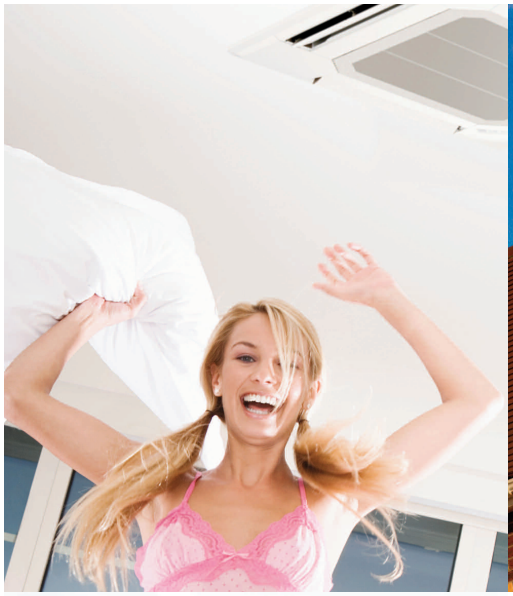
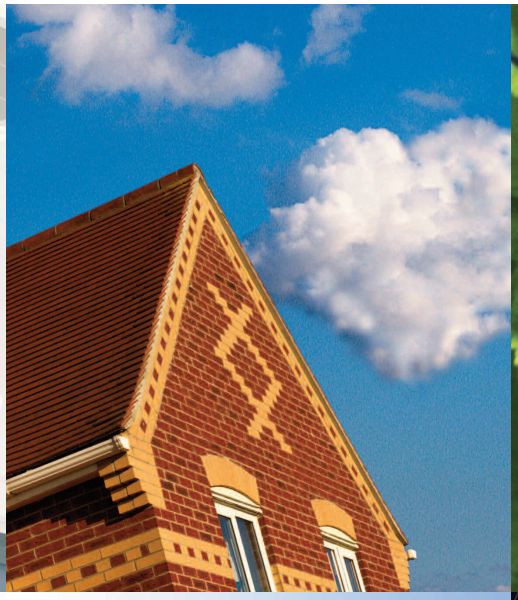


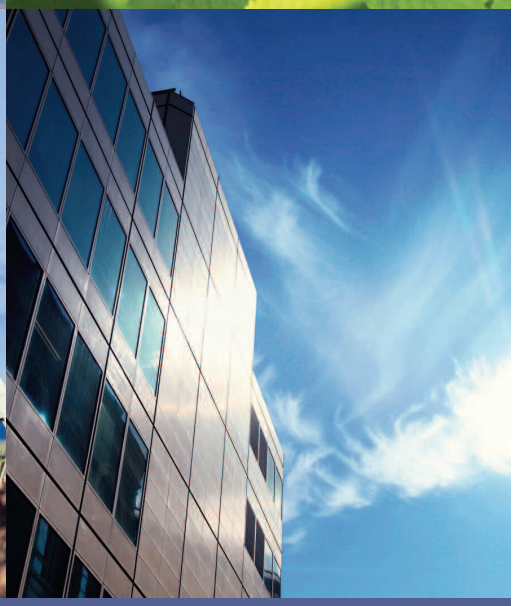

Information Guide:

Energy efficient technologies

Issue 28

CPD CERTIFIED
Construction CPD Certification Service

MITSUBISHI ELECTRIC
LIVING ENVIRONMENTAL SYSTEMS

Information Guide:

Energy efficient technologies

This is an independent guide produced by Mitsubishi Electric to enhance the knowledge of its customers and provide a view of the key issues facing our industry today. The guide accompanies a series of seminars, all of which are CPD accredited.

The changing face of construction in the 21st Century demands that designers, specifiers and suppliers work as teams to create better buildings - or occupants and the environment.

Mitsubishi Electric aims to be a part of this by encouraging employees and customers to work together to increase their knowledge of the latest technology, legislation and markets.

Contents

The drive for energy efficiency

While Global Warming Potential (GWP) provides a standard single number for assessing a refrigerant's impact on the environment, it does not tell the whole story. Unfortunately, GWP is currently being used by environmental lobbying groups, Government and opposition parties to justify moves to ban HFC refrigerants completely.

For many organisations energy costs are still smaller than other outgoings such as staff or property, but this type of price rise has a way of catching the eye of financial directors. And the price of energy seems set to keep on rising. As well as saving money, the need to be more energy efficient is being driven by important new legislation: the Carbon Reduction Commitment (CRC) Energy Efficiency Scheme. The aim of the scheme is to oblige qualifying public and private sector organisations to cut carbon emissions - not only in building energy use, but other forms of carbon-producing activities including transport.

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The CRC Energy Efficiency Scheme

The CRC Energy Efficiency Scheme starts in April 2010, although organisations have already been informed whether they qualify for the CRC. Although the scheme will apply to all forms of carbon production, the qualification criteria are based on building energy use and electricity in particular. If an organisation had one half hourly electricity meter settled on the half hourly market during the qualification year (2008) it is required to take action to comply with the CRC. Government estimates that the scheme will save participants 'around £1 billion a year by 2020 through cost effective energy management measures that are not yet being taken up'.

Qualification for CRC is based on electricity supply across organisations and groups of undertakings - not an individual site basis. Organisations that are a single entity (not part of a group) will need to establish CRC qualification across the sites that are part of that organisation. Organisations that are part of a group will be grouped under the highest parent undertaking. However, changes to the rules in October 2009 mean that large subsidiaries consuming more than 6,000 MWh can participate in the scheme separately from the group. There are certain other rules and exemptions for franchises, overseas parent companies and joint ventures, so it is important to double check on the Environment Agency website (see our Further Information section).

Qualification as a participant is based on total half hourly electricity supplied during 2008. If you use more than 6,000 megawatt hours (MWh) you must be registered as a participant in the CRC. If you do have a half hourly meter, but don't use that much electricity, you will be required to make an 'information disclosure'. It is important to make this disclosure, which can be completed online, by the end of September 2010, as fines will be imposed for each half hourly meter within your organisation which you have not disclosed. The aim of information disclosure is to ensure that all half hourly meters have been accounted for. Also, those organisations who take part in information disclosure will have to reassess their eligibility to take part in the CRC scheme's next phase.

Those private and public sector organisations taking part in the CRC Energy Efficiency Scheme will be expected to buy carbon credits, priced for the initial sale at £12 per tonne of carbon. After the initial purchase, these credits can be traded with other organisations – with a price set by the market forces of supply and demand.

Rules on refrigerant - an opportunity to increase efficiency

For building owners, finding sources of energy saving is increasingly important. Where organisations are in air conditioned buildings, other legislation is also coming into force which creates the opportunity to increase the energy efficiency of this equipment. The EU is targeting HCFC refrigerants for phase-out, and one of the most common of these is R22. There are two very important deadlines that building operators must bear in mind. The first is December 31st 2009, when the use and sale of all 'virgin' HCFCs such as R22 will be banned. It is important to note that this includes any refrigerant purchased before the deadline, use of which is also prohibited.

The second deadline is still a few years away, but one which will certainly affect purchasing and maintenance decisions much sooner. On December 31st 2014, the use and sale of recycled HCFCs will also be banned. The use of non-refillable containers for transporting or storing HCFCs is already banned. These two deadlines are set to have a huge impact on how building operators manage their R22-based air conditioning systems. R22 stocks are already depleting, creating price increases and leading to reduced availability for maintenance and servicing. An ill informed approach to the ban on HCFCs could prove expensive, and at worst leave a building without an operational air conditioning system.

It is possible for building operators to overcome the issues with R22-based air conditioning systems by replacing that refrigerant with a 'drop in' replacement. This is a comparatively low capital cost approach, however there are long-term implications. Drop in refrigerants rarely operate at high energy efficiency levels, so running costs for the equipment can rise. The process also involves removing all traces of R22, which is comparatively simple, but if the new refrigerant requires different oil, removing the old oil is more difficult. An alternative approach is to use the introduction of bans on R22 refrigerant as a sound reason to replace an older air conditioning system altogether. The latest air conditioning equipment offers up to 50% energy savings compared to older models. Modern technologies are now available from leading manufacturers which make this a very cost effective solution. The most up-to-date replacement techniques can make use of existing pipework, and in some cases even the existing wiring and controls can also be used. The units are replaced with new and more efficient kit, reducing installation costs and disruption to business.

The next section of this guide will examine other ways to reduce energy use in a cost-effective way, by tapping into free cooling, or using heat transfer technologies. The latest techniques and technologies can help organisations meet the requirements to reduce energy, and also save them money in the long-term.

Summary of the CRC Energy Efficiency Scheme

1 April 2010 - 31st March 2011
Introductory phase. Participants will not have to purchase carbon credits. They will have to report their carbon emissions.

1st April 2011 - 31st March 2012
An unlimited amount of carbon allowances will be available to participants at a cost of £12 per tonne of carbon. Participants will have to anticipate the number of credits they need for the year ahead, and purchase the correct amount. Extra weighting will be given to organisations which take early action to improve energy efficiency.

2013
Carbon allowances will be capped and auctioned. The price for credits will be set by the forces of supply and demand. Participants will be able to purchase credits from other organisations.

Technologies for efficiency
- transferring and recovering heat

There are numerous technologies available today which can help building owners and managers provide comfortable and productive indoor environments while taking a low-energy approach. Products which combine heating and cooling, or hot water production with air conditioning can be used to ensure that energy waste is minimised.

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Government studies show that the provision of heating and hot water accounts for over 50% of the energy consumed in non-domestic buildings. There are a number of technologies which can reduce the need for 'traditional' boilers. For example, heat pump technology works by transferring heat from one place to another in a building. Ground source and air source heat pumps are now well-known technologies in the UK commercial and domestic markets. They operate by taking 'warmth' from the ground or air and transferring this into the building. The key benefit of heat pump systems is their high energy efficiency. For example, an air source heat pump boiler can convert 1kW of input energy into 3.6kW of output energy.

Heat pumps can also be used to move heat from one area of a building to another. For example, a heat pump system can transfer excess heat from a variable refrigerant flow (VRF) air conditioning system to supply hot water. This means that heat from areas such as server rooms can be used elsewhere in the building, rather than simply wasted. Hot water production can therefore be virtually free to the building operator all year round.

Water-cooled VRF systems teamed with heat pump technology are ideal in the UK's temperate climate because they can also provide simultaneous heating and cooling in a single building. This is very useful where one side of an office is oriented towards the sun and tends to overheat, while the other side of the building is in shade. This helps to reduce the effects of occupant discomfort such as use of individual heaters or desk fans which use a disproportionate amount of energy.

Utilising energy that would otherwise be wasted is an important principle when looking to find every opportunity to save energy and cut spending on energy bills. Heat recovery units reduce the overall energy costs of a building by extracting stale air from a building, and recovering the heating (or cooling) energy to either warm or cool incoming fresh air.

Fresh air intake in commercial buildings is required by Part F of the Building Regulations, and it is important for occupant health and comfort. However, the fresh air taken into a building has to be heated or cooled before being circulated internally, so it can require extra energy to pre-condition. Using heat recovery can save up to 30% of the initial capital costs of heating and cooling plant, as well as giving excellent long-term lowered energy costs.

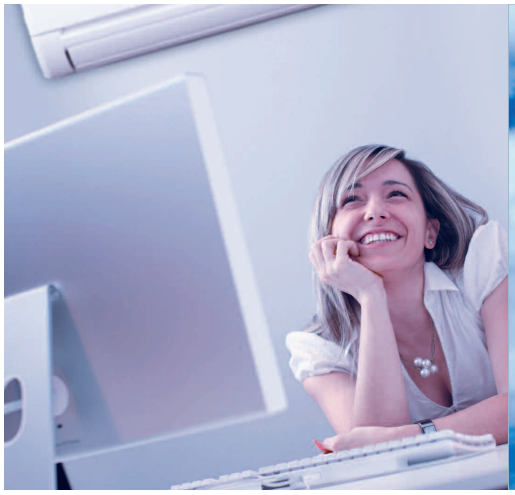
The usefulness of heat pumps and heat recovery technologies means that they are being applied to a growing range of products. For example, heat pump/heat recovery air curtains are proving increasingly popular in the retail sector. Air curtains have long been used to ensure that the busy entrances of commercial buildings suffer from minimal energy losses when the door is open. They also help the retail sector operate an 'open door' policy to provide uninterrupted access for passing trade without compromising comfort.

By linking the air curtain system to a VRF air conditioning system, excess energy can be diverted to the air curtain, and they can achieve COP efficiency levels of around 5.0. When connected to a VRF heat pump system, the air curtains require less than a third of the power of an equivalent direct electric heated air curtain - and are much cheaper to operate.

Technologies for efficiency
- free cooling and controls

As well as diverting otherwise wasted energy around the building or into hot-water production, it is also possible to tap into free cooling opportunities to reduce energy requirements. The mixed-mode technique is now easier to install in existing buildings, as technologies have been developed to enable easier retrofitting of such set-ups.

The mixed-mode cooling system is a combination of natural ventilation and comfort cooling. It is a servicing strategy that offers lower energy use, good indoor air quality along with predictable and controllable indoor temperatures. Outdoor air is drawn into the building by the natural 'stack effect', through the plenum of the ceiling void, for example. The mechanical elements are reduced, so energy is saved - along with maintenance costs.



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In using a mixed-mode approach, it is important to select an air conditioning element that is energy efficient. Inverter technology is vital to ensure that the cooling is efficient even at part loads. A mixed mode system with air conditioning works by sensing internal air temperatures. As daytime temperatures rise, passive ventilation is used to draw external air into the office space. At a certain point, internal temperatures will rise further, and the air conditioning will automatically switch on to provide what is known as 'spot cooling'. An added element in this type of system is night cooling. By drawing in cool night air while the building is unoccupied, warm air is flushed out of the building - keeping temperatures down the following day, and lengthening the time period when mechanical cooling is not required.

The aim of mixed-mode is that its operating method should reflect the external environment, and take advantage of the ambient conditions. The control system should therefore be able to track external and internal conditions, to optimise system settings. The natural ventilation aspect of the system also needs to be carefully balanced, with the control systems tracking elements such as wind speed and direction to ensure that the flow of fresh air is steady through the indoor space.

The control system plays a vital role in the mixed-mode approach. A lack of good control strategy can cause problems because the mechanical and natural ventilation elements of the system need to be carefully coordinated. For example, in hot weather, energy waste can occur because excess natural ventilation can impose an unnecessary fresh air load.

The importance of controls in any building (whatever the cooling and heating strategy) cannot be overstated. The Carbon Trust estimates that premises with good building controls can achieve heating bills between 15% and 34% lower than buildings with poor control strategies. And with air conditioning systems, for every degree that the system deviates from the required temperature, energy costs can rise by up to 5%. Controls also ensure that equipment life is extended by reducing unwanted or out-of-hours use.

Building controls give building operators the ability to monitor all parts of a building from a central location. This is particularly useful for large sites, or even across numerous retail outlets. Automated alarm calls can ensure that machinery is fixed before occupant comfort is affected. Machine-to-machine (M2M) controls technology is taking this a stage further. Using M2M means that the equipment sends messages directly to PDAs, mobile phones or email. The M2M technology platform allows users to integrate multiple sites onto one network. Many different types of equipment can be wirelessly connected to the M2M server, and use the GPRS network to communicate. Machines using this technology can automatically send signals once they detect a potential failure in any component - enabling the maintenance team to arrive on site with the correct part, reducing their call-out costs.

Balancing centralised control with the ability of occupants to set their own comfort levels is an important issue in many buildings. This is particularly true in hotels, where individuals will have their own ideas about what temperature is 'comfortable' for them. Energy use in the hotel sector is of increasing concern to those businesses, so controls which offer flexibility, but ensure energy efficiency are very important. Latest developments include controls systems for the air conditioning system which link to the hotel key-card system.

Once in the room, visitors must place their key-card into a slot in order to switch on the air conditioning for heating or cooling. The controls allow visitors a range of temperatures, but also have automated elements such as night set-back which mean that the air conditioning is not operating when not needed. Further links can be made to windows, so that if visitors open windows, the air conditioning switches to 'Off' automatically - thus saving large amounts of potentially wasted energy.

There are numerous technologies available that can save energy - from heat recovery and free cooling to highly flexible controls. It is up to the contractor to offer advice to end-users about the systems that will work best in their buildings and for their businesses.

Further information

You can find more information on the topic of **Energy efficient technologies** and related issues at the following websites:

www.environment-agency.gov.uk <http://www.environment-agency.gov.uk>
The Environment Agency will administer the CRC Energy Efficiency Scheme. This website contains the latest information and also background documentation.

www.mitsubishi-aircon.co.uk <http://www.mitsubishi-aircon.co.uk>
For details on the latest energy-saving technologies from Mitsubishi Electric, including heat pumps, heat transfer, mixed mode and controls.

www.berr.gov.uk <http://www.berr.gov.uk>
For information on the R22 phase-out regulations.

If you missed the CPD seminar on **Energy efficient technologies** you can call your Mitsubishi Electric Regional sales office to arrange an in-house presentation of this information.

Please call one of the numbers below:

London North East & East Anglia	**01707 282480**
London North West	**01707 282480**
London South West	**01689 881030**
London South East	**01689 881030**
London Central	**0207 9286810**
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Mitsubishi Electric's commitment to the environment
www.greengatewayinitiative.co.uk