MITSUBISHI ELECTRIC
AIR CONDITIONING SYSTEMS

Information Guide

Renewable Energy Sources

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Issue **Fourteen** >

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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.

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Going green - the drive to use renewable energy sources

In the 21st century, energy is one of the biggest issues of our time. The main concern is to reduce energy use, and to find alternatives to fossil fuels such as coal, oil and gas. In 1992, the UK Government signed the Kyoto protocol, an international agreement aimed at mitigating the global effects of climate change. Under this, we agreed to reduce greenhouse gas emissions to 20% below 1990 levels by 2010.

However, apart from mitigating the effects of global warming, there are additional reasons for wanting to find alternatives to fossil fuels for the UK. In 2005 74% of the UK's electricity was generated from fossil fuels. We already import 50% of our coal; in 2006 we became net importers of gas; and 2010 will see an end to the UK's oil independence. Security of supply is therefore a major consideration.

Europe itself will be a net importer of energy by 2030, and one of the most publicised achievements of the UK's presidency of the EU was persuading the 27 member states to sign up to increasing the EU's use of renewable fuels by 20% in 2020. This is now one of a number of objectives for the UK on reducing carbon emissions and using more renewable energy sources.

As part of the drive to reach the renewable energy targets, the Government also introduced a target for generating electricity from renewable energy sources - 10% by 2010. There is also an 'aspiration' to double this by 2020. This won't be an easy target to reach. In 2005, only 4% of the UK's electricity was generated from renewables. To meet the 10% target around 10,000 megawatts of renewable energy would be needed - about 4,000 wind turbines or two hundred 50 megawatt biomass power stations.

Local authorities have been encouraged to promote use of renewable energy through the planning system. PPS22 gave councils the power to use the planning system to insist on a certain percentage of on-site renewable energy on new domestic and commercial building projects. Depending on location, designers can be faced with on-site renewables targets of between 10% and 20% of the project's projected energy use.

At a large-generation level, the Renewables Obligation was introduced in April 2002 and requires all licensed electricity suppliers in England and Wales to supply a specified proportion of their power from renewables. However, there are technical problems to overcome. Greater levels of renewable generation will require investment in the transmission and distribution networks.

Greater use of renewables mean that the electricity generating market will shift away from the dominance of very large generators, to a wider range of generation sizes and technologies. Renewables also produce fluctuating levels of power which must be accommodated into the existing system. This raises the question of how the smaller generators will be integrated into the existing grid system. This is both a technical and a commercial point.

Of course, the route to greener energy is not an easy one and with politics thrown into the mix it gets tougher. For example, although the EU states agreed to increase use of renewables, compromises over each nation's share of the burden for reaching the target are still to be negotiated - and that will be the hard work.

Some countries faced with similar energy concerns view nuclear power as an alternative to carbon producing fossil fuels. When agreeing to greater use of renewables in Europe, in what was viewed as a concession to France, the text of the agreement recognised the importance of nuclear energy in reaching the targets for CO_2 emissions cuts.

Many of the UK's older nuclear power stations are to be phased out, but last year the Government said it would give the go-ahead for the private sector to fund construct and operate new nuclear plants. Whether this remains the case for a new Government remains to be seen. But nuclear plants take time to come online, and wouldn't make a contribution to the UK's electricity requirements until at least 2016.

The energy debate is complex, with various organisations pushing their own agendas. One thing is clear though, however we are generating and using energy now, we won't be doing it the same way in ten, or even five, years' time.

The 2007 Energy White Paper - Some key announcements made in June this year

- A requirement for new meters to come with a real-time display from 2008 and a short term offer of free displays from energy suppliers for households to 2010. In addition, the Government is encouraging the introduction of smart meters, also with displays, in the household sector and for small firms and expects everyone to have a smart meter within 10 years, whilst requiring smart meters for all but the smallest of businesses in the next five years.
- A consultation setting out how the energy efficiency of consumer electronics will need to improve is published.
- A consultation to double energy suppliers' current obligation to deliver energy efficiency measures to customers through a new 'Carbon Emission Reduction Target'.
- A cap and trade 'Carbon Reduction Commitment' for large commercial organisations such as banks, supermarkets and large local authorities.
- A 'Distributed Generation' Report is published including simplification of energy market and licensing arrangements for localised energy by the end of 2008 and clearer export tariffs from all six major energy suppliers for microgenerators to sell excess electricity.
- Legislation to band the Renewables Obligation to benefit offshore wind, wave, tidal and other emerging technologies. The cap on the amount of co-firing generation qualifying for support will be removed.
- Publication of a Biomass Strategy as well as a response to ' Creating Value from Renewable Materials' - a two year progress report on the Strategy for Non - Food Crops and Uses.
- Detail on the competition announced in the Budget to build the world's first end-to-end Carbon Capture and Storage plant, which will deliver at least 300MW capacity, 90% CO_2 saving, and be up and running between 2011 and 2014.
- Legislation to allow the storage of natural gas under the seabed and unloading of Liquefied Natural Gas at sea.
- A three month deadline within which DTI will make consent decisions on large scale energy projects, pending more radical reforms set out in the Planning White Paper.
- A new energy market information and analysis service from this autumn.
- A Low Carbon Transport Innovation Strategy is published backed by funding of £20m for public procurement of low carbon vehicles, an up to £30m R&D 'Innovation Platform' and £5m additional funding for the Energy Technologies Institute.

In addition, published alongside the White Paper, are:

- A new consultation on the Government's preliminary view that it is in the public interest to give private sector energy companies the option of investing in new nuclear power stations. A 20 week public consultation running until 10 October starts today.
- A related consultation setting out the proposed 'Justification' and 'Strategic Siting Assessment' processes for new nuclear power. A 'pre-licensing' process has separately been started by the Health and Safety Executive. Work on all three of these facilitative actions will be on a contingent basis alongside the main nuclear consultation. We will review whether to continue with this work in the light of the main consultation responses.

Green generation - supplying the country

Renewable energies fall into a number of categories: large scale centralised generation; on-site local generation; electricity production; heat production.

A brief examination of centralised renewable energies shows that in the UK biomass, hydroelectric and wind are the most common and currently viable forms of large scale centralised generation available.

The latest DTI figures show that biomass accounts for around 80% of renewable energy sources in the UK. The majority of this came from landfill gas and waste combustion. Biomass is obtained from organic matter such as plants and sewage, or from the bi-products of industry such as straw from agriculture. In fact there is a wide variety of materials that can be used to produce heat and electricity, from waste wood and straw to slurry and chicken litter. There are also 'energy crops' grown specifically for biomass, such as coppice, willow and poplar.

Depending on the 'fuel' used, energy is created from these sources by burning, rapid decomposition, gasification, fermentation or anaerobic digestion - decomposition by bacterial action. In future, the supply of landfill gas will shrink, so it seems likely that more small scale regional projects will be promoted, and the growth of energy crops.

Hydroelectric generation, with turbines placed in the flow of water to rotate and create electrical energy, currently accounts for only 0.8% of the UK's electricity generation. It is a proven technology, but for the UK opportunities to increase its large scale use are limited as most commercially and environmentally viable sites have been used.

It seems likely however that small scale hydroelectric schemes could be encouraged in the future. According to DTI figures, if small scale hydroelectric power from the streams and rivers in the UK could be tapped it would be possible to produce 10,000 gigawatt hours per year - enough to meet just over 3% of our electricity needs.

The British Wind Energy Association (BWEA) states that there are currently around 1800 wind turbines in operation at 137 sites in the UK. These give a total installed capacity of just over 2,000 megawatts, just over 1% of UK electricity supplies and enough for 1 million homes.

There is huge potential for growth here - some EU countries produce 20% of their electricity requirements from wind energy, so the UK has a long way to go. The BWEA claims that wind energy can play a key part in meeting the 10% renewables by 2010 target. It would mean that onshore and offshore wind farms would be supplying 8,000 megawatts - about 2400 turbines split equally between land and sea sites.

One of the big challenges for the Government if it wants to promote centralised renewable energies is the current national grid. If the 10% renewables target is met, this will involve a change in the geographical distribution of generating capacity. Infrastructure must be in place to transmit the power generated from renewable sources, particularly remote regions, to where it's needed.

However, the main problem for the Government is that centralised generation of electricity is a time-consuming approach to meeting our need for energy. Even with Government backing new wind farms and hydroelectric plants take years to come 'online'.

Another factor affecting energy delivery is that the balance of how energy is used in our homes will change. Between now and 2050, the building stock will increase by more than 30% - and these new homes will be built to high standards of air tightness and energy efficiency. As a result, the homes won't use as much energy for heating, but domestic appliances will still swallow up a lot of energy - about 70% to 75% of a home's energy requirements will be to run washing machines, dryers, televisions, home computers and other electronic equipment.

So different approaches to energy delivery are required, with energy generated at the home, development and district level. Our next feature looks at the Government's plans for meeting our energy needs in the future.

Going green - local level

Until last year, the Government's renewable energy generation policy focused on grid-end projects: large scale electricity production by methods such as wind farms or harnessing tidal power.

While there are clear benefits to moving away from a dependence on fossil fuels for large scale electricity generation, projects on this scale take time to deliver - and the UK has pressing carbon reduction targets to meet.

In the 2007 Energy White Paper, the Government's view is that a combination of new and existing technologies are opening up possibilities for carbon reduction by producing power and heat at the local level. The White Paper mentions microgeneration, district heating schemes as well as combined heat and power. Biomass is an option which the Government sees as cost competitive with fossil fuels for some purposes - a further report on developing biomass fuels was published with the White Paper.

A number of new pieces of legislation, along with Government-backed guidelines have already been introduced to support greater use of renewables at the local level. The recently launched Code for Sustainable Homes sets new targets for energy efficiency and use of renewables in dwellings - and is regarded as a forerunner to similar guidance for commercial buildings.

The market is also reacting to the Government's carbon reduction targets - more and more local authorities are adopting on-site renewables targets; and in the non-residential markets required BREEAM ratings are being set by clients at ever-higher levels.

A challenge for housebuilders in the future is that while they will be expected to demonstrate a renewable energy element in new developments, our homes will be using increasingly power-hungry appliances including plasma screens, dishwashers, dryers and larger fridges. This means that energy efficiency will remain at the top of the agenda for a long time to come, as the higher costs of investing in renewable energy sources mean that we cannot rely on the continuing availability of cheap power for homes or businesses.

It is crucial that if the homes of the future are to operate on a large percentage of renewable energy, then they must use equipment which also reduces the amount of power required. For example, solar thermal hot water production is likely to become more common. Heat pumps also offer an excellent way to maximise energy input into a building, with 1kW of power input producing around 4kW of heat.

Energy source	Benefits	Problems and challenges
Photovoltaics	Integrate with building architecture; proven technology with recent advances increasing efficiency.	Capital cost is high and payback period is still very long.
Wind turbines	The UK has great potential for using wind power; recent developments created more efficient turbines for use on buildings. Cost is reasonable and falling.	Requires careful design and installation in the urban environment; need to be able to store energy to allow for 'down time'; wind power is seasonally affected. Turbines larger than 15kW require a crane for installation, adding to costs.
Combined Heat and Power	Produces power and utilises cogenerated heat for space heating. CHP can be driven by fossil fuels, or renewable sources (eg biofuels). Provides a decentralised power source which is more efficient than the traditional grid supply.	Homes fitted with CHP are still connected to the mains, and have back-up gas boilers.
Solar thermal	Produce hot water for domestic use, as well as for space heating. Use direct and indirect solar energy.	May not always be suitable for high density urban environments
Biofuels	Use a wide variety of organic materials to produce energy and heat through a number of processes including burning, fermentation, anaerobic digestion. Strong support from Government for further development and use of biofuels.	Biofuels are considered carbon neutral because the CO_2 released during the process is balanced by that absorbed during the life of the plant material. But this doesn't take into account other carbon emissions caused by their growth, transport etc. There is also some controversy about growing crops for fuel rather than food, particularly in poorer areas of the world.
Heat pumps	A highly efficient way to use energy to create heat. Approximately 1kW of energy produced 4kW of heat. Uses electricity which can be generated from fossil fuels or renewable sources.	

Further information

www.dti.gov
Links from here to the Renewables Advisory Board, as well as copies of the latest Energy White Paper 2007.

www.communities.gov.uk
Click on the link 'Planning, building and the enviroment' for information on local government and renewable energy sources.

Mitsubishi Electric Guides
Previous Mitsubishi Electric Guides are available which cover the Energy Performance of Buildings Directive and Part L of the Building Regulations.

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

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