MITSUBISHI ELECTRIC DIRECT
AIR CONDITIONING SYSTEMS

Information Guide

The Energy Performance of Buildings Directive (EPBD)

CPD CERTIFIED
Construction CPD Certification Service

Issue **Two** >

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Further Information

A lot more development is needed to bring the EPBD to a point where its requirements are workable. Energy labelling buildings and organising regular assessment of air conditioning systems are just two of the major challenges. Ideas on how to tackle these are still under development. To stay ahead of what's happening, take a look at these websites:

www.breeam.org
The BRE Environmental Assessment Method is the voluntary measurement currently used to grade buildings for sustainability. This website describes how BREEAM works, and gives details on the requirements for an 'Excellent' rating.

www.diag.org.uk
The Directive Implementation Advisory Group (DIAG) was set up to help the UK Government bring the EPBD into UK law, and to make it work. This site contains useful information on how this work is progressing, as well as good background on the EPBD.

www.europrosper.com
This is the website for the Europrosper team, which has worked on developing one proposed method for labelling new buildings as required by the EPBD. A new project on energy labelling has just started, and will deal with making this method work for existing buildings.

www.ukace.org
The Association for the Conservation of Energy website contains interesting articles on reducing energy use in commercial and domestic buildings.

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

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The Energy Performance of Buildings Directive (EPBD)

Information Guide

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 - for 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

What is The Energy Performance of Buildings Directive?

The Energy Performance of Buildings Directive (EPBD) is a concerted effort across the European Union to reduce the energy used in buildings, both domestic and commercial. This strategy springs from the EU signing up to the international Kyoto Protocol, which deals with climate change on a global scale. Under this agreement, the EU member states must collectively reduce greenhouse gas emissions by 8% compared to 1990 levels. The deadline for this is 2012. The Kyoto agreement also says that 'demonstrable progress' must be made by 2005.

Calculations show that 40% of Europe's energy is spent on heating, lighting, cooling and running our homes and offices. The EU estimates that by 2010 we could save 22% of the energy used in buildings. This would represent 20% of the cuts required by the Kyoto agreement.

The EPBD, however, is not just about cutting energy use. It is also a response to concerns in Europe about the security of its energy supplies. The EU will become increasingly dependent on external sources for its energy. Current forecasts show that by 2030 Europe will import 70% of its energy. Efficient use of our existing resources is becoming more important.

The EPBD includes four key tasks for each member state to implement:

1. Develop a general framework for calculating the energy performance of buildings. This would be a measurement of how much energy a building uses for its lifetime. The methods used to calculate energy can differ from country to country.

2. Set minimum standards of energy use and performance for new and existing buildings.

3. Introduce energy certification of buildings. In theory, this would work the same way as energy labelling on domestic appliances such as fridges. A-rated appliances have excellent energy efficiency; a G-rating is poor.

4. Instigate regular inspection and assessment of heating and cooling installations by independent inspectors.

Minimum standards

The EPBD requires member states to ensure that buildings, and their heating, cooling and ventilating systems, are designed to ensure low energy consumption. The standards have to be flexible, to allow designers to create comfortable environments for occupants. The minimum standards can be expressed as simple energy indicators.

For new buildings with a total useful floor area over 1000m^2, countries in the EU must ensure that before construction starts feasibility studies are carried out on alternative systems such as:

- Heat pumps
- Decentralised energy supply systems
- Combined heat and power (CHP)
- District or block heating or cooling

Refurbishment work also falls under the EPBD. Renovations over a certain value will also be subject to minimum energy standards. This will apply in buildings over 1000m2 where "the total cost of the renovation related to the building shell and/or energy installations such as heating, hot water supply, air conditioning, ventilation and lighting is higher than 25% of the value of the building."

Building certificates

This is one of the most controversial aspects of the EPBD. The idea is to raise awareness among occupiers, property managers and developers of the importance of energy efficiency. If an A rated building becomes a more desirable asset, then more energy efficient buildings will be created to meet the demand. The theory is based on the programme of energy labelling household appliances, which has proved so successful in increasing demand for A-rated appliances among consumers.

However, measuring the energy use of a building at design stage and beyond is more complex than assessing a fridge. The EPBD states that when buildings are constructed, sold or rented out, an energy performance certificate must be made available to the owner, or by the owner to the prospective buyer or tenant. These certificates will have a life of ten years.

The aim of the certificate is not to give a theoretical performance indicator. It must describe the actual energy performance of the building, and may be revised accordingly - that is, a building may begin life with an A rating, but will see this slip if maintenance and refurbishment is not carried out. The certificate will also be accompanied by "recommendations for the cost-effective improvement of energy performance."

The EU is encouraging public authority buildings, "and buildings visited frequently by the public" to set the example and display energy certificates so that the public can learn more about the principles of saving energy.

Regular inspection

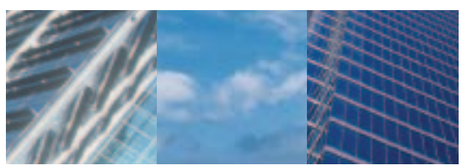
The EPBD requires "regular inspection" of air conditioning systems of an effective rated output of more than 12kW. This would include assessment of working efficiency and sizing, compared to the actual requirements of the building. Advice should be given to users on possible improvements, or replacement of the air conditioning system, and on "alternative solutions". Boiler systems are to be treated in a similar way.

Another aspect of inspection, is that it is to be carried out "in an independent manner by qualified and/or accredited experts, whether operating as sole traders or employed by public or private enterprise bodies".

Clearly, the number of individuals required to carry out these inspections across the UK and other EU member states is enormous. Estimates go as far as 20,000 trained inspectors for commercial inspections; and 7,000 for the domestic sector. This is why the legislation comes into force in 2006, but member states have three years after this to train enough people to carry out the work.

Making it work

The EU is a huge geographical area, with a broad range of climates. To set standards across the whole Union would be unrealistic. This is why member states have the responsibility for developing and deciding how to measure energy use; how to carry out certification; and how to educate their domestic markets on the whole process. The Government will incorporate its plan for transposing the EPBD into UK law in the new Part L of the Building Regulations, due out in January 2006. From that point, the UK will have three years before it must enforce new energy efficiency standards on new and existing buildings; display energy certificates; and start the programme of inspections.



Measuring Up

A look at ideas for calculating energy use in buildings and allocating grades

There are three stages in a building's life when energy performance can be measured. Firstly, the design stage. A calculation of energy performance can be carried out based on the design concept. Any energy measurements at this point are theoretical, and might be carried out as part of a submission to building control to win planning permission.

The second stage is after construction. The Government proposes that the calculation of energy performance would be based on the building as constructed, to include any effect of the variations in design or specification from the initially approved design. This measurement would take into account information generated during commissioning such as building air tightness, commissioned fan powers etc. The calculation would reflect the quality of the asset being handed over by the construction team to the client, and hence the energy performance measurement would be known as the Asset Rating.

The third stage in the life cycle of a building is in-use, with energy performance measurements based on actual metered energy consumption. Clearly the design of the building has an effect on energy used, but maintenance and operation will also play an important role. An energy performance measurement at this time would be called the Operational Rating. The Government suggests a minimum of three years after construction before an Operational Rating is given - two years to settle in, and one year of stable operation.

The Operational Rating could prove very useful for example to a tenant who may be taking part of a building, and has to meet a proportion of the cost of landlord services. In this context, the tenant would want to understand how the building as a whole operates and how this influences their future costs. Also, even if the whole building is being purchased, the Operational Rating will show the buyer how well the building has performed historically, and this would be a good indication of the manageability of the building and its services. The EPBD requires that advice on improving performance must be given when a certificate is awarded, and measuring in-use energy performance (for the Operational Rating) would give assessors a good idea of where energy can be saved.

It should be noted that in spite of the obvious usefulness of the Operational Rating, the UK Government feels that it is only obliged by the EPBD to provide an Asset Rating on buildings. This is a strict legal interpretation of the (rather vague) wording on the EPBD. Based on past experience, the first stage of EPBD implementation may require only the Asset Rating, with the Operational Rating made mandatory at a later date. However, the Government wants to encourage voluntary use of the Operational Rating and it has suggested that Action Energy will be charged with this.

Putting it into action

The EPBD states that the Asset Rating should be given to prospective purchasers or tenants of new or existing buildings. This means that the certificate must be prepared when a building is sold or let. Government envisages a rolling program of energy measurement and Asset Rating calculations. This would make the process of allocating energy certificates much more manageable than trying to certify every building in the UK between 2006 and 2009. Organising the process of certification is difficult enough, but the challenge of working out how energy performance of a building can be calculated is far greater. The method used must be straightforward, easy to carry out, applicable for all buildings, create easily compared results and be available to all.

At a very basic level, the Government has to decide whether the Asset Rating reflects the carbon emissions of the building, or the level of investment in energy efficiency measures. It looks as though there is a strong pull towards the latter, as it is felt that this is more easily comparable across buildings.

There is much still to be decided on how the EPBD will manifest itself in the UK construction and property industry. One thing is clear though, if the certification of buildings is adopted then developers and owners will be looking to equip their buildings with plant that has a proven record of energy efficiency.

Whatever approach is taken to energy performance measurement, if HVAC systems are as efficient as possible, then there is a much better chance of gaining a good Asset Rating. And while the Operational Rating will probably be voluntary for some time, good maintenance of systems will be required in order to retain a good rating when selling or renting out the property. While the debate on implementing the EPBD continues, forward thinking suppliers will be aware that energy efficient products are their best asset.

Looking Forward

From 2009, every element of a building will have to be considered if it is to win an A rating under the EPBD. The buildings of tomorrow will be designed to create more thermal mass and minimise solar gain, with smaller windows and a lot less use of glass.

A lot more consideration will also be given to less visible aspects of the building. The office building of the future will be procured differently. The legislative drive towards sustainability, energy efficiency and keeping records of energy use will put greater emphasis on whole life costing. The long-term view of the costs of equipment will outweigh the capital cost, and customers will demand that suppliers can show evidence of running efficiencies and costs for all their products.

Beyond running cost

We can safely assume that, in the future, buyers will be much more aware of the importance of how well air conditioning equipment, for example, runs at part load. Already, there is a growing concern among building services engineers that such equipment rarely runs at full capacity, and that achieving energy efficiency at part load is more of a challenge for equipment suppliers.

In future buildings may tap into what are now considered more unusual forms of energy, and new techniques which are not only energy efficient but also meet other requirements such as saving water use. From the air conditioning point of view, use of boreholes and heat recovery could be more prevalent in years to come. Using boreholes is energy efficient and can use otherwise concealed sources of water. For example, the Zetter Hotel in Clerkenwell, East London uses energy efficient heat recovery air conditioning units. Here, the air conditioning is cooled by water pumped from a bore hole which sinks 130m below the building, into a natural underground lake. The other energy efficient aspect of the system at the Zetter Hotel is double heat recovery. First, extraction of heat from the underground water source, and then heat recovery between condensing units and then the indoor units, so the system provides maximum efficiency at all times.

Getting control

The technology which controls buildings is also moving forward rapidly. Advanced building energy management systems (BEMS) and equipment controls will aid the efficient running of buildings, from the air conditioning system to car park security. The latest generation of controllers use the Internet to enable them to communicate with any other piece of building services equipment. The new controllers give users access to all control functions from a PC, and to receive malfunction alarms on their mobile phone. They can control up to 50 indoor units. The systems can also connect to almost any network of computers via Ethernet. Using Programmable Logic Controller (PLC), signals can travel between the air conditioning controller and other plant such as supply air/extract fans, window contacts, card-key readers and passive infrared detectors.

The most important aspect of a future building will be that it can be easily managed by the facilities team. Usable controls will be key to ensuring overall energy efficiency. Unless facilities managers understand and use the controls correctly, there is little point in installing the technology.

Measurement and assessment will play a greater role for office buildings of the future than they do today. Facilities manager will have to keep records of energy used by each part of the building, retain log books for boilers and air conditioning systems, and ensure that their energy label rating doesn't slip.

What will it cost?

One of the key questions about the future of buildings is how much more (or less) they will cost. What will the extra cost of creating an A rated building be, compared to a C rated office, for example? Because so little is known about how the building labels will be applied, there hasn't been much research in this area. However, cost consultants Davis Langdon Everest (DLE) have briefly considered the costs of sustainability at a conference in May 2004, titled *Is Sustainability Sustainable?*

DLE considered the range of options available to developers investing in sustainable and energy efficient buildings. There are some low-cost options, with relatively quick payback, such as building orientation, or passive environmental enhancements (such as solar shading). The additional costs of these were estimated at around 2% to 5% of construction costs (at current prices).

More advanced measures, such as active environmental controls, or enhanced low-energy building services could command an additional 5% to 10% of construction costs.

The clear message is that long-term thinking is required from all parts of the market. Manufacturers must invest in developing more efficient products now with a view to an increasing market share; specifiers must look beyond capital cost and ask for information on equipment running costs and part load efficiencies; and developers must invest in A rated buildings, with a view to payback over the lifetime of the building.