Sector Focus

Blast Chilling

	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) potato 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

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. Over 1,200,000 tonnes of chilled prepared food is produced in the UK each year. Much of this is chilled from 80°C to a final target temperature approaching 3°C.

Energy used in sector.

Blast chilling systems in the UK for cooked and chilled products are estimated to consume 250 to 600 GWh of energy per year.

Systems in use

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.

There is very little measured or published data on their energy efficiency.

Simple cabinets/rooms

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

Push through and conveyerised tunnels

For larger throughputs where floor space is available linear chilling tunnels can be used.

Many types are commercially available ranging from simple manual push through rack systems to automatic rack systems and conveyerised belt systems for individual hot products.

Cryogenic chilling tunnels are also available but are more expensive to operate.

Spiral chillers

For larger throughputs where floor space is at a premium then a range of spiral chillers are commercially available.

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 prior to cooling.
  - Use water sprays to remove heat prior to cooling.
  - Minimise thermal load from packing and racking.
- Minimise heat generated
  - Fit energy efficient fans with drive motors outside chiller.
  - 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 used as a chilled storage system.
- Minimise heat infiltration
  - Position chiller 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 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 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 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.

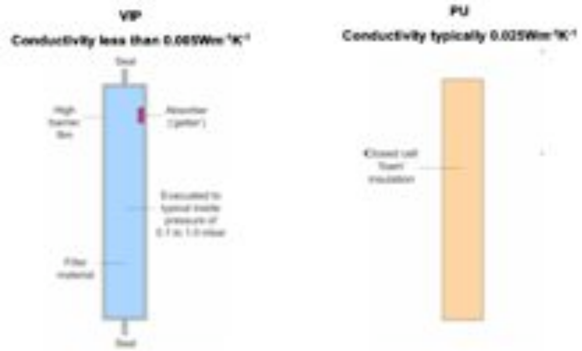
Maintenance

- Ensure that refrigeration systems are checked to ensure heat exchangers are free of dirt and that refrigerant is not leaking. Check operation of refrigeration components to ensure operating at installed capacity and efficiency.

- 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%.



- Fit variable speed drives to fans controlled by feedback from IR surface temperature measurement of food being chilled

Other options to consider

- High efficiency components such as compressors, heat exchangers, fans and lighting can reduce energy by up to 20%.
- 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%.
- Consider reclaiming heat from refrigeration plant for heating water or space heating.
- Consider reclaiming heat from refrigeration plant for low temperature thawing, tempering, drying or smoking processes.

Energy saving potential of future technologies

A number of technologies are under development for use in the near future. Some of the most promising include:

- Greater use of renewable energy sources such as solar electricity (PV), solar thermal, wind energy, biomass, geothermal heating and cooling.
- Greater system integration by use of heat pumps, Combined Heat and Power (CHP) and Trigeneration.

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