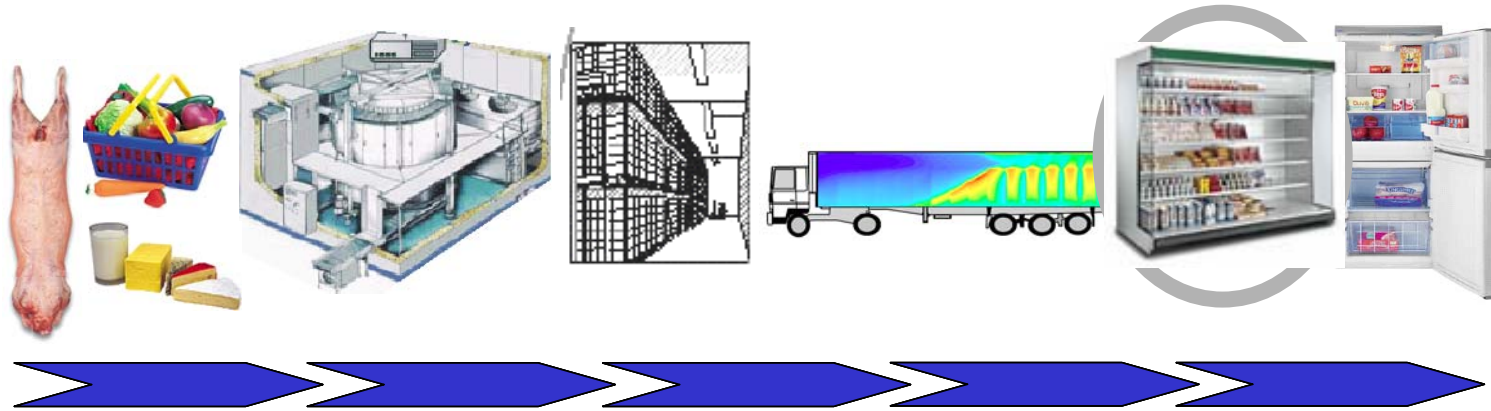


Collaborating organisations

Campden-BRI, Dairy UK, Food & Drink Federation (FDF), Chilled Food Association (CFA), Meat and Livestock Commission (MLC), the Federation of Environmental Trade Associations (FETA), Food Storage & Distribution Federation (FSDF), Catering Equipment Suppliers Association (CESA), Food Processing Faraday Partnership (FPFP) and the Institute of Refrigeration (IOR), etc.



Cold chain



Whole cold chain:

Primary Chilling - Freezing, thawing & tempering - Secondary chilling - Chilled & frozen storage - Transport & distribution - Retail/Catering

Main topics in work programme

- 1. Mapping of energy use.**
- 2. Identifying new technologies and business practices.**
- 3. Feasibility studies on promising technologies and business practices.**
- 4. Continuous interaction with food and refrigeration industries.**



Mapping of energy use

Objective

Identify and rank 10 'operations' (process/food combinations) in order of the **potential** by the use of improved technology and enhanced business practice to reduce energy usage in food refrigeration.



Target - Energy efficiency matrix

	Chilling	Freezing	Storage	Retail	Catering
Energy used					
Throughput					
Energy change					
Efficiency					
Saving potential					



Where is the Energy Used? - Mark Swain

- Available data and its reliability
- The Top 10
- What is lacking?

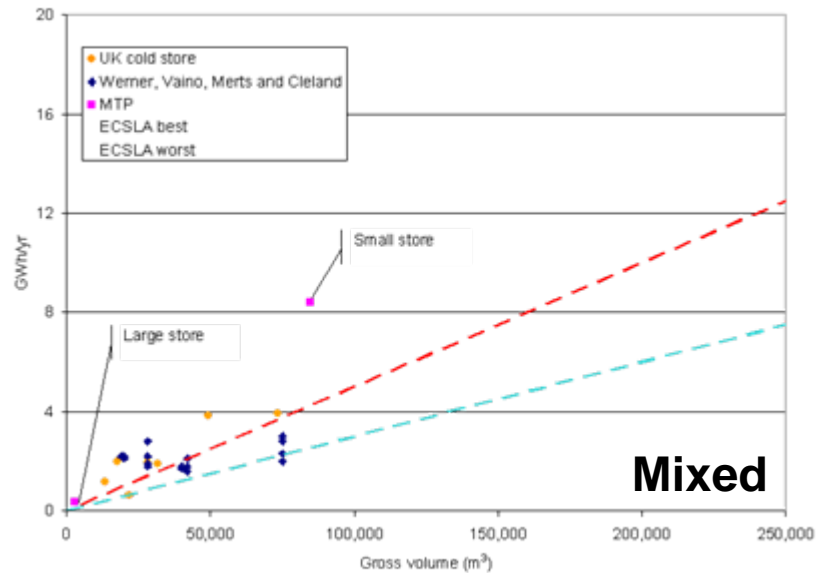
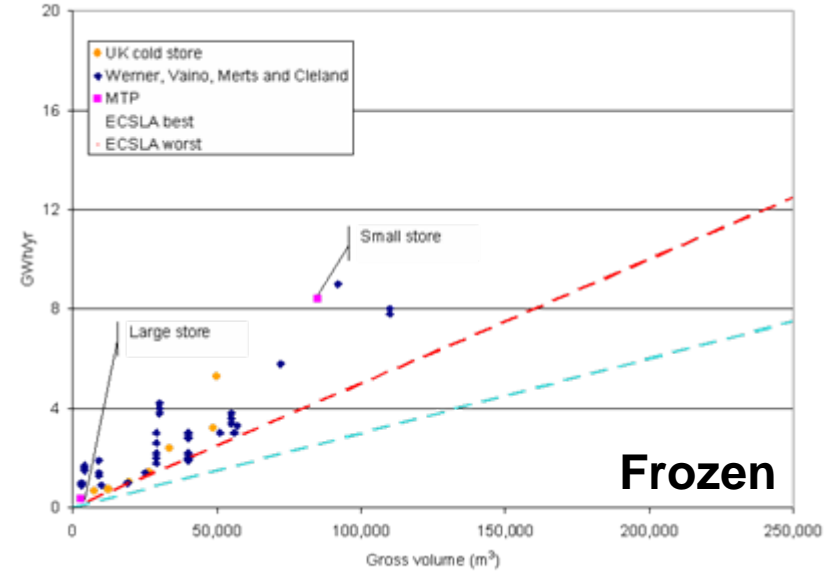
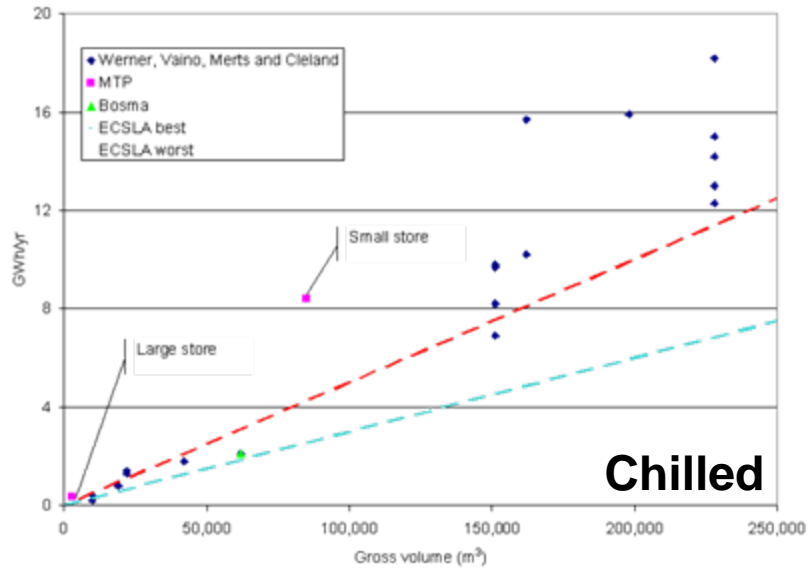


Primary chilling - Mark Swain



- Energy measured over 7 days in abattoirs.
- Throughput and temperatures measured.
- Base (empty) consumption measured.
- Efficiencies calculated.

Cold stores - Judith Evans



Refrigerated transport - Savvas Tassou

- **52,000 refrigerated vehicles in use.**
- **Average 26 litres/day for refrigeration.**



Retail and Catering - Judith Evans†



RETAIL

- Improvements insulation, fans and lighting but only 10 to 30% of heat load.



CATERING

- Approximately 500,000 commercial service cabinets.
- Chilled consume 2,900 kWh per year.
- Frozen consume 5,500 kWh per year.

Lunch

University of
BRISTOL
Food Refrigeration &
Process Engineering
Research Centre

Brunel
UNIVERSITY
WEST LONDON

LONDON
SOUTH BANK
UNIVERSITY

**University of
Sunderland**

defra
Department for Environment
Food and Rural Affairs



Refrigerant leakage - Graeme Maidment

- **How you are invisibly wasting energy and money!**



How maintenance is essential to energy saving - David Baglee

- **Badly fitting doors, poor door seals, wet insulation, etc increase heat loads.**
- **Dirty/choked condenser coils increase energy consumption.**
- **However, does a well maintained food refrigeration plant itself consume less energy than a poorly maintained one?**

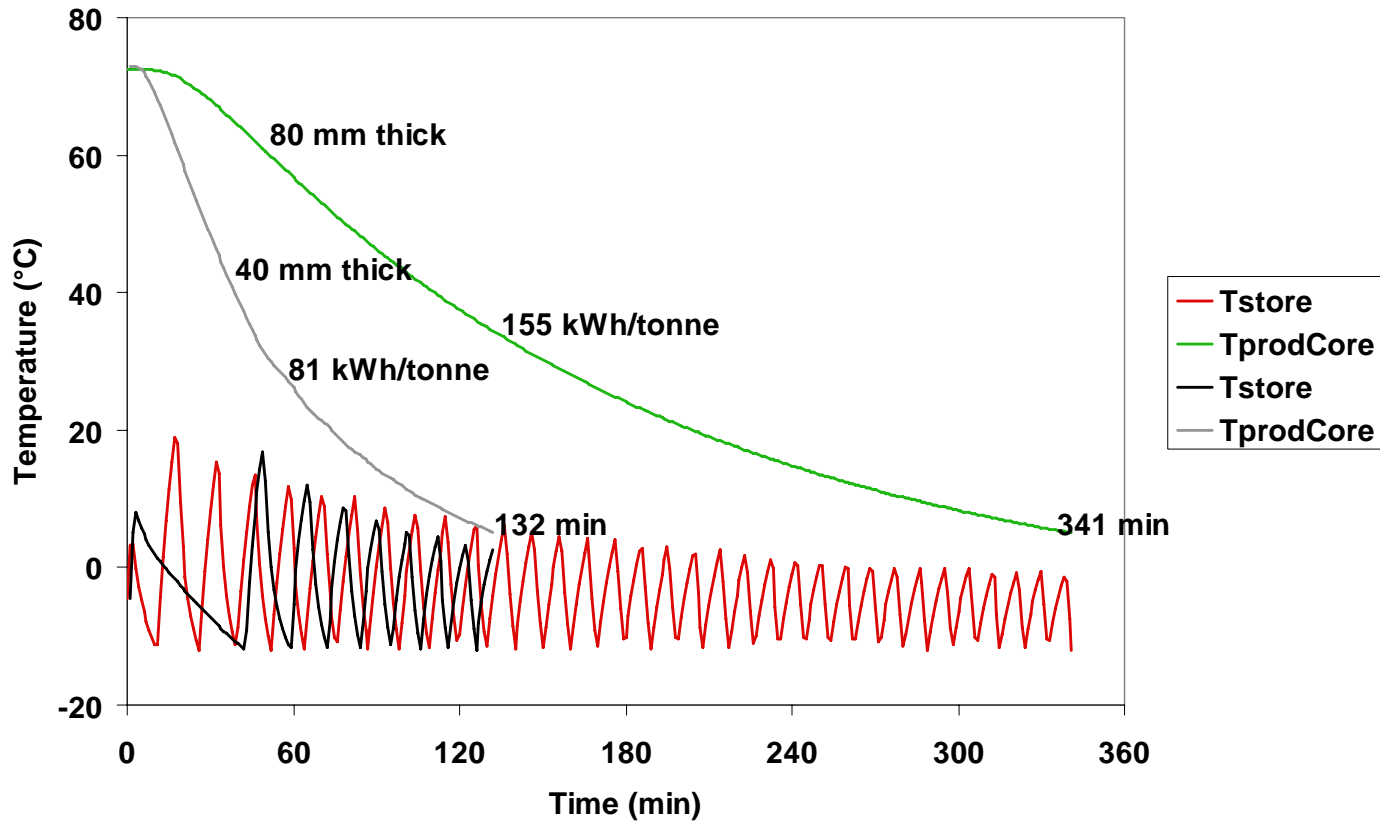
Optimisation of a food refrigeration system - Ian Eames

“No accurate model of a complete food refrigeration system is possible unless both the food and mechanical plant are considered simultaneously in the model.”

(Cleland 1990)



The dynamic model



Alternative and Emerging Refrigeration Technologies - Savvas Tassou



- **Magnetic**
- **Thermoacoustic**
- **Thermoelectric**
- **Stirling cycle**
- **Air cycle**
- **Tri-generation**
- **Sorption technologies (absorption and adsorption)**
- **CO₂ refrigeration systems**

Future trends - Graeme Maidment

- **What are the future trends in food refrigeration?**
- **How can we help the food industry take these forward?**



How it all fits together -Mike Lawrence

- A short open discussion.



Thanks

