

SUPERMARKET REFRIGERATION

Supermarkets are the most energy intense type of commercial building, using about 3.3 GJ/m²/annum^(112 pp 8), and overall about 26 PJ (7.2 TWh) in 2011 ^(112 pp 67). This represents about 2.9% of Australia's overall electricity consumption ^(113 pp 15). The single greatest energy use in supermarkets is refrigeration ^{114,115}. About three-quarters of the refrigeration energy is lost to air infiltration, mainly because of open cabinets ^(114 pp 153). Refrigeration can also have a more direct effect on emissions through refrigerant leakage, which might be in the range of 2-4% ^(114 pp 43) of refrigerant charge per annum on very well-maintained systems. More typical leakage might be in the range of 10-30% per annum ^(114 pp 150).

Emission and energy reduction measures

A number of possible measures can be taken to lessen the energy and emissive implications of retail refrigeration. A study by the Carbon Trust ¹¹⁷, from the UK, lists 32 different measures that have potential to reduce energy use and direct emissions in retail refrigeration systems. Some of those are:

- **Use lower-GWP refrigerants.** Refrigerants such as CO₂ (R774), propane (R290) and ammonia (R717) have much lower global warming potential than the more commonly used hydroflouorocarbons (HFCs). The use of these improved refrigerants would normally require new refrigeration hardware.

For more immediate improvements, there are sometimes direct refrigerant substitutes which, while still HFCs, have lower GWP. An example would be replacing the widely used R404A (GWP=3922) with R407A (GWP=2100).

• **Maintenance, training and re-commissioning.** Active measures to improve the plant maintenance can save significant amounts of energy. Examples of improvements are replacement of door seals, leakage detection and correction, cleaning of condensers and evaporators, checking and re-setting temperature set points.

• **Cabinet doors.** Retrofitting glazed doors to open refrigerator cabinets can save significant amounts of energy by reducing infiltration losses. However, the savings are less than might be imagined because of the need to use energy to keep the doors free of condensation. Energy savings of around 30% ¹¹⁸ to 50% (¹¹⁴ pp 153) are reported. An indirect, but seasonal, benefit of cabinet doors is the reduction in store-wide heating load, since air temperature for customers needs to be maintained. One possible improvement is glass door treatments that resist the formation of water droplets on the glass (¹¹⁷ pp 31), lessening the need for anti-sweat heaters. Some reports suggest savings as high as 68% are possible ¹¹⁹.

• **Air curtains.** An alternative way to control infiltration losses is to use a fan-driven curtain of air.

• **Night curtains.** For stores which are closed overnight, the use of retractable night curtains is a simple and proven way to lessen infiltration losses. Energy savings of around 20% are reported (¹¹⁴ pp 153).

• **Air locks.** Install air locks on supermarket entrances to lessen ingress of moist air, which in turn improves refrigerator efficiency (¹²⁰ pp 48) from reduced condensation and frosting.

• **High-efficiency motors and fans.** Refrigeration equipment using high-efficiency motors and fans can save energy. For example, an electronically commutated motor is reported to use 67% less energy than a conventional alternative motor (¹¹⁴ pp 153). Energy loss in motors and fans gives rise to heat which adds to the work of the system, so the savings go beyond the direct reduction in motor energy.

• **Smart controls.** An example of a smart electronic control that can save energy is 'defrost on demand' in freezers. Electric defrost heaters are required to keep evaporator coils ice-free. These heaters typically operate at a fixed, conservative frequency of two to four times per day. If this is too often or not often enough then energy is wasted. Adaptive controls can sense the ice and only defrost when required. Energy savings of about 12% are reported.

Source: <http://decarboni.se/publications/zero-carbon-australia-buildings-plan/4-electrical-appliances-and-services>