Sector Focus

Retail Display

	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

For a typical size food retail store, 3500 MWh of electrical energy will be consumed in a year, of which 2100 MWh can be due to the refrigeration systems.

The aim of a refrigerated display cabinet is to attractively display chilled or frozen foodstuffs placed within prescribed temperature limits. There are approximately 0.8 million refrigerated display cabinets in use in the UK and the energy consumption is considerable.

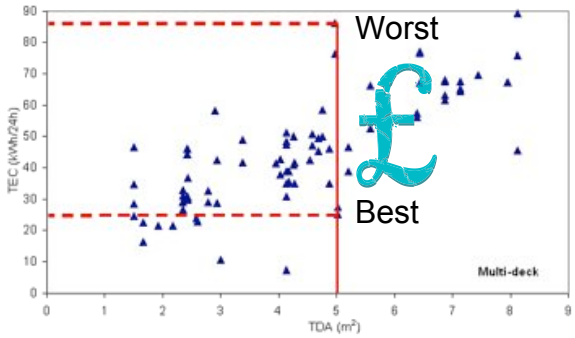
Energy used in sector

Retail display cabinets in the UK are estimated to consume between 5,768 and 12,698 GWh of energy per year.

Simple low cost energy savings

Cabinet purchasing

By selecting an energy efficient cabinet savings can be made throughout its operational life. There are large variations in the efficiency of cabinets currently on the market; for example in a test situation the worst cabinet can consume 3 times the energy of an efficient model.



Cabinet positioning

- Ensure that cabinets are not in direct draughts from doorways (this can increase overall mean temperatures in an open cabinet by 3°C and energy consumption by up to 80%).
- Make sure cabinets are not close to hot items such as cookers or there are high heat output lights in line of sight of cabinets.

Cabinet setting

Ensure that cabinets are set at the correct temperature setting. Raising the set point by 1°C generally provides a saving of between 2 and 5%.

Cabinet use

- Make sure that food and labels do not obstruct the cabinet air curtain in open fronted or open topped cabinets. Do not load food beyond the cabinet load lines.
- Try to keep cabinets fully loaded to the load lines. Large gaps between shelves in an open fronted cabinet can produce a 13% increase in energy use.
- Make sure that air cannot by-pass the evaporator by sealing ducts to force all air through the evaporator.

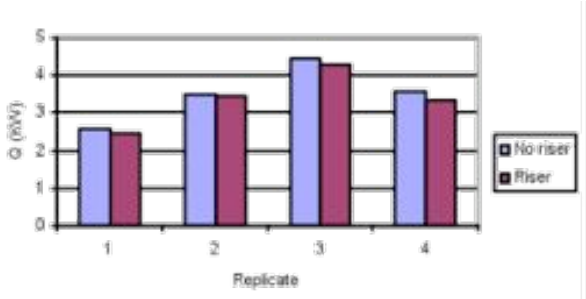
Maintenance

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.

Retrofit options

Consider the following features when purchasing or operating a cabinet:

- Fitting door protection for open fronted cabinets (either doors, strip curtains, night blinds) or covers for open topped cabinets. Fitting protection to open fronted cabinets can save up to 50% of the energy used. Well-fitted night blinds can save up to 75% of the energy used.
- Radiant reflectors can reduce energy consumption in open topped cabinets by 10%.
- Use of risers in front of the return air grille on multi-deck cabinets can produce energy savings of up to 7%.
- Retrofitting an old meat display cabinet with energy efficient lamps, ballasts and fan motors reduced the cooling load by 13% and the overall power consumption by 27%.



Other options to consider

- Optimising the air curtain can result in energy savings of up to 30%.
- 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 refrigerant leakage can produce energy savings of up to 30%.
- Installing fibre optic lights in a display cabinet produced a direct annual energy savings of 11,200 kWh (49.3%). In addition the reduced heat load resulted in an annual compressor energy savings of 11,800 kWh (16.7%). The estimated total annual energy savings was 23,000 kWh.
- Consider reclaiming heat from refrigeration plant for heating water or space heating.
- Low emissivity glazing ('K' glass) can enable cabinets with lids or doors to be operated at a higher evaporating temperature resulting in savings of up to 10%.
- Dehumidification of supermarkets can reduce the need for defrost and reduce latent load on open cabinets. In extreme cases where ambient humidity is high this can results in energy savings of 29% but in the UK

the savings are likely to be nearer 5%.

- Defrost optimisation is a simple means to reduce energy particularly in freezer cabinets. Only defrosting cabinets when necessary can result in energy savings of up to 10%.
- Installing anti sweat heater (ASH) controls for freezer cabinets to ensure that the ASH are used only when needed and are controlled by the dew point of the supermarket air. Savings of up to 7% are possible.

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:

- Pulse electro-thermal de-icers (PETD). Recently work has shown that thin, electrically-conductive films applied to surfaces and heated with milliseconds-long pulses of electricity can make ice melt from surfaces. These have the potential to reduce defrost times and energy used in defrosting.
- 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%.
- 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.

Energy saving summary

Technology	Saving	Application										
		C	F	I	R	MD	W	HGD	FGD	D	AC	R
Adding doors to display cases	Up to 50%	✓	✓	✓	✓	✓						
Strip curtains	30%	✓	✓	✓	✓	✓						
Optimisation of air curtain	30%	✓	✓	✓	✓	✓	✓					
Night blinds and covers	20%	✓	✓	✓	✓	✓	✓					
Trigeneration	20%											✓
Liquid pressure amplification	Up to 20%											✓
ECM/Variable Speed Compressor	15%			✓								✓
High-Efficiency Compressors	12%			✓								✓
Defrost optimisation	10%		✓	✓	✓		✓	✓	✓			
Radiant heat reflectors	10%	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Dehumidification	5-29%										✓	

LED lighting	5-10%	✓	✓	✓	✓	✓	✓	✓	✓	✓		
High-Efficiency Fan Blades	9%	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Risers	7%	✓	✓	✓	✓	✓						
External Heat Rejection	2%											✓
Economizer Cooling	2%											✓
Efficient 'standard' lighting	~ 2%	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Tangential fans	~ 2%	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Heat Reclaim	1%											✓
Low emmissivity/reflective glazing ('K' glass)	1-2K inc. evap. temp.	✓	✓	✓	✓			✓	✓	✓		

C = Chilled, F = Frozen, Integral = I, Remote = R, MD = Multi-deck, W = Well, HGD = Half Glass Door, FGD = Full Glass Door, D = Delicatessen, AC = Supermarket Air Conditioning, R = Supermarket Refrigeration system.

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

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