

# COLD CHAIN TECHNOLOGY BRIEF

## COMMERCIAL, PROFESSIONAL AND DOMESTIC REFRIGERATION

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# Commercial, professional and domestic refrigeration

- Commercial
  - 90 million commercial refrigerated systems worldwide
  - 477,000 supermarkets
  - 45% energy for refrigeration in supermarkets
- Domestic
  - 1.5 billion appliances



# Commercial, professional and domestic refrigeration



Professional – catering/kitchens



Domestic – home

Commercial – supermarkets, retail (also beverage coolers, vending machines, water coolers, drinks fountains)



# Commercial, professional and domestic refrigeration

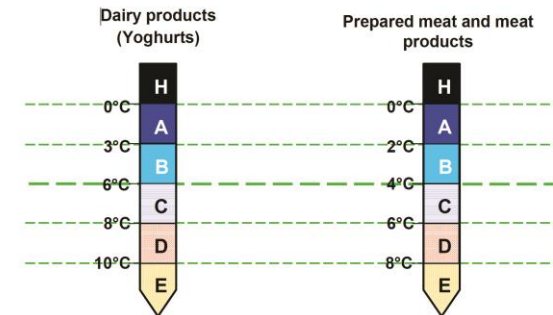
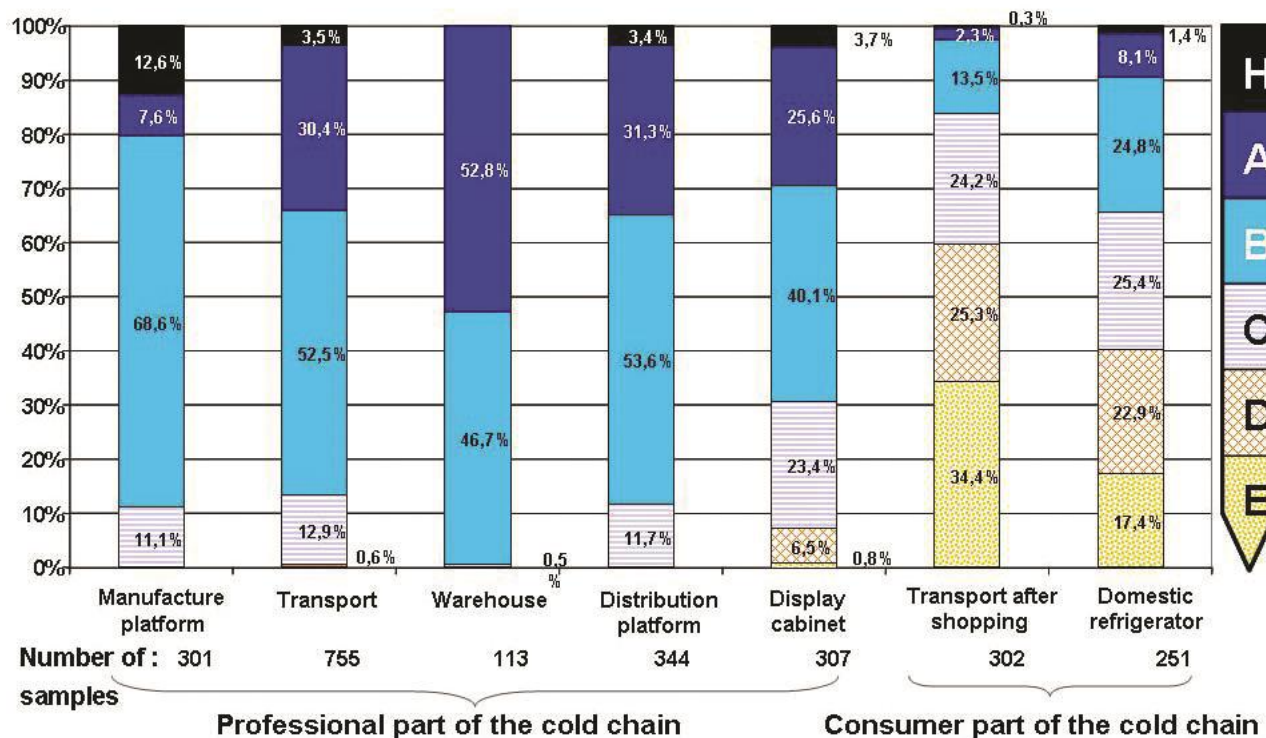
- Commercial
  - Majority of systems in use are plug-in (integral)
  - Usually <3 kW
  - Large supermarket system operate from a remote refrigerant plant
- Professional
  - Majority plug in systems
  - 300 W to 1-2 kW
- Domestic
  - Almost universally plug-in
  - 20-150 W





# Commercial, professional and domestic refrigeration

- Control of temperature begins to be an issue

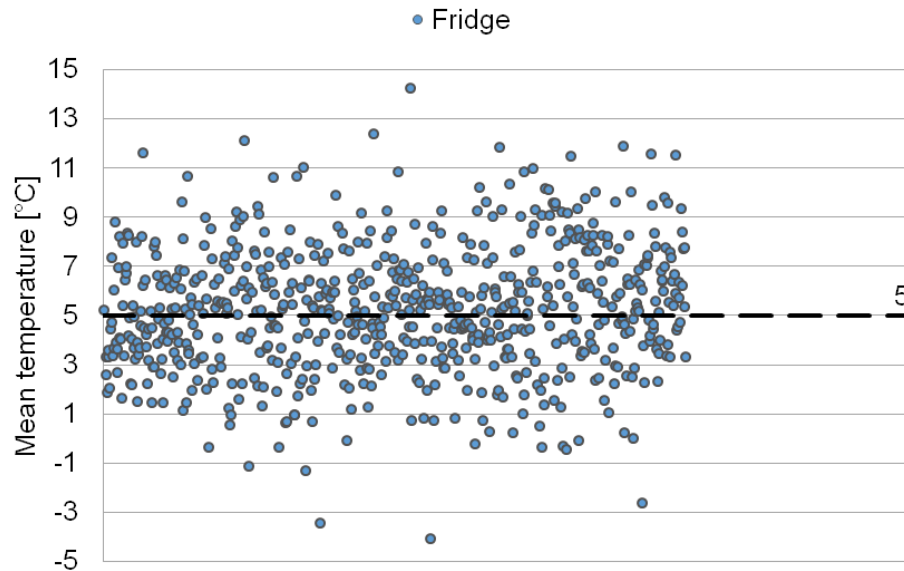


*Derens, E., Palagol, B., Cornu, M., Guilpart J., 2007. The food cold chain in France and its impact of food safety. IIR ICR2007, Beijing, China.*

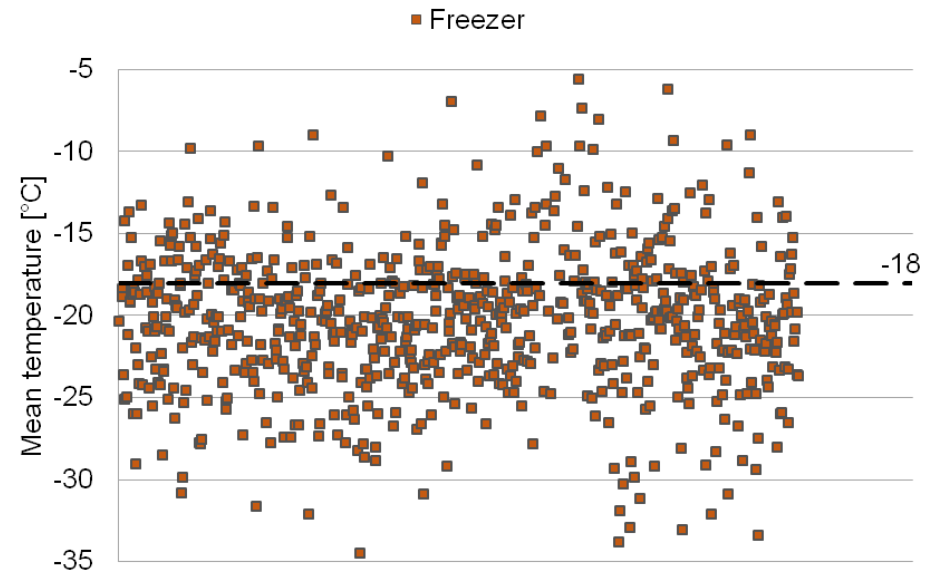


# Temperature performance

- Large variations in performance of similar equipment



Mean temperature (°C) for refrigerators



Mean temperature (°C) for freezers



# Emissions - direct

- Refrigerant emissions:
  - Commercial
    - Remote 3% at very best up to 20-30%/year
    - Integral <1%/year
  - Professional
    - Little information on professional
    - Similar production methods
    - 0.5-3%/year
  - Domestic
    - 0.1-0.5%/year



# Emissions - direct

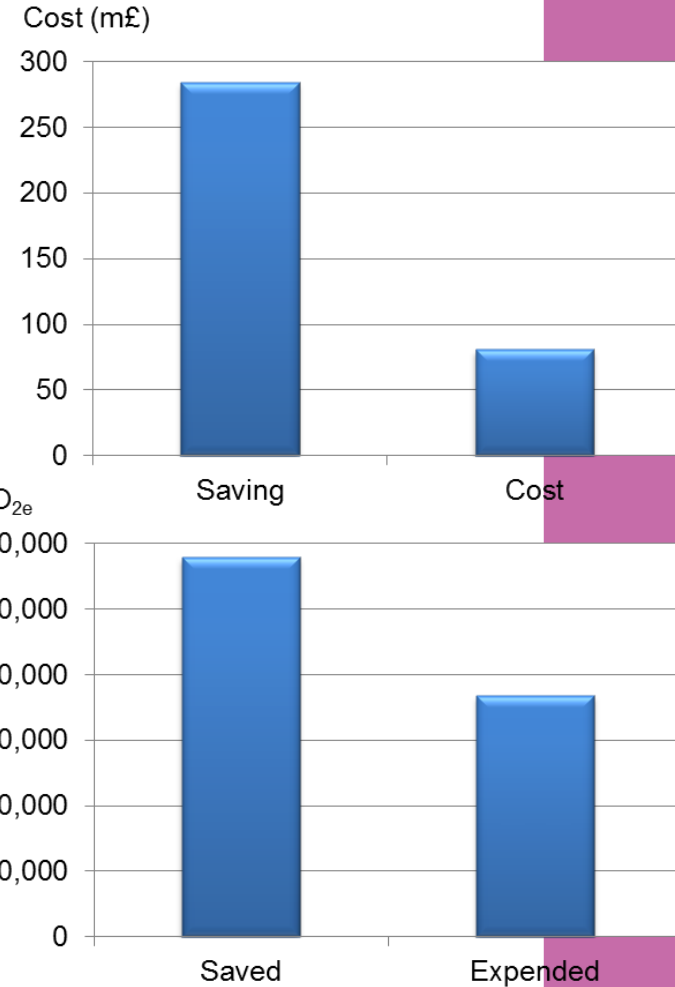
- Refrigerants:
  - Commercial
    - Traditionally high GWP refrigerants
    - Move to CO<sub>2</sub> (R744), HFOs and lower GWP alternatives in remote plant
    - HCs in small plant or HFO/HFO blend refrigerants
  - Professional
    - Move to HCs with low GWP
  - Domestic
    - 35-40% HCs (increasing, 70% by 2020)





# Emissions

- Food loss:
  - Often related to lack of refrigeration
- Food waste:
  - Refrigeration extends storage life of food
  - Reducing storage temperature from 7°C to 4°C extend storage life by ~50%
  - Could save UK £162.9 m of waste annually (270,000 tonnes CO<sub>2e</sub>)
  - Additional savings if include foods which are not always refrigerated and remove others which do not benefit from refrigeration
  - Costs and emissions associated with increased fridge energy consumption lower

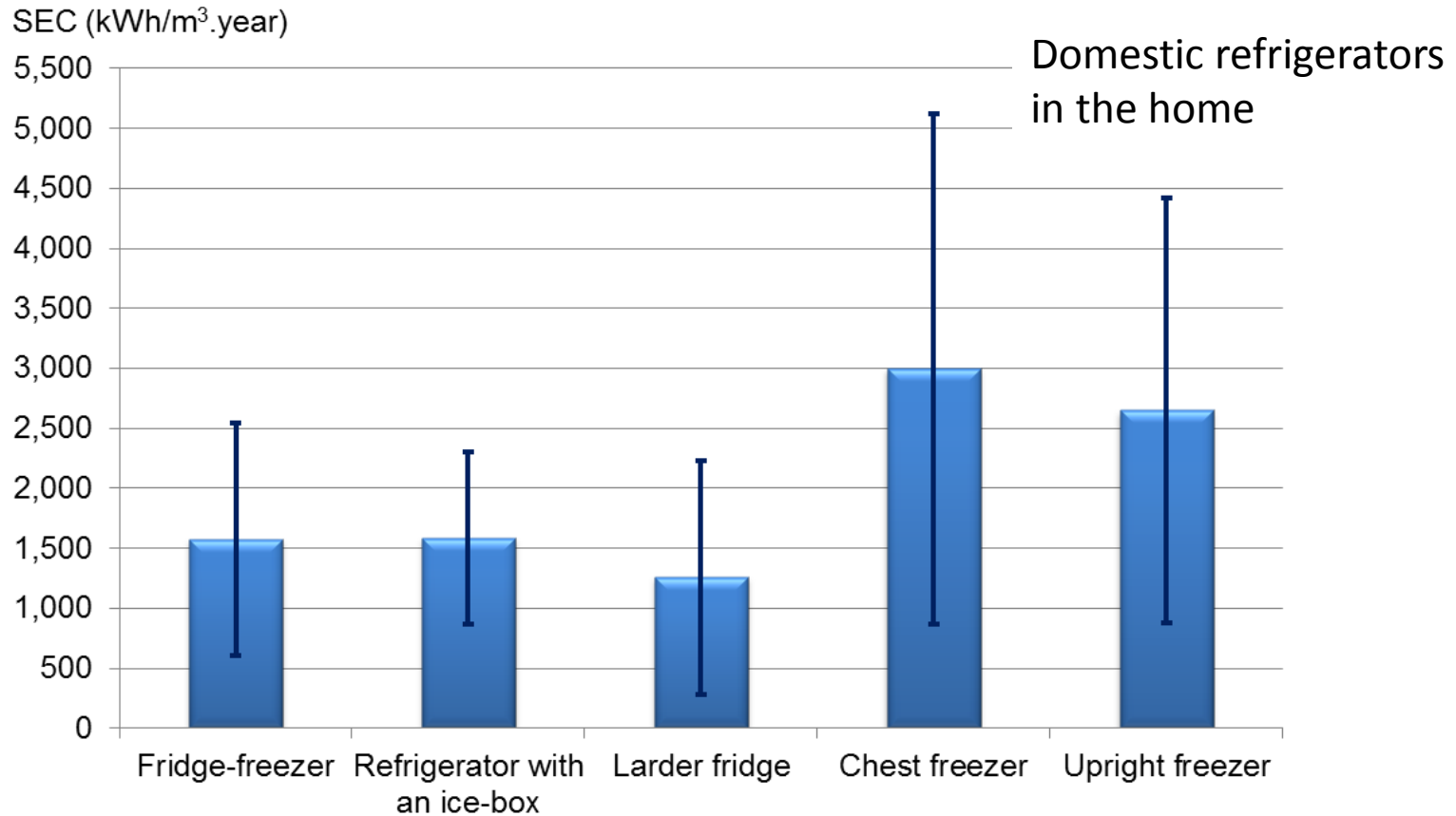


Brown T., Higgs N.A., Eastel S., Parry A., Evans J.A. Reducing domestic food waste by lowering home refrigerator temperatures. *International Journal of Refrigeration* Volume 40, April 2014



# Emissions - indirect

- Energy consumption - wide range in performance



# Developments and perspectives

- Opportunities to reduce energy usage
  - Often prevented by cost (emphasis on initial cost rather than lifetime)
  - Large number of options available
  - Loss in sales (e.g. doors on commercial cabinets)
  - Energy labelling may have impact (has already reduced energy used by domestic refrigerators by ~50%)
- Opportunities to reduce direct emissions
  - Safety of HC and A2L refrigerants
- Number of novel systems (magnetocaloric, electrocaloric, acoustic) under development or close to market, suitable for plug-in units



Thank you for your attention

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