Sector Focus

Catering

	Sector	GWh/y
1	Retail display	9,233
2	Catering – kitchen refrigeration	4,380
3	Transport	4,822
4	Frozen storage – generic	900
5	Blast chilling – (hot) ready meals, pies	425
6	Blast freezing – (hot) prepared products	316
7	Dairy processing – milk/cheese	250
8	Milk cooling – raw milk on farm	207
9	Potato storage – bulk raw potatoes	165
10	Primary chilling – meat carcasses	129

Mean estimated annual UK energy usage

Technology

Catering establishments traditionally use a range of refrigerators and freezers to store raw material, side orders and part and fully prepared dishes prior to serving. In recent years establishments have to have in addition blast chillers or blast freezers. The aim of a blast chiller is to cool hot ready meals, pizza, pies, coated foods, pasta, soups, sauces etc after they leave the cooker.

The following table shows the energy consumption of 5 refrigerated appliances in a small catering establishment. An upright freezer used to store raw material consumed over 40% of the total energy used.

Equipment	*Mean energy consumption (kWh/24 h)*	Proportion of total energy used for refrigeration equipment
Gram upright freezer	12.7	40.4%
Polar 2 door upright fridge	5.8	18.5%
Polar 4 door counter fridge	4.4	13.9%
True cold drink vending m/c (Coca Cola)	4.7	14.9%
Ice cream freezer cabinet (Mars)	3.9	12.3%
Total	31.4	

Energy used in sector

Refrigerated systems in catering establishments in the UK are estimated to use 5,584 GWh of energy per year.

Systems in use

Refrigerators and freezers

Upright chilled and frozen storage cabinets are often used in catering operations for convenience.

Chest freezers are more energy efficient but inconvenient.

Commercial frozen storage cabinet

Blast chillers and freezers

Invariably systems pass refrigerated air over the hot food to cool it. Blast chillers range in complexity, size and cost depending on type of food to be cooled and throughput.

Simple cabinets or rooms are suitable for small-scale operations. They are versatile, easy to load/unload and easy to clean.

Simple low cost energy savings

Reducing Main heat inputs

- Minimise heat that has to be extracted from cooling food.
  - Use ambient cooling to remove heat from cooked products prior to cooling.
  - Minimise thermal load from packing and racking.
  - Cover unwrapped foods to reduce evaporation and subsequent condensation and freezing of moisture on evaporator coils.
- Minimise heat generated.
  - Switch off fans when systems are empty.
  - Reduce fan speed when surface temperature of food is within 2°C of air temperature.
  - Minimise air movement when chiller/freezer used as a storage system.
- Minimise heat infiltration.
  - Position chiller/freezer away from or shield from heat sources i.e. cookers, windows, south facing external walls, poorly insulated roofs, etc.
  - Fit effective door protection systems on all personnel and food entry and exit points.
  - Minimise surface area of chiller/freezer that is exposed to ambient temperatures.
  - Use maximum thickness of insulation and design structure without thermal bridges.

System loading

- The energy efficiency of a blast chiller/freezer, chilled storage or

frozen storage system operating without any food in it is zero.

- Ensure air passages are not blocked during loading.
- When the system is only partially loaded:
  - Make sure the loading pattern does not allow air to short circuit and return to the evaporator without extracting heat from the food.
  - Reduce depth of hot food by using more containers thus reducing chilling/freezing time and requirement for refrigeration system to be in use.
- Make sure that air cannot by-pass the evaporator by sealing ducts to force all air through the evaporator.

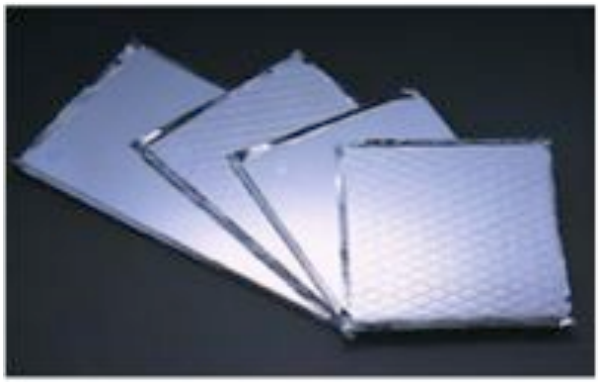
Maintenance

Condenser unit prior to cleaning

- Cleaning condenser unit reduced energy consumption by 8%.
- Ensure that refrigeration systems are checked to ensure heat exchangers are free of dirt and that refrigerant is not leaking.
- Replace and adjust worn or badly fitted door and food entry protection systems.
- Replace worn door seals.
- Check for any breakdown in insulation and replace.

Retrofit options

- Advanced insulation such as VIPs (Vacuum Insulated Panels) has the ability to reduce heat load across insulation. VIPs could replace current insulation and reduce energy consumption by 5-10%.



- **High-efficiency compressor systems** – Energy savings potential for high-efficiency compressors are estimated to be 6% for ice machines, 9% for vending machines and beverage merchandisers, 12% for reach-in refrigerators, and 16% for reach-in freezers.
- **High-efficiency evaporator fan motors** - Specifying high-efficiency motors for evaporator fans is almost always a good investment, and they can also be implemented on a retrofit basis. Energy savings are estimated to be about 2% of refrigeration system electricity use for reach-in freezers, 7% for reach-in refrigerators, 5% for ice machines, 14% for vending machines, and 29% for beverage merchandisers.
- Improving performance of the refrigeration system through liquid pressure amplification, suction pressure optimisation, evaporative condensers and checking to ensure no leakage of refrigerant can

produce energy savings of up to 30%.

Opportunities for saving energy and reducing energy costs for refrigeration systems will depend on the particular application. The table below shows the application of selected energy efficiency measures to different refrigeration technologies

Energy efficient measure	Beverage merchandising	Reach in freezers	Reach in refrigerators	Vending machines	Walk in coolers & freezers	Ice machines
High-efficiency evaporator fan motors	√	√	√	√	√	√
High-efficiency condenser fan motors	√	√	√	√	√	√
High-efficiency compressor systems	√	√	√	√	√	√
Floating head pressure controls					√	
Liquid pressure amplifiers					√	
Anti-sweat heater controls		√	√		√	
Defrost controls		√			√	
Ambient subcooling					√	
Efficient lighting	√	√	√	√	√	

Fostering the Development of Technologies and Practices to Reduce the Energy Inputs into the Refrigeration of Food

This project was funded by defra Department for Environment Food and Rural Affairs

Project coordinator: FRPERC Food Refrigeration and Process Engineering Research Centre; THE GRIMSBY INSTITUTE of Further & Higher Education; University of BRISTOL

Project partners: Brunel UNIVERSITY WEST LONDON; LONDON SOUTH BANK UNIVERSITY; University of Sunderland

For further information on saving energy see: www.grimsby.ac.uk/What-We-Offer/DEFRA-Energy