

COOL ROOM EFFICIENCY FACT SHEET

Tips for owners and operators

BE A COOL ROOM HERO



Do you own or operate a cool room or freezer room in your business?

This fact sheet explains how you can save money, save energy, increase efficiency and reduce environmental emissions, all at the same time. It applies to small-and-medium-sized cool and freezer rooms found in many businesses, such as those in food services (café, restaurant, shops, hotels), retail, agriculture (dairy, fruit and veg, wine), food processing and businesses involved in the cold-chain.

Measurement is the key to success

You must know how much energy you are using before you can calculate your savings. Installing an electricity meter that measures the refrigeration system's energy use is the best way to monitor energy use and savings. Logging refrigerant use is also critical.

Today's cost versus tomorrow's cost

It is not only about how much the project costs today but also how much the improvements will reduce the ongoing operating costs into the future. Owners should consider the full life-cycle savings of any initial investment and the potential reduction in environmental impacts.

This fact sheet includes information on management behaviour, maintenance for energy efficiency, low-cost adjustments, and system upgrades or replacements that can save energy and reduce emissions. You can reduce the running cost and increase the life of your system. Be prepared to do something different and change your focus from cost assessment to risk assessment (financial, business, safety, environmental).

Change the way you do business – Behaviour changes

Everyday thinking

Keep the room full –

Keeping the room at close to its optimum storage capacity (66 per cent for cool rooms and 75 per cent for freezers) is more efficient than running a room half-full. Refrigerated product adds thermal mass and reduces a system's running time and cycling. Applying capacity control by using a variable-speed compressor reduces these issues. Be careful that stored stock does not block the airflow to and from the evaporators in the room.

Have a loading and unloading policy –

Load product as soon as it arrives, do not allow refrigerated product to gain heat from the ambient air any more than is necessary. Where possible, avoid loading product that is warmer than ambient air. Scatter product that is to be frozen for maximum air circulation around the packages, then consolidate together after freezing. Place high-turnover product near the doors for easy access.

Keep the door closed –

Ambient air entering the room causes a significant load for the system. The ingress of moisture in the air can cause frost to form on evaporators, products, ceiling and floors. Ensure doors are self-closing. Never chock them open; ensure they seal tightly and quickly. An audible alarm or flashing indicator is a great way to avoid inadvertently leaving a door open even fractionally. Use strip curtains wherever possible.

Turn the lights off –

Lights within a refrigerated space introduce a heat load onto the system. Lights should be turned off when the room is not occupied. This can be automated by occupancy sensors or door-limit switches. Note that building regulations require lights to be operable from within the room.

Learn how to drive –

Know how to control your system, select the highest operating temperature suitable for your product, and don't overuse your system. Normal design temperatures are typically cool rooms from 0–4 °C, and freezer rooms from -18 to -20°C. The actual operating temperature set-point should be selected on the optimum temperature and humidity required for the type of product being stored, and no colder. Overcooling costs money. Regularly check and calibrate temperature sensors.

Long-term thinking

Monitor the energy use –

Remember that meter you installed? It is there so that you can monitor the system energy use and costs. If you don't monitor it you can't manage it. Energy consumption will typically be greater during the day than at night, and greater during hot

weather than during cool periods. If there are unexplained spikes, call your service provider. Once you understand the current energy use, you can set future goals for your service provider.

Leaks cost money –

Keep the refrigerants inside the system, monitor refrigerant use and eliminate all leaks.

Intentional emission of many refrigerants is illegal. Once a leak is known about, it becomes intentional – don't ignore leaks. Be proactive – fix leaks, monitor the refrigerant level, question refrigerant top-ups, and keep the refrigerant in the system.

Plan the maintenance –

Maintenance, for many owners, is making a service call when the system fails or is not working well. Having a planned approach to maintenance can save a lot of energy. Talk to your service provider about providing a "maintenance for energy efficiency" contract. Keep an eye on your meter and count your savings.

Maintenance for energy efficiency – A new paradigm for industry

Just like servicing a car or a delivery vehicle, maintaining refrigeration systems makes them work better for longer.

Service providers will clean heat-transfer surfaces and air filters, lubricate bearings, check drive belts for tension and wear, check operating temperatures and running currents, check the refrigerant charge, calibrate thermostats and controls, and perform a range of maintenance actions on fans, pumps and water-cooled condensers. This will keep your system running as smoothly and as cheaply as possible.

Spending money on maintenance saves money on energy. Other maintenance benefits include a better storage environment for refrigerated product, increased system reliability (no business can afford stock loss due to system failure), and reduced noise, which may have been affecting staff, customers or neighbours.

Ask your maintenance provider or technician to routinely identify and discuss any low-cost adjustments that could be made to the system to improve its efficiency or reduce its energy consumption. Talk to the expert – technical service providers are there to guide and inform you.

Low-cost adjustments – The low-hanging fruit of energy efficiency

Apart from applying frequent energy-efficiency maintenance, there are many low-cost adjustments that can be carried out by owners, managers or service providers to save energy.

Validate the integrity of the room –

Check for damage (inside and outside) to insulation or vapour barriers. Gaps between panels or around door seals all allow warm air to infiltrate and cold air to escape, wasting energy. Regularly inspect the rooms from inside with the lights off to see if external light can penetrate, showing any gaps, damage, worn seals or door misalignment. Hire a thermal imaging camera to identify hot-spots due to gaps or inadequate, failed or compromised insulation in walls, floors and ceilings.

Lighting systems –

Sometimes lighting levels in these rooms are unnecessarily high for the actual use. Owners can consider de-lamping (removing some lights from use) or retrofit existing light fittings with low-power LED lights or compact fluorescent bulbs.

Check the airflow to evaporators and condensers –

Both the evaporators in the room and the condensers outside of the room need good unrestricted airflow. Lack of good air circulation makes the system work harder and longer; remove obstructions such as stock (inside) and vegetation or decorative covers (outside). Straighten bent fins.

Temperature and defrost management –

Check the accuracy of the thermometer/thermostat/controller by regularly calibrating gauges, thermostats and thermometers against independently tested and approved instruments. Check timer settings on any automatic electric defrost – is the defrost on for too long or too often?

There are also some low-cost adjustments that should only be carried out by qualified technicians.

Install a power meter –

This is the first step to managing your energy use and saving your cash.

Upgrade controls – Often a reasonably sized system with a significant power bill is controlled by a 10-year-old mechanical thermostat. Upgrade system controls and controllability using direct digital control (DDC) panels.

System upgrades – Investing in efficiency

Incentives –

State and federal governments have incentive schemes available to cover some of the costs of energy-efficiency interventions. These can be in the form of grants, technical assistance or low-interest loans. See <http://eex.gov.au/business-support/programs/>

Upgrade the room –

Improved insulation and air-tightness of the refrigerated space reduces thermal losses and eliminates infiltration of warm moist outdoor air. Thermal insulation and vapour barriers in walls, floors and ceilings, automatic door-closers, door seals and high-speed closers, strip curtains, plastic doors, air locks, night curtains, cabinet doors and lids can all be used to reduce refrigeration loads. The use of reflective coatings on external walls and roofs and thermal coatings on floors, as well as the use of compact fluorescents or LED lighting systems that are suitable for low-temperature operation, will all reduce energy consumption and internal heat loads. Linking the operation of lighting system to occupancy sensors can also help to further reduce this energy use.

Update the system technology –

Many new technologies have been developed to save refrigeration energy, including: high-efficiency motors and variable-speed drives for compressors, pumps and fans; highly effective pipe insulation; electronic expansion valves; evaporators with staggered or wider fin spacing; larger condensers; internal heat exchanger surface enhancement; natural refrigerant-based systems; direct digital controllers and smart monitors; refrigerant containment strategies; and automatic fault detection and alarm systems. Ask the expert.

Drop-in components – Many manufacturers now offer new energy-efficient components (including variable-speed compressors, high-efficiency motors, electronically commutated (EC) fans, and entire condensing units) that are designed to be retrofitted into existing plant and systems. These can offer an easy low-cost pathway for energy-efficiency upgrades.

Refrigerant leak detection –

Depending on the system size and refrigerant type, refrigerant leakage presents a financial, safety and energy-efficiency risk for owners. The installation of an automatic refrigerant detection system can help to reduce these risks. Refrigerant detection within very cold or well-ventilated areas may be technically difficult, but detectors can be installed around plant and at high-risk leakage points. Some systems can incorporate low-liquid-level alarms, and maintenance protocols should always include for regular leak surveys.

Audit all refrigeration equipment and record the •Make •Model •Year •Refrigerant type •Refrigerant charge size • Maintenance reports • Refrigerant replacement volumes and costs

Heat recovery –

Refrigerant desuperheater waste-heat-recovery systems can recycle rejected heat from a refrigeration system and use it to heat water or other fluids, while lowering refrigerant temperature and pressure, and so reducing energy input. Pre-heating water reduces the energy required for water heating while increasing the efficiency of the refrigeration system. Desuperheaters can be applied to any refrigeration system with reciprocating, rotary, scroll or screw-type compressors. Desuperheaters can be used for domestic hot water, hot deck reheat, space heating, subsoil heating (freezer and ice rinks) and process fluid heating. Desuperheaters are best installed on systems that have high annual cooling run-times and at sites that have a constant heating requirement. Greater amounts of waste heat are available from older, less efficient equipment.

New systems – Do it right the first time

Where systems are old, dilapidated or based on out-of-date technology, replacement with a modern energy-efficient solution is often the best long-term option. This is particularly true for CFC (R12) and HCFC (R22, R502) based systems.

Size really does matter –

It is important to have a clear definition of the refrigerated space required for your business needs. Oversizing the rooms or equipment “just-in-case” or selecting the “next size up” will impose an initial capital-cost penalty and ongoing energy-cost penalty. Specify exactly what you need and expect from your system. Poorly specified systems tend to have the lowest capital costs but the highest operating costs, as well as the shortest useful life. Ask your expert to pay particular attention to part-load energy performance during the system design.

Oversizing compressors (motor) and **undersizing** evaporators or condensers (heat rejection) is **bad** energy practice

Refrigerant types –

Systems can use a range of synthetic as well as so-called natural refrigerants. All refrigerants are dangerous if misapplied. Owners should demand accurately sized and leak-tight systems with high energy-efficiency and low safety risks.

Synthetic refrigerants such as R22, R134a, R404a and R410a have traditionally been used for these applications. R134a uses less power than most other HFCs, and pays back the extra capital cost in a few years. These refrigerants have high GWP. Natural refrigerant alternatives such as ammonia, carbon dioxide, and hydrocarbons can deliver good energy efficiency, zero ozone depletion potential (ODP), low global warming potential (GWP), and do not attract any environmental levies.

Best practice –

Things are no longer done the way they always have been. Ask for best-practice options including: thicker insulation, fast-closing automatic doors, highly efficient refrigeration plant, variable-speed compressors and fans, natural refrigerant options, application of secondary refrigerants for reduction of primary refrigerant charges, volatile secondary refrigerants for reduced pumping power and improved humidity control, reduced temperature differences across heat exchangers, reduced compression ratios, dual-stage compression, low-energy LED lighting, leak-tight pipe installation, desuperheaters, and modern control and defrost strategies. Ask the designer or contractor to identify the increased costs (from a standard package) and the running cost savings (compared to the standard package) over the expected life of the room or system. Ask for a total environmental warming impact (TEWI) analysis or a life-cycle cost (LCC) assessment.

The don'ts – there are some things you should never do

Don't – Disrupt system airflows. The evaporator within a room and condenser outside of a room need good airflow to operate. Never cover them up or in any way block the airflow to these components.

Don't – Spray water on an air-cooled coil. Air-cooled equipment is not designed for water spray, and this will introduce corrosion and microbial problems.

Don't – Ignore any warning signs or unusual operating characteristics. Know how the system runs when it is in good order, and be aware of changes that don't seem "right". Be proactive on prevention.

Further information

Only qualified engineers (look for M.AIRAH) and licensed technicians should implement energy-efficiency interventions. Interventions should be individually costed and their expected energy performance quantified before implementation. Energy-efficiency incentive schemes may impose additional implementation requirements.

www.enterpriseconnect.gov.au

www.business.gov.au

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<http://training.gov.au>

www.realskillseurope.eu

For a list of sites offering more info about incentives, energy efficiency and more, go to www.airah.org.au/Links

