The Renewable Solutions Provider

Making a World of Difference

Green Gateway

The way we do business

MITSUBISHI ELECTRIC

LIVING ENVIRONMENTAL SYSTEMS

Air Conditioning | Commercial Heating

Domestic Heating | Photovoltaics

Making a world of difference

Climate change, fuel security and fuel affordability are major challenges confronting the UK. As the biggest consumers of energy, buildings must be part of the solution. To make this happen, people in all areas of the sector – from construction through to renovation – need to change the way they think and work together. Dialogue is key.

Building the UK's greener future

Radical change to how we produce and consume energy is required. And not just because our national fossil-fuel supplies are dwindling, along with our energy independence. Other key drivers, from climate change and fuel poverty to Government legislation and increasing consumer pressure, are at work too. Our domestic and commercial building stocks – characterised by a disproportionate number of old structures and a slow rebuild rate – remain massive consumers of energy. To reach the ambitious emission reduction targets the UK has set itself, our occupied spaces have to be made more energy-efficient, less carbon-intensive and incorporate renewable energy where possible. The good news is that many of the solutions are affordable, scalable and available now.

Our credentials: Living Environmental Systems

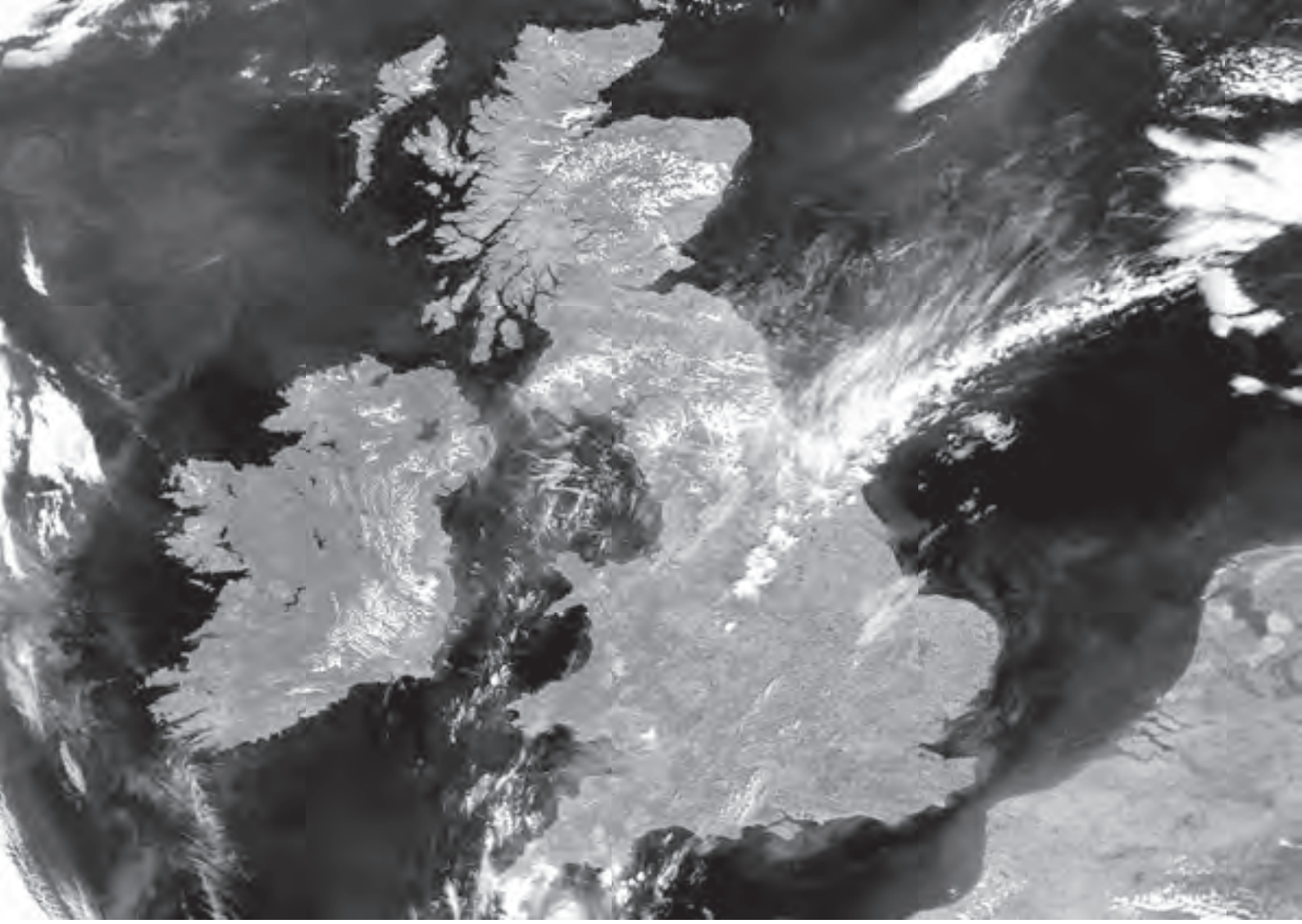
We are Mitsubishi Electric; a market leader in providing solutions to heat, cool, ventilate and power your world – or Living Environmental Systems as we like to call them. As a major manufacturer of some of the pivotal technologies, we hold the UK's energy challenges close to our heart. We want to help the nation achieve its climate goals; we want to help individuals to reduce their energy consumption while in buildings and reduce running costs. But we can't do it alone.

Opening the door on dialogue

We long foresaw that a change of thinking would be needed and this triggered our Green Gateway Initiative in 2007. Since then the challenge has got bigger and the opportunity broader. How we make our buildings habitable is going through its biggest change since we moved from solid fuel to gas and oil to heat our homes.

At Mitsubishi Electric Living Environmental Systems, we've evolved and our areas of expertise go way beyond air conditioning alone. Today, along with advanced air conditioning systems that recover heat, we also specialise in dedicated commercial and domestic space and water heating, and heat-recovery ventilation – all with associated monitoring, controlling and reporting – and photovoltaic systems for power generation.

Green Gateway thinking aims to open a dialogue between everyone in the construction industry and to show how the required transitions will impact on all our lives. We're encouraging others to reassess and realign their businesses and to interact more with other parts of the supply chain. We want everyone to work together to deliver the right solutions.



Now is the time

Product development alone is not enough. It's time for us all to interact and share knowledge across the decision making, specification and supply processes. Our updated Green Gateway draws a course for the next three to five years. It aligns us with the Government's target for a 34% reduction in greenhouse gas emissions by 2020 (relative to 1990 levels), with an eye on the long-term goal of an 80% reduction by 2050.[1]

Preserving comfort, pushing for change

Here in the UK people have become used to certain levels of comfort, convenience and instantaneous response. Perhaps this explains the UK's attachment to the little blue flame; but that little blue flame is growing ever smaller.

What's required now is an evolution in attitudes and actions. By contrast with continental Europe – where renewable energy systems have been used in homes for years – the UK has been energy rich, with fuel economy and energy efficiency being low priorities. However, as our nation's reliance on imported fuels has increased, so too has the need for energy responsible behaviours.

Making the vision a reality

The original Green Gateway model started a dialogue with some of the UK's largest and most respected institutions, companies and local authorities that are now challenged by new UK and European policy. Since Green Gateway was launched, we've been quietly developing, collaborating, educating and honing our approach. In 2007 we developed our proactive approach to reducing emissions and driving purchasing and behavioural change within UK buildings. As of March 2011, Mitsubishi Electric customers had achieved CO_2 savings of 85,301 tonnes and reduced the running costs of their buildings by over £12 million. We consider the savings made so far to be a good start. But we know more is possible and how even greater savings can be achieved.

Growing greener together

Today, we have extended Green Gateway thinking across our organisation, our partner channels and our customer base. We want this philosophy to be understood as "how we do business"; through it, we aspire to be a beacon for best practice within our industry. The whole world – from entrepreneurs to governments, from CEOs to investment managers – is talking about a low-carbon future. We have become part of a wider conversation.

1 http://www.decc.gov.uk/en/content/cms/emissions/carbon_budgets/carbon_budgets.aspx

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Key market drivers forcing the agenda

Growing awareness and evolving values are driving Government, businesses and individuals to demand greener, more affordable and socially acceptable energy technologies. It is up to all of us in the industries concerned to forge a plan and ensure we're ready and fit for the future ahead.

Fossil fuel challenges

Three primary goals are identified by the Department of Energy and Climate Change (DECC):

- Reducing CO_2 emissions by 80% compared to 1990 levels by 2050
- Ensuring energy supply meets demand
- Achieving a secure energy system for the UK

Green Gateway is totally aligned with meeting these goals and underpins our ongoing dialogue with central Government.

Climate change – different solutions for buildings

As low-carbon thinking changes industry and customers' buying behaviour, the UK's buildings still need heating and sometimes cooling – only differently. Our Green Gateway strategies focus on creating fact-based arguments for the alternative solutions we propose and ensure that the right solution is applied in every case.

Fuel security – the drive to rebalance

More and more important for Government strategy is the issue of fuel security. It's predicted that in coming years 70% or more of the energy the UK uses will be imported.[2] We depend on international energy markets including Norway, Qatar and Saudi Arabia, which face growing demand from emerging markets such as China and India. We need a more balanced energy supply in terms of both source and type.

Fossil fuels will remain a part of the mix for the foreseeable future, but it's accepted that we need to rely less on these and to increase the proportion of renewable energy. When people use renewable energy, they become more connected with their consumption and this can help reduce it. Buildings with renewable technology not only provide some level of visible energy independence, behind the scenes they also consume less primary energy, thereby assisting fuel security.

2 Energy Security: A national challenge in a changing world. Review by Malcolm Wicks MP, August 2009

Fuel prices – the struggle for affordability

The need to maintain an adequate heating level in homes coupled with rising energy prices has increased the number of households that need to spend more than 10% of their income on maintaining a satisfactory heating level.[3] Tackling "fuel poverty", as this is termed, means reducing the cost of running our homes' heating systems and introducing different heating technologies. Installing adequate insulation, as promoted by the Government's Green Deal is crucial too and will make the transition to lower-carbon heating options much easier. Some 82% of energy used in homes is for heating space and water.[4] Mitsubishi Electric promotes microgeneration as having a key role to play in meeting this demand.

Powered by the people

Public attitudes are evolving along with the requirement to make energy consumption more visible and this is creating a change in opinion in favour of renewable technologies. To make the most of this, we need to demonstrate to consumers the environmental and financial returns of these solutions.

Easing the greening

"Being green" can be seen as demanding time and space in people's increasingly busy lives. However, when it comes to heating, ventilating, cooling and powering buildings, there already exist scalable and publicly acceptable alternatives requiring minimum input from the end user. The latest and readily available renewable heating technologies outperform today's more familiar systems against key criteria (see page 27). We can be confident that today's children – tomorrow's consumers – will demand an economy that's low carbon. In the face of increasing public and Government pressure, Green Gateway continues the discussion on persuading all concerned parties to pursue the right energy solutions.

3 Annual Report On Fuel Poverty Statistics 2010, DECC

4 The UK Low Carbon Transition Plan – Page 80

Government – leading with legislation and incentives

Vast in volume and scope, a wealth of Government legislation and analysis confirms the UK's standing as a world leader in tackling climate change. To speed the take-up of replacement energy solutions that are viable in the long term, there are also major incentive programmes.

Taking responsibility

Consecutive UK Governments have been consistently committed to more sustainable energy use and solutions. Central to this agenda is helping – and in some cases compelling – individuals and organisations to take more responsibility. Given its sheer volume, breadth and depth, the emergent analysis and legislation demands far greater levels of cooperation and communication. This is where the opportunities start for an industry that wants to be fit for the future.

2050 Pathways Analysis

The Department of Energy and Climate Change's 2050 Pathways Analysis enables us to consider some of the choices the UK faces over the next 40 years and the resulting trade-offs.[5] This report covers all parts of the economy and all greenhouse gas emissions in the UK. It shows we can meet the CO_2 emissions reduction target in a range of ways and highlights the importance of taking actions today to avoid locking in years of poor performance.

The Code for Sustainable Homes – targeting emissions

The Code for Sustainable Homes (CfSH) requires new homes to meet ever improving standards to reduce their overall emissions, it represents "a step change in sustainable home building practice" – crucial if we're to develop a low-carbon residential sector.[6]

Parts L and F of the Building Regulations – aiming at 25% reductions

An average 25% reduction in the emissions from new commercial buildings is the overall aim of Part L (2010).[7] In addition, Part F mandates that fresh air should be introduced into buildings. To avoid undue energy consumption, handling this air correctly is vital.

These regulations will help ensure new buildings continue to become more efficient. To achieve this, different solutions will be required to control the temperatures of internal areas and hot water production.

Planning policy – requiring low and zero-carbon solutions

Planning is key to how buildings are delivered and has an important role in achieving the wider goals of reducing UK emissions. In 2003, Merton Council stipulated that any new development must generate 10% of its energy needs from on-site renewable energy technologies.[8] These solutions offer end users considerable financial benefits over the longer term, while Feed-In Tariffs and the Renewable Heat Incentive have helped accelerate return on investment. Since 2003, most other councils have adopted similar requirements, although these increasingly require energy savings to be made through deploying efficiency measures and low and zero carbon solutions to achieve wider targets.

5 www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/2050/2050.aspx

6 www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf

7 www.planningportal.gov.uk/buildingregulations/approveddocuments/partl

8 www.merton.gov.uk/living/planning/planningpolicy/mertonrule/building_a_zero_carbon_future.htm

Energy Performance and Display Energy Certificates – certifying performance

The Energy Performance of Buildings Directive requires properties to display an Energy Performance Certificate (EPC) and in some cases a Display Energy Certificate (DEC).[9]

Prospective tenants or buyers can therefore compare the relative efficiencies of different buildings – placing the onus on property owners and developers to achieve the highest levels of certification.

CRC Energy Efficiency Scheme – increasing corporate responsibility

Central to the UK's strategy for improving energy efficiency and reducing CO_2 emissions is the Carbon Reduction Commitment Energy Efficiency Scheme (CRC).[10] To stimulate efficiencies, organisations that produce major CO_2 emissions are required to purchase CRC allowances from the Government.

It's estimated that CRC allowances will cost businesses £1 billion per year by 2014/15 – to help reduce this expense, companies are increasingly seeking to improve the energy performance of their buildings.

Kick-starting change

Replacement-energy incentives work by mitigating the higher capital costs incurred up front with financial benefits over the longer term. They also help enable the fledgling renewables industry to become part of the mainstream – further accelerating the take-up of these important technologies. In putting its money where its mouth is, the Government proves its commitment to a green agenda and helps power the required change.

Renewable Heat Incentive – stoking demand for renewables

The world's first scheme of its kind, the Renewable Heat Incentive (RHI) is designed to help the UK reach its goal of a total of 12% of heat from renewable sources by 2020.[11] Different eligible technologies attract differently geared incentives. Through the RHI and removing non-financial barriers such as planning and building regulations, local authorities are creating a level playing field for mass-market deployment of renewable heating.

Feed-in Tariffs – paying users to produce, paying users to consume

Feed-in Tariffs (FiTs) pay consumers for producing electricity from renewable sources – whether they consume this themselves or export it back to the grid.[12] The scheme aims to help ensure that, by 2020, 30% of the electricity the UK uses comes from renewable sources.

9 www.diag.org.uk

10 www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/crc/crc.aspx

11 www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/policy/incentive/incentive.aspx

12 www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/feedin_tariff/feedin_tariff.aspx

Green Gateway philosophy – our guiding principles

Changing behaviour – through debate and increased understanding of the crucial issues we face – is the ultimate goal of Green Gateway. Guided by five core principles, it provides us with a compass for the way we do business.

The Green Gateway principles

1. Doing the right thing

The UK Government is unique in the emission-reduction targets it has set, the legislation it has introduced and the specific incentives it has developed to support these goals. This, coupled with a changing market due to overwhelming environmental arguments and customers who increasingly wish to address these issues, add to the ever changing market that we find ourselves in. We believe that increasing awareness of, and support for, broader energy-production and consumption goals are the right thing for our industry to do. To this end, Green Gateway is closely aligned with national and international targets and supports the creation of a built environment able to help meet them. It also requires us to manage the impact of our own business.

2. Increasing efficiency

Achieving major and lasting reductions in running costs and emissions demands we use energy more efficiently. To do this we believe the priorities that affect the way equipment is selected, installed, maintained and controlled need to change. We also need to take a whole life cycle view when applying a solution.

3. Reducing carbon

Carbon will increasingly be given a direct value and as a result become more visible to those responsible for its consumption. It's crucial that we switch away from burning fossil fuels on-site as these generate relatively high emissions. A future where electricity is the only end-use energy is desirable and possible.

4. Promoting renewables

Renewable solutions applied to buildings enable a level of energy independence from the grid supply and reduce our reliance on fossil fuel, thereby aiding fuel security. In addition, users of renewably generated energy tend to be more aware of their consumption and so are more pro-active in reducing it – to the benefit of these individuals and society as a whole.

Many UK buildings are ripe for the installation of renewable generating systems. Truly mass-market solutions exist now and represent a massive opportunity to make a real and immediate difference.

5. The way we do business

Ensuring the right solutions are selected, taking into account the product's entire lifecycle, requires more collaboration and diversification by all involved in the industry. It has changed the way we do business by ensuring that engagement with all those required to deliver truly sustainable buildings is at the centre of all our activity. We are also open to learning how others do things, and look to exchange expert knowledge with our working partners. The best solution will always be an integrated solution.

Collaboration at a corporate level enables us to pass on know-how and to learn the issues facing the ultimate users of our solutions, so we can all work better together. Developing new solutions and ways of doing business, in response to current and future challenges, is always the aim of our discussions. Also paramount is education – for example through best-practice installation methods and responsible end-user behaviour.

Developing our skills and knowledge within the sector, Mitsubishi Electric is uniquely positioned to help inform all those in the supply chain. We don't think we know all the answers – that's why we listen. But we do know our technologies and the solutions to which they can be integrated inside out.

Doing the right thing – the energy hierarchy approach

Generating truly sustainable buildings is the ultimate goal. As the best way to achieve this, Green Gateway supports a three-stage approach to achieving the right heating, cooling, ventilation and power solutions.

Lean, mean and green – towards low-energy buildings

Consecutive Governments have shown their commitment to a low-carbon agenda, and buildings can play a big part in achieving the wider goals we have set ourselves. Tackling this major issue starts with taking a staged approach to how we can reduce the impact of our building stock. This approach is not a Mitsubishi Electric idea, it is implied by much of the Government's actions to reduce emissions and energy consumption. This progressive Government approach is something we support and in our view is a basis for a framework that all involved in the building industry should adopt.

A staged way of applying solutions to a building helps to identify the measures required to achieve the low-energy, low-carbon buildings that are required. By taking these steps in the right order they can be implemented in the most economical and convenient way. Doing the right thing means ensuring basic mitigation measures have been applied before equipment is selected; it cannot be right to address the needs of a leaky building simply by applying more equipment or consuming more energy. Such a hierarchy precisely defines how we need to do business going forward.

In simplest terms, we must:

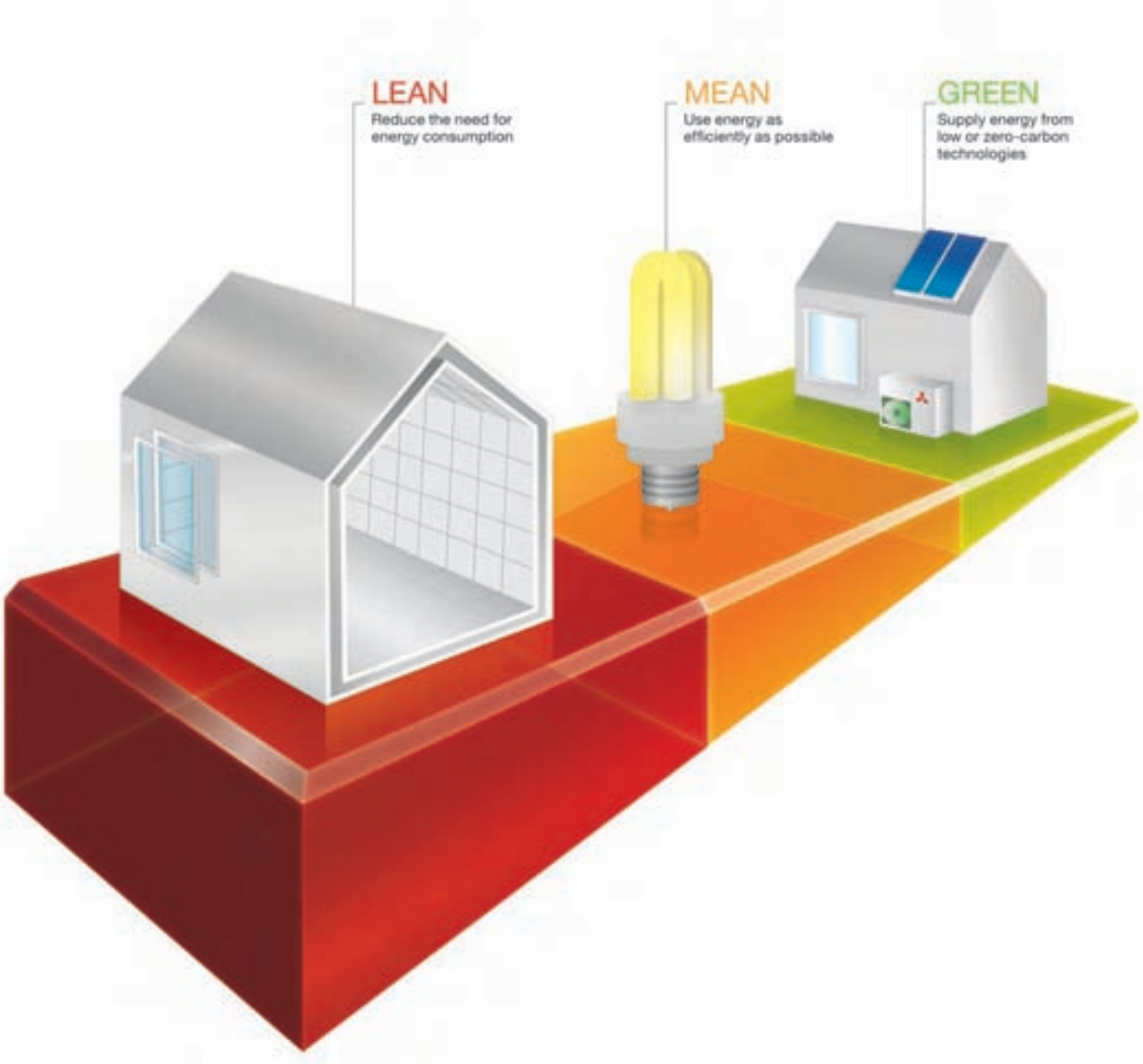
Firstly, reduce the need for energy consumption. This requires insulating the building's envelope, ensuring doors and windows are effective barriers to heat loss and replacing energy-inefficient building materials. While these moves may seem elementary, they are overlooked in a surprising number of UK homes and businesses.

Secondly, deploy the most efficient products and ensure they maintain their efficiency throughout their life. The choices of what solution to install from new – or to offer as a replacement to existing systems – and then how this is operated, will have a massive bearing on the emissions generated by that building during its life.

Thirdly, incorporate low and zero-carbon technologies to meet all or part of the building's energy needs. Many options exist and the ideal solution – or combination of solutions – for different premises will vary.

The second and third steps are so crucial to the overall operation of a building, that we advocate a distinct approach known as "ECR" as you will see in the following pages.

One step at a time: producing truly sustainable buildings means doing the right things and meeting the challenges in the right order. Firstly, reduce the need for energy consumption. Secondly, correctly deploy and monitor the most appropriate and efficient systems. Lastly, incorporate low and zero-carbon technologies where possible to create some or all of the energy required.



Our ECR approach – meeting today's energy challenge

Buildings need heating, ventilation, power and sometimes cooling. We want these requirements to be delivered in ways that are as **Efficient** as possible, emit lower amounts of **Carbon** and, wherever possible, incorporate **Renewable** energy. Through its **"ECR"** approach, Green Gateway helps ensure these needs and wants are reconciled at every stage.

Practicing ECR at every stage

Once measures have been taken to reduce overall energy demand, buildings need heating, ventilation, power and, in some cases, cooling. Without these, we cannot create the comfortable, operational and profitable spaces we require. At the same time however, we want our buildings to be energy efficient, less carbon intensive and to use more renewables.

At Mitsubishi Electric, we're aware that reconciling these needs and wants has changed the way equipment purchases have to be made. Our "ECR" approach places Efficiency, Carbon reduction and increased use of Renewable energy at the centre of every decision-making process in respect of fulfilling a building's heating, cooling, ventilation and power requirements. Moreover, we're committed to practicing this approach throughout our business and promoting it to our customers and onward to the ultimate users of our equipment.

Efficiency – apply the right solution

Maximum efficiency is paramount: the cheapest and cleanest kilowatt of energy is the one you do not use. Achieving this means more than just sealing a building's envelope – it also requires the selection and correct installation, maintenance, monitoring and operation of the most energy-efficient technologies.

Short-term decisions need to give way to those that take a whole lifetime view. As their costs increase and availability decreases, fossil fuels become a less and less attractive option – especially as the technologies that burn them on-site are already at the peak of their efficiency. Greater economies can be realised by switching to alternatives, indeed, a future with electricity as the only point-of-use energy is now possible and desirable due to the lower direct emissions this will generate moving forward.

Focal point: a potential disparity exists between what we require for our buildings – heating, ventilation, power and sometimes cooling – and what we'd like for our buildings – greater Efficiency, lower Carbon emissions and the inclusion of Renewable energy. Through its "ECR" approach, Green Gateway helps create solutions that reconcile these needs and wants.

Carbon – reducing emissions

Buildings in all their forms account for 44% of the UK's CO_2 emissions.[13] Reducing this burden and specifically those emissions generated by heating – and by cooling and ventilation in some commercial properties – is key.

We believe this can be achieved through innovating more efficient products, removing the direct use of fossil fuels from buildings, recovering waste heat to use elsewhere and replacing equipment in a timely manner.

We are still facing challenging targets and time is running out. Our business objective is to engage all key players and to move towards viable lower carbon solutions.

Renewables – refreshing the energy supply

The UK building stock is able to accommodate renewable technologies relatively easily. We are also fortunate that our climate is often ideal for supplying renewable energy via currently available technology. Renewable solutions for use in buildings are varied and span both heating and power generation. Their inclusion gives buildings a level of energy independence and the skills exist to incorporate them.

The task ahead of us is so large that we rapidly need to find those mass-market solutions that can deliver the savings we require as soon as possible. Also, historically, those in contact with renewable solutions are generally more aware of their energy use; this has greater effects in society than just the building where the solution is provided. Therefore, the widest possible inclusion of low and zero carbon solutions in UK buildings is required.

13 BRE Digest of UK energy Statistics

The way we do business

Meeting the UK's energy challenges head on demands more integrated thinking from everyone supplying heating, cooling, ventilation, power and associated technologies to buildings. Green Gateway takes an approach that addresses the whole product cycle, from pre-purchase to end of life.

Pre-purchase

Engagement

Since Green Gateway's inception, we have sought collaboration with all parties involved in procuring, constructing and managing buildings, as we see this as the best way to ensure needs are translated into the right solutions. We are already making inroads with Central and Local Governments, the construction industry and consultants. Now we are nurturing all relationships – including those between manufacturer, installer, architect, specifier and end user. In this way, ECR principles can be embedded throughout the whole process from conception to delivery and beyond.

Mitsubishi Electric doesn't have all the answers – we're all in this transitional phase together so we will need to find the solutions together.

Optimisation

Gone are the days of increasing capacity to overcome deficient building fabrics. New builds must now meet tighter thermal guidelines from the start; leaky old structures need to batten down the hatches too. More and more, it's realised that a building should anticipate – at design stage – the heating, cooling, ventilation and power technologies to be used in it. To meet wider considerations, the types of energy utilised need to be optimised too.

Specification

At the final stage before purchase, it's essential to understand how people will use the building and to ensure the proposed solution or combination of solutions meshes with other systems required on-site. The correct control solution should also be incorporated giving users easy access to valuable real time information. Ensuring that energy Efficiency, Carbon reduction and Renewable energy integration are at the very heart of the specification process helps everyone to arrive at the right solution for each specific application.

Post-purchase

Installation

For solutions to work to their optimum, correct installation – including testing, commissioning and handover – is required. As new technologies come on-stream, even skilled technicians will need to expand their knowledge. Likewise, end-users must know how to operate a system to get the most from it. So dialogue and training become key. We're not suggesting a skills shortage; indeed, we're only asking skilled people to use their experience and apply this to new solutions. Rather, Green Gateway recognises the need to fill the knowledge gap when applying different solutions, we advocate the professional training and accreditation of approved installation partners, supported by a network of commissioning specialists.

From cradle to grave: our Green Gateway 360 model above shows how seven touch points – engagement, optimisation, specification, installation, operation, management and disposal – encapsulate the whole lifespan of a product or system. Green Gateway's philosophy, with its focus on ECR, is at the heart of every stage.

During life

Operation

Correctly operating a technology helps to ensure its optimum efficiency for life – a factor much of the industry has long overlooked. Indeed, effective system control, monitoring and reporting are probably the easiest and most affordable "quick wins" consumers can make. Today's operational capabilities are becoming more powerful, flexible, intelligent, dynamic, user-friendly and affordable – and more in demand from end-users eager to gain efficiencies and optimise the life span of their equipment.

Management

Planned maintenance is not just about fixing or preventing faults; it's also about ensuring existing solutions remain the optimum in the face of changing needs, altered building use, and the arrival of new alternatives. Continuous active assessment will ensure optimum performance throughout the life of a system.

Replacing an entire system makes absolute sense when the preferred alternative offers increased efficiencies. But choosing when to switch is a challenge – waiting until a technology fails can be the worst option, as the need to get things "back to normal" can supersede other, more long-term considerations. It's much better to monitor a system's efficiency and to replace when reduced performance or changed priorities makes this the better option.

End of life

Disposal

What happens to a product at the end of its life is important from an emissions point of view. Moreover, customers increasingly demand that components from redundant systems be re-used or recycled.

As part of its global policy, Mitsubishi Electric develops products that are almost completely recyclable and offers routes for their correct disposal. We're also constantly innovating new and improved processes for recovering raw materials and reintroducing these into the manufacturing process. Finally, we devise monitoring and reporting technologies that predict when systems need to be replaced and which enable and enhance end-of-life services.

Making the big switch

Meeting the UK's urgent energy challenges calls for high-impact mass-market solutions that adhere to the ECR principles. Practicable over the long term, these must also be environmentally sound, scalable, economical and publicly acceptable. Such demands represent enormous opportunities as we aim for a future using more viable technologies.

Choices and trade-offs

As the best way to reduce CO_2 emissions and building run-costs, Mitsubishi Electric has always advocated a three-stage hierarchy of reducing the need for energy consumption, use energy as efficiently as possible and then application of low and zero carbon technologies.

We concentrate on developing technologies that best address the specific problems confronting UK buildings and which, crucially, are viable over the long term. This is why in 2007 – contrary to our own short-term interest – we decided to stop actively promoting the use of air conditioning to the domestic market, preferring instead a more pragmatic approach which ties in closer with Government strategy. As shown in this document, the demand for heat in domestic properties is one of the UK's biggest challenges, so our efforts focus on addressing this.

Scoping the challenge: mass-market alternative technologies must be viable over the long-term and environmentally sound, scalable, economical and publicly acceptable.

Acceptable in every way

Any alternative technology meant for mass-market deployment must be viable over the long term and be judged against four inter-connecting criteria. It needs to be:

1. Environmentally sound compared to existing technologies – demonstrably working towards environmental targets and offering clear green benefits.
2. Scalable – able to be built and deployed in large enough numbers and used across a wide range of applications, all supported by a skills infrastructure that's in place or able to absorb the new knowledge required.
3. Economical – cost-effective to build and produce in large numbers, and usually delivering run cost benefits for consumers.
4. Publicly acceptable – comfortable and straightforward for end users to live with and operate.

Heat pumps – the pivotal solution

Perhaps the single most important alternative renewable technology is the heat pump. They are proven over time, supported by Government incentives, economically viable, flexible in their application and suitable for mass-market deployment. They could meet up to 75% of residential heat demand and 90% of non-residential space heat demand in the UK.[14]

Proven for more than 50 years

Heat pumps are an established, continually developing technology and the primary solution for many buildings. They are the preferred choice for providing domestic heating and hot water in countries such as Sweden. In the UK's commercial buildings too, effective and economical heat-pump technology has long been used to heat and, where required, cool spaces. Rapid advances achieved over the last 10 years, such as the introduction of inverter technology, have helped position heat pumps as a true alternative to the UK's existing heating systems.

Movers and multipliers of energy

Heat pumps transfer heat from a range of natural sources – air, ground or water – and transforms this into heat at usable temperatures. In recognition of the ability of heat pumps to obtain heat from the environment they have been classed as a renewable technology and been given a definition to clarify their required performance within the European Renewable Energy Sources directive (RES).

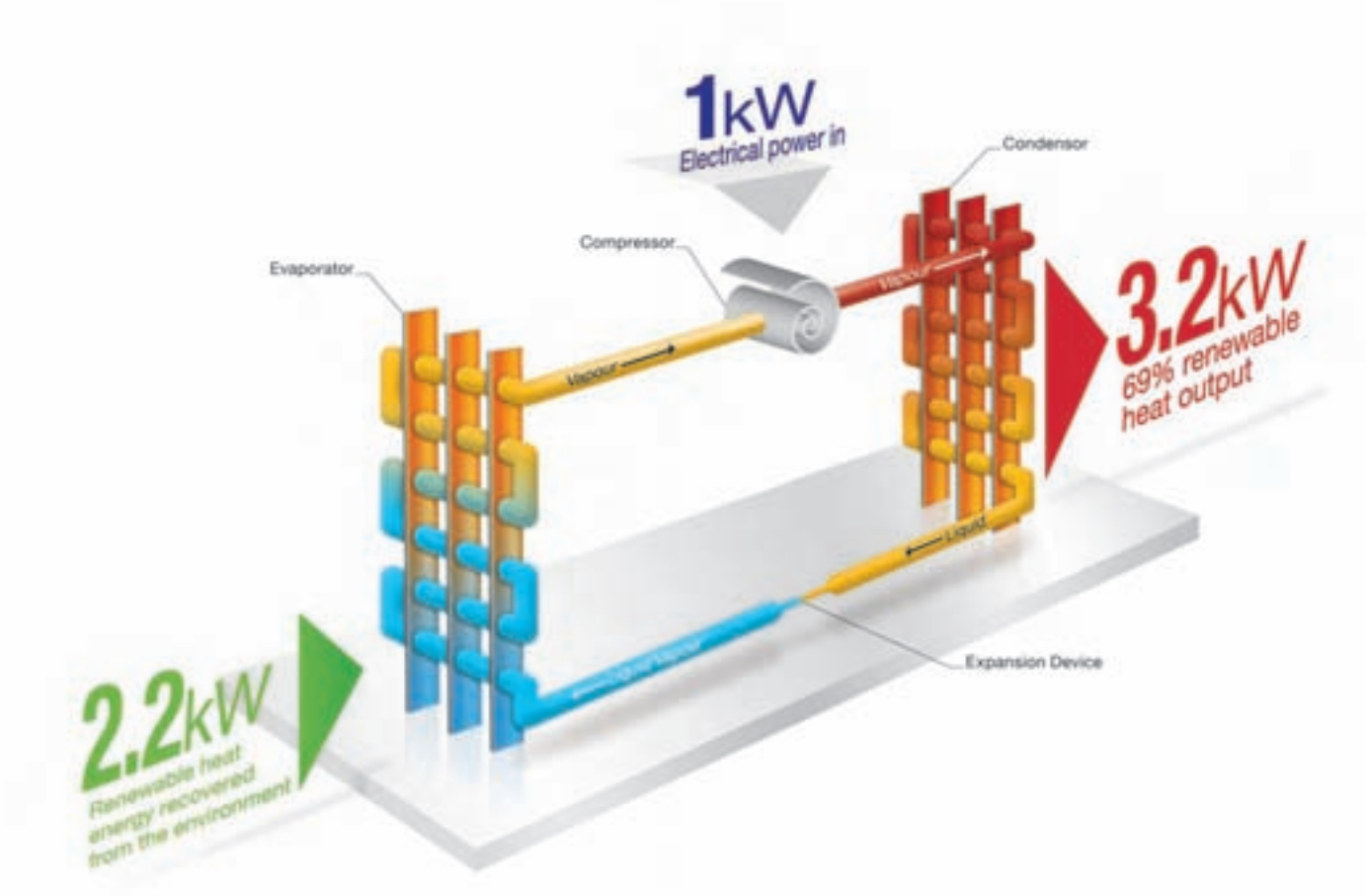
Flexible and multi-purpose

Once collected, this heat can be delivered to domestic or commercial buildings to heat space and water. In commercial contexts, heat pumps are also useful for heat recovery in that they move heat from areas where it's not required to where it can be more useful – such as another room, to generate hot water, or over retail doorways and they can do this simultaneously. They are also increasingly being used to generate heat which contributes to community distribution systems.

Suitable for use across sectors

Heat pumps are already fully accepted within the commercial sector where they are used in buildings of all kinds, right up to multi-storey office complexes. They are also suitable for homes, right down to even the smallest dwellings. Indeed, their future role in helping meet the heating and, where required, cooling requirements of UK buildings looks pivotal.

14 The Renewable Energy Review, May 2011, Committee on Climate Change – Page 122



Ingeniously simple: Operating in a similar way to a domestic refrigerator in reverse, a heat pump harvests naturally occurring energy, upgrades it and uses it to generate space and/or water heating.

Radically more efficient

At point of use, for every 1 kilowatt of electrical energy input into our heat pump, 3.2 kilowatts of heat can be produced*. By contrast, for every 1 kilowatt of energy input into a conventional fossil fuelled boiler, less than 1 kilowatt of heat is produced. This input/output ratio, or Coefficient of Performance (COP) of the heat generating device has been independently tested by the Building Research Establishment (BRE) and Building Services Research Information Association (BSRIA), and shows heat pumps already perform excellently. Even so, they've yet to reach their maximum efficiency – greater investment in the technology will continue to deliver improvements.

As shown on pages 24 and 25 of this document, when calculating efficiency, it's also important to factor in the primary energy each technology uses.

Affordable and controllable

Modern heat pumps use the latest technology to extract renewable ambient energy from surrounding environments. Through the way this heat is delivered, they also make internal room temperatures more controllable – increasing energy efficiency, reducing running costs and normally cutting CO_2 emissions. Included in the Mitsubishi Electric Ecodan® range are products approved by the Microgeneration Certification Scheme, which meet Ofgem's Carbon Emission Reduction Target.

Ingeniously simple

Most heat pumps work on the same principle as a domestic refrigerator, using the vapour compression cycle. The main components are the compressor, expansion device and two heat exchangers, evaporator and condenser.

- Contained in the evaporator is a refrigerant. This is colder than the heat source, so attracts heat and evaporates.
- The resulting vapour moves to the compressor where its pressure and therefore temperature are increased.
- The hot vapour now enters the condenser where it gives off usable heat as it liquefies again.
- The refrigerant then moves to the expansion device where it drops in pressure and temperature.
- The liquid-vapour mix returns to the evaporator and the cycle starts again.

*As tested to BS EN14511 Part 3. Based upon standard test conditions. Due to the method of operation, the performance of heat pumps will vary based upon the temperature of the heat source and the requirements of the heat delivered.

Comparative efficiencies – weighing up the true costs of heating

Different heating technologies convert fuel to heat with varying efficiencies. However, when making a comparison, it's crucial to factor in figures for the primary fuel source as this stage of the process is often overlooked.

Fuelling more informed decisions

Our diagram on pages 24 and 25 illustrates, for each heating technology, the relative efficiency of each equipment type at converting inputted energy into heat. It shows that a heat pump with a typical COP of 3.2 creates the same amount of heat as an A-rated gas-fired boiler or direct electric heater, while emitting less CO_2. Also key when making comparisons is the amount of primary energy consumed prior to entering the heating technology. So the diagram overleaf demonstrates this variable too.

For the same heat output, heat pumps use less primary energy than direct electric heating, gas or oil boilers.

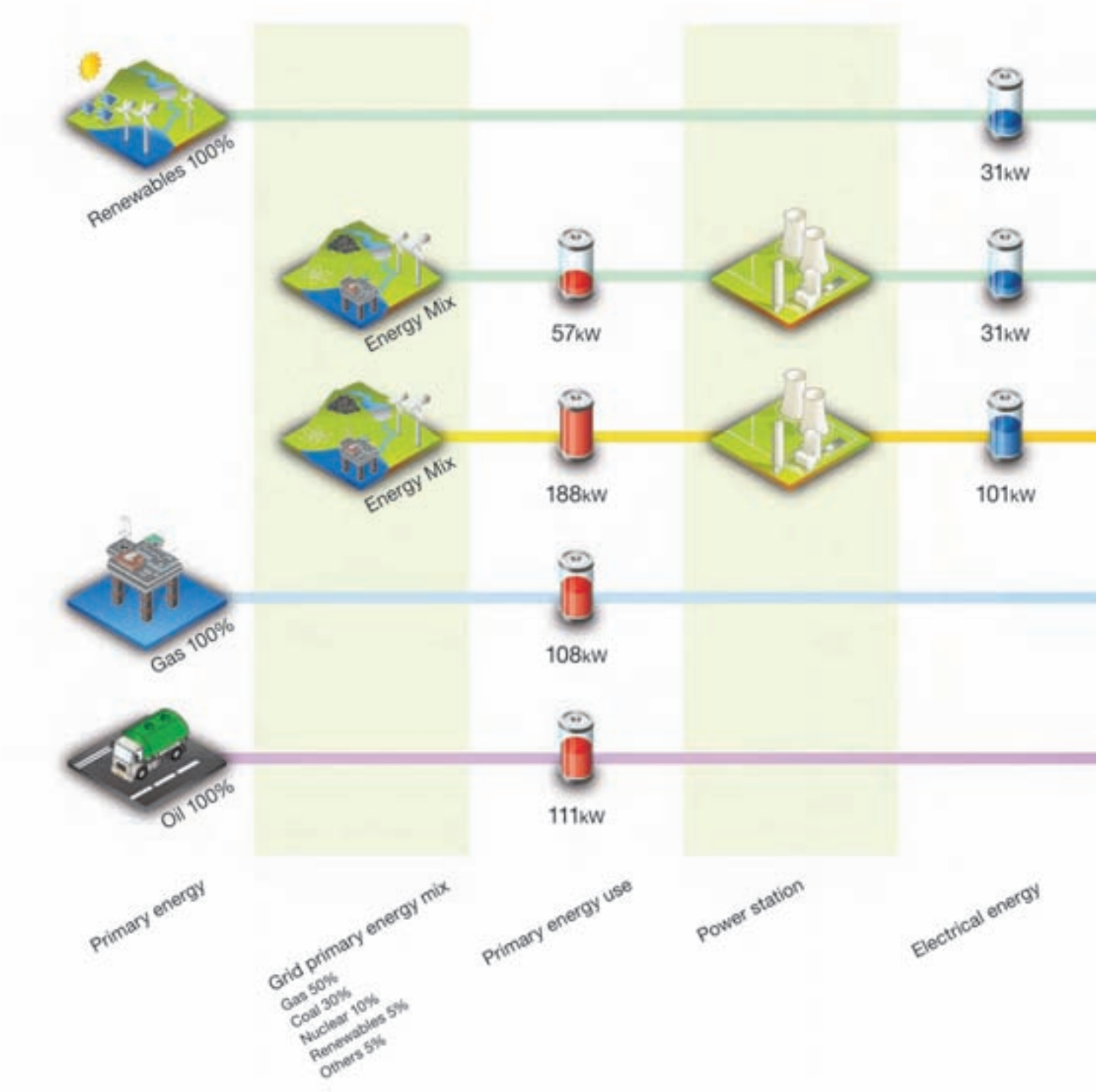
We believe this consideration to be crucial as it enables more informed product development and purchasing decisions. If we install a new heating solution in our home or commercial building while disregarding the source of its energy, we may think we're acting greener. But in fact, we could be generating a similar amount of carbon and missing a valuable opportunity to reduce it. Moreover, some solutions – such as heat pumps – are more aligned than others to Government thinking on electrifying the UK's building and transportation infrastructure.

Telling the whole story

The Primary Energy Ratio (PER) enables us to factor in, for each heating technology, the amount of energy needed to power any particular heating system. It allows us to produce a more complete picture of the relative efficiency of each heating technology and to gauge the wider implications of our equipment choices. Heat pumps emerge more energy efficient in terms of PER.

Telling the whole story

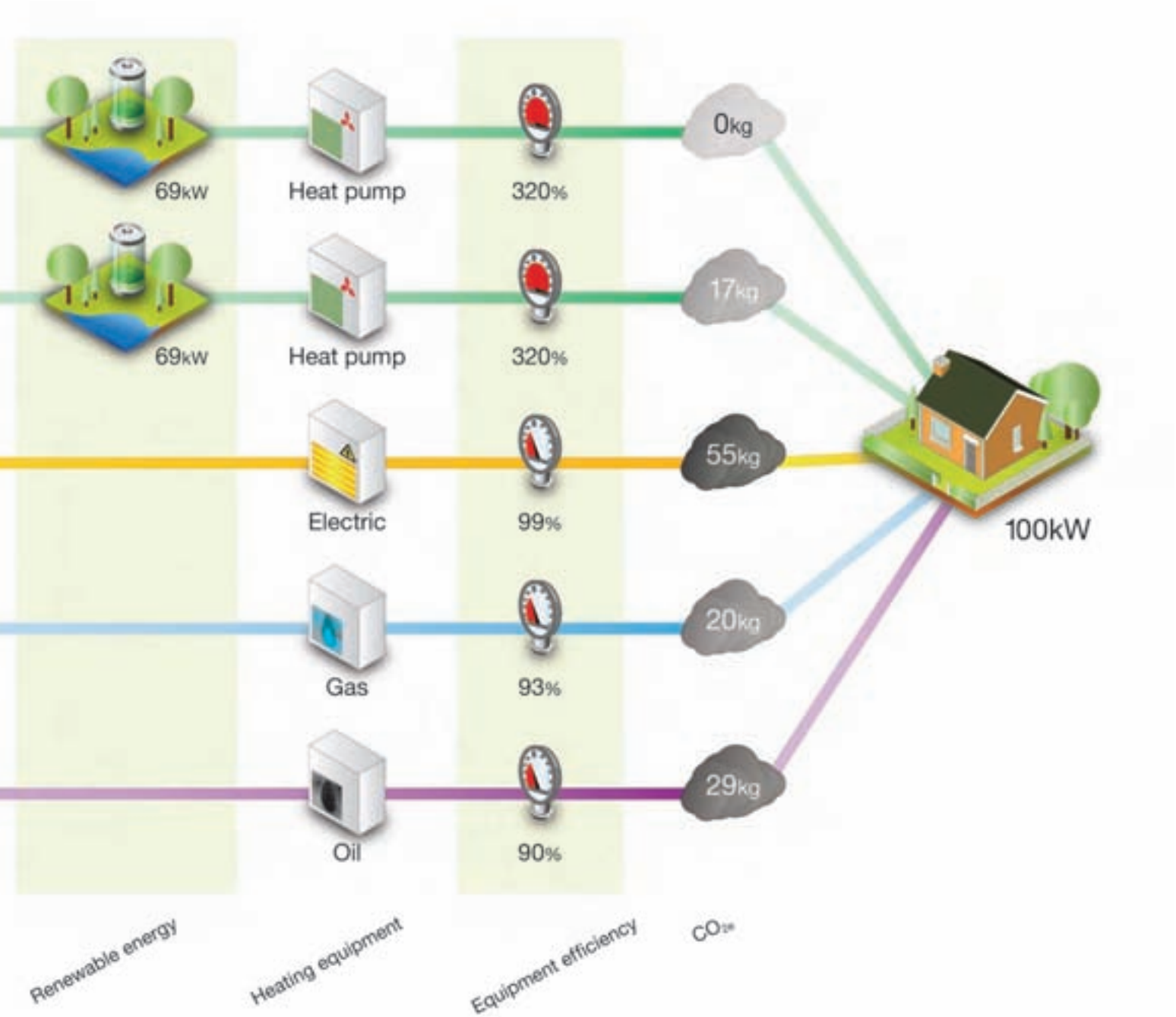
In order to understand the true efficiency and wider implications of any technology choice, it is necessary to consider the primary energy used.



Emissions factors obtained from Carbon Trust Conversion Factors, Energy and Carbon Conversions, 2010 update

Buying into a greener future

Heat pumps are the only solution that fully buys into the greening of the grid and so become more attractive from a strategic point of view as the grid becomes cleaner. Indeed, we can conceive of a time, when other renewable sources are being utilised to provide a clean grid, that heat pumps provide a further benefit by uplifting the energy generated from low or zero carbon sources into usable heat. This diagram shows a future vision of how heat pumps can be connected to a grid supplied by purely renewable sources on the top line and compares it to a more typical situation as we have today with a grid that obtains its energy from mixed sources. In this way heat pumps provide a degree of future proofing no other solution can deliver – certainly compared to gas-fired boilers which are already at, or near, their maximum efficiency.



Comparing the alternatives – informing technology choices

Differences in how spaces are configured and utilised means no single heating solution can be ideal for each and every application. Going forward, a range of viable renewable technologies will provide the answer.

Fossil-fuel failings and renewable rewards

Fossil-fuel heating solutions may be scalable and easy to implement but they generally score low on efficiency, increase our carbon footprint and make us more reliant on world markets for their supply. The devil is in the detail. Comparing any two fossil-fuel alternatives, we see that each has its own relative strengths and weaknesses in our view but all are inherently unviable as progressive mass-market solutions.

To replace these fossil-fuel technologies, a wealth of environmentally friendly, affordable and fuel-security enhancing renewable options is available in the UK. These include:

- Geothermal community heating
- Biomass combined heat and power community heating
- Heat pumps
- Biomass boilers
- Fuel cells

Making the right heating choices

Drawing these comparisons helps to open minds and dispel mistruths. An opportunity exists to enable a change in behaviour and to connect people with their energy use. Full citizen engagement is achieved not simply by recommending, but by demonstrating and ensuring all alternatives and their wider implications are fully understood.

In the view of Mitsubishi Electric, heat pumps uniquely perform well against all relevant criteria. Crucially for a mass-market solution, they are highly scalable – applicable to projects of every size from single houses to whole towns and cities. While it has existed for a long time and is tried and tested, heat pump technology continues to evolve and improve.

The diagram above is intended to show the Mitsubishi Electric view of how some of the key non-renewable fuelled and renewable heating technologies compare. It does so by highlighting four key areas which are important factors in considering which solutions are effective in terms of both efficiency or carbon reduction and which are capable of rapid mass deployment in order to make a meaningful impact.

Low Carbon – We have to make our buildings less carbon intensive as the demand for heat is so large. In our view, differing technologies prove to be more or less effective in achieving this goal.

Energy efficient – When comparing the relative efficiencies of varying technologies you should consider the fuel used, where it is sourced, if it can provide renewable energy to meet required targets and if it reduces reliance on conventional grid supplies.

Ease of implementation – For a technology to make an impact in the timescales that are required it has to be easy to implement. Some fossil fuel based systems do this very well when they are closely connected to a supply but in our view can be challenged by remoteness and/or building type.

Scalable – Any mass market solution that is going to impact in the time frames required must be suitable for the majority of buildings and have in place enough capacity in terms of production and fuel supply, not only for today but also for its peak demand. Just as critical is the existence of the appropriately sized skills and knowledge infrastructure to install and maintain the required numbers of systems that are needed.

Heat pumps for air conditioning – the optimal solution

Heat pumps have been used in air-conditioning solutions for decades. They are the most efficient, environmentally sustainable way to heat and cool spaces where a cooling capability is required, due to their unique ability to recover heat for use elsewhere. As modern buildings demand low-energy solutions, today's high-performance heat pumps emerge as a truly effective option.

Airing the argument

Air conditioning is about delivering an all-round level of comfort including heating, ventilation and cooling and is a central requirement in many premises. As new buildings become more and more airtight, those requiring air conditioning are likely to increase. At the same time, improved fabric efficiency, solar shading and lower heat gains are likely to reduce the absolute amount of cooling required.

Heat pumps are the most efficient way to provide heating and cooling, where a cooling capability is required. They remove the need for separate heating and cooling systems and the potential problems of integrating the two. Moreover, to suit the operation of a building and to enable a phased approach to refurbishment, heat pumps can be installed in incremental stages, minimising disruption. In addition, the performance of heat pumps continues to advance.

As it does, the case for replacing old air conditioning systems with newer, more efficient and more environmentally friendly designs grows stronger.

A key reason why heat pumps have become the dominant choice in commercial premises is their ability to recover heat from areas where it is not required, as a by-product of delivering cooling. For example, one area could have a cooling load and the heat recovered can be used in another area or to generate hot water. This heat recovery function makes modern heat pumps the optimum solution in many applications.

Monitoring, reporting, controlling –
efficiencies through intelligence

Enhanced capabilities to control heating and cooling systems, and to anticipate, monitor and report their performance, provide massive opportunities to reduce energy use and run costs. More flexible, intelligence-based operation is increasingly demanded by customers, required by legislation and central to a solution's design.

Effective and easy to implement

Improving the monitoring, control and data reporting of our heating and cooling equipment is perhaps the single most impactful enhancement we can make. With today's increasingly predictive systems, the benefits are easy to achieve too.

Historically, the capital costs of equipment and installation drove purchasing decisions; few people gave too much thought to ongoing running costs. But "fit and forget" is no longer an option if we are to deliver greener, more energy efficient and more economical buildings. Monitoring and reporting capabilities are increasingly requested by consumers with major energy needs and required by building regulations.

Capabilities have increased massively in recent years and are becoming more and more central to a system's design and installation. Highly user-friendly interfaces are becoming common place, while more advanced products can be intensively monitored straight out of the box. Controls are now so flexible that they allow users to adjust their living environments from a laptop. Developments in wireless technology are making the retrofitting of modern controls into existing builds far easier.

With these increased capabilities, variables such as user habits, energy consumption patterns and outside temperature can now inform system management and control. Delivering the right information to the right people at the right time helps to speed-up interventions and to reduce undue energy use. Based on predictive algorithms, interventions can even be made automatically to ensure optimum performance is maintained at all times.

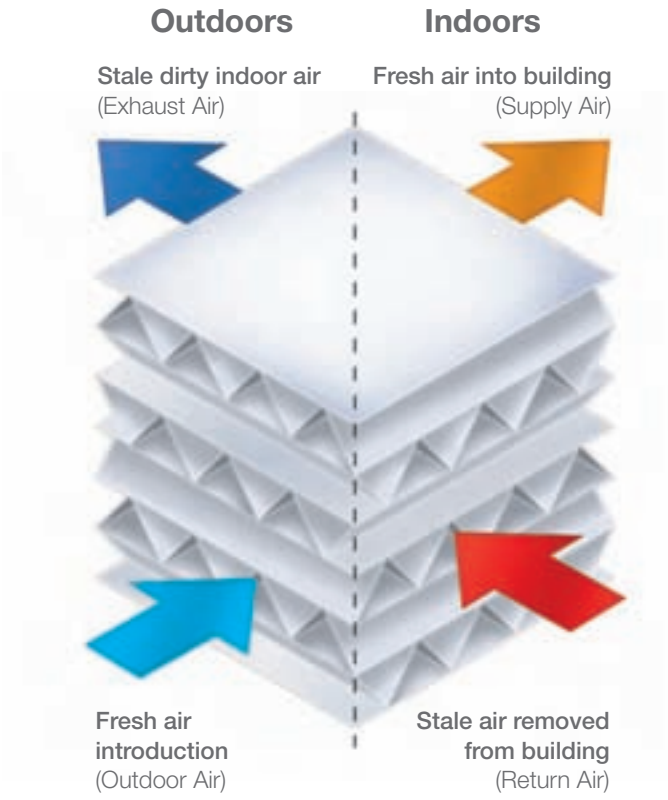
Ventilation –
channelling the air around us

We need air of the right quality and temperature to live in, to work in and to prevent damage to our buildings. Thanks to the UK's temperate climate, free cooling is often naturally available and the ability to recover heat means that the right balance between passive and mechanical ventilation is easy to achieve.

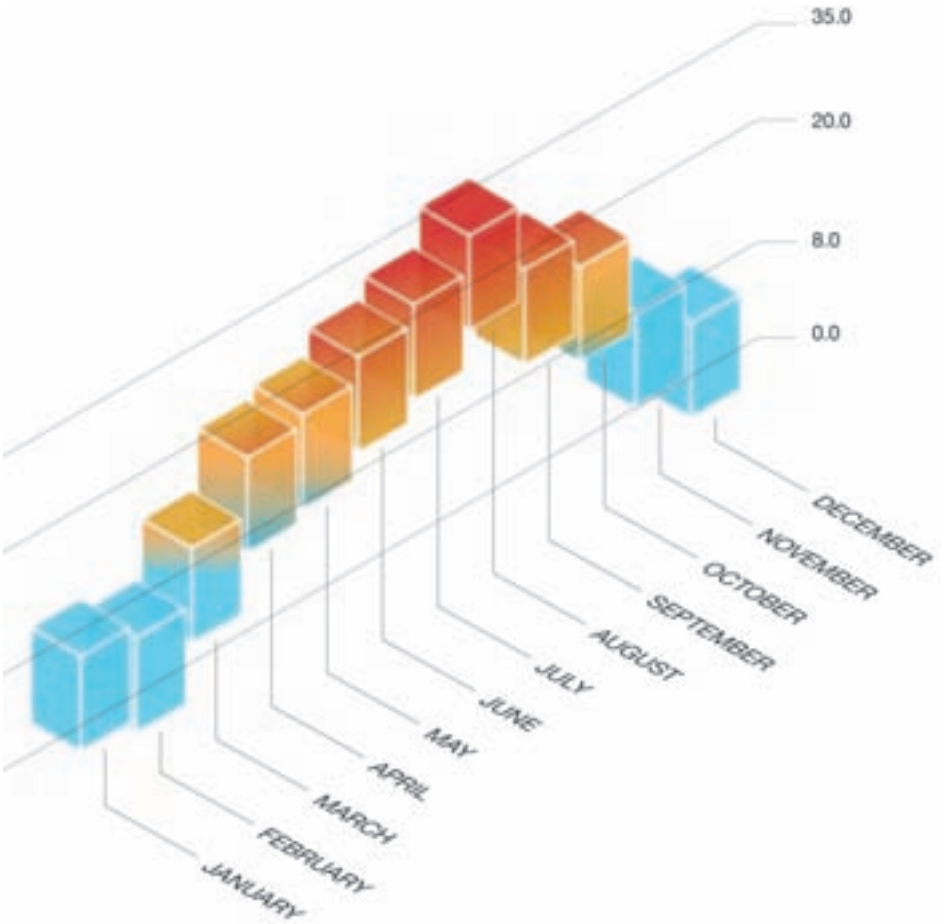
Cooling can be a breeze

UK temperatures for the vast majority of the year are in the range of 8 to 20ºC, offering the opportunity of free cooling, without the need to add mechanical cooling.[15] For most domestic buildings, this is sufficient to maintain comfortable temperatures.

However, many commercial buildings are of a size, design or layout that makes mechanical ventilation desirable. In these cases, heat-recovery systems – which use already cooled air to temper inputted fresh air – can help reduce overall cooling loads by up to 20%. It's also possible to develop bespoke ventilation solutions for existing buildings or to meet specific user requirements. Typically, passive measures teamed with mechanical heat-recovery ventilation elements, or combined heating and cooling equipment, offer the best solution. Ventilation systems can now be controlled based upon CO_2 concentrations and interlocked with other equipment and user set points.



15 http://news.bbc.co.uk/weather/forecast/2574#



Home advantage: average monthly temperatures for the UK – in this case London – usually fall within a range of 8 to 20°C. Depending on the season, free cooling can often be achieved, so is the preferred option for many commercial and domestic properties.

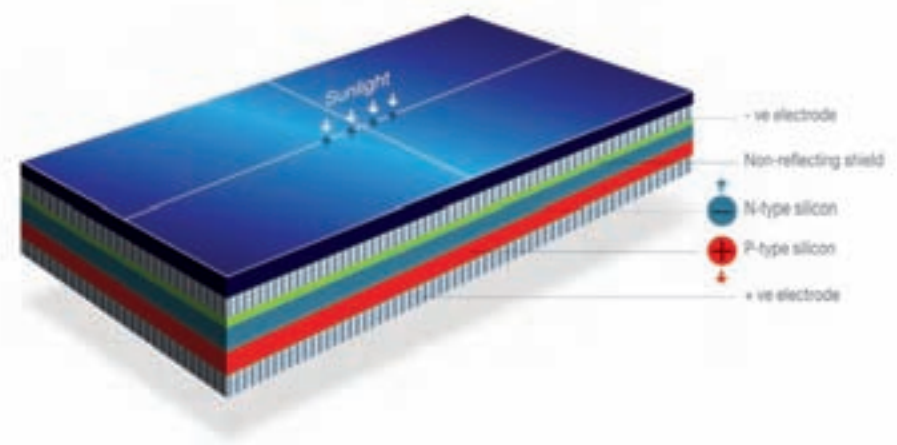
Photovoltaics – harnessing the sun's energy

Photovoltaic systems convert light energy from the sun into electricity. They power homes and businesses reliably, help reduce the UK's carbon emissions and connect people with their energy usage. Proven technology, ambitious targets and Government incentives have combined to drive their take up.

Let the sunshine in

Substantial growth in the photovoltaics (PV) market is set to play a key role in addressing the UK's energy needs for new and existing buildings – as anticipated by both Government plans and Green Gateway. PV fits well with the Government's strategy to promote electricity-based systems and partly to encourage the technology's take-up, Feed-In Tariffs have been introduced. These enable PV users to generate a return on the energy they produce – whether they use it themselves or sell it back to the grid. Indeed, the UK's Photovoltaic Manufacturers Association considers PV could contribute more than 20 TWh/year of electricity by 2020.[16] PV places independent power generation firmly at a local level, connecting people with their energy usage. In providing a clean primary source of renewable energy, PV also opens the opportunity for totally sustainable solutions.

A key consumer benefit is that PV displaces carbon-heavy electricity, so is particularly effective in helping people and organisations to meet their CO_2 targets. Builders of new homes are seeking economical ways to meet their obligations under the Code for Sustainable Homes. Likewise, housing associations and local authorities are looking to achieve efficiencies in the existing housing stock. To help meet these aims, Mitsubishi Electric is combining PV systems with Ecodan® air source heat pumps across the residential sector. In fact, we were a pioneer in PV research and development. We started work in this sector in 1974, and two years later launched our space-satellite business which utilised PV technology. In 1996, we started international deployment of PV across domestic markets, and in 2009 take-up of the technology began in the UK.



16 www.parliament.the-stationery-office.co.uk/pa/cm200910/cmselect/cmenergy/193/193we43.htm

Residential environments – challenges old and new

The future is already largely built: it's estimated 75% of the homes we'll be occupying in 2050 are standing now.[17] Insulating these often ageing structures and addressing their energy loads is a great challenge. So too will be meeting the Government's zero-carbon criteria for new builds as we aim to avoid locking in years of poor performance.

Homes already built – the legacy challenge

Most of the homes we'll be using in 2050 have already been built. Fewer new houses are going up than ever before, with only 102,830 built in the year to April 2010 – a record low and a drop of 23% on the previous 12 months.[18]

Our ageing homes are expensive to preserve and extravagant to heat. In the UK, we use more energy to heat our dwellings than people do in Sweden, where winters are longer and colder. The challenge is how to introduce new technologies – particularly access for homes that are off the gas grid – and to achieve acceptance of these by householders.

History shows it can be done. Over the last four decades, the UK heating sector was transformed with gas boilers moving from a low market share in 1970 to today's market leader. In private households, it's now common for all rooms to be heated. These changes happened at a time when the UK was self-sufficient for its supplies of energy. However, this is no longer the case, so we must push towards another transformational shift – this time towards low and zero-carbon solutions in our homes.

Taking the temperature of domestic demand

Average household internal temperatures have increased from the 1970 average of 12ºC to 17.5°C in 2007.[19] Likewise, higher-flow showers are driving demand for hot water. In 2007, fuel use for space heating and hot water in the UK totalled 535 TWh, with the residential sector accounting for an estimated 78%.[20]

Conversely, most UK homes do not require cooling. Internal spaces can be made more comfortable in high ambient temperatures and this is best achieved with heat recovery ventilation systems which will, in most cases, keep internal temperatures within acceptable comfort limits. In a typical home, most of the energy load is for heating.

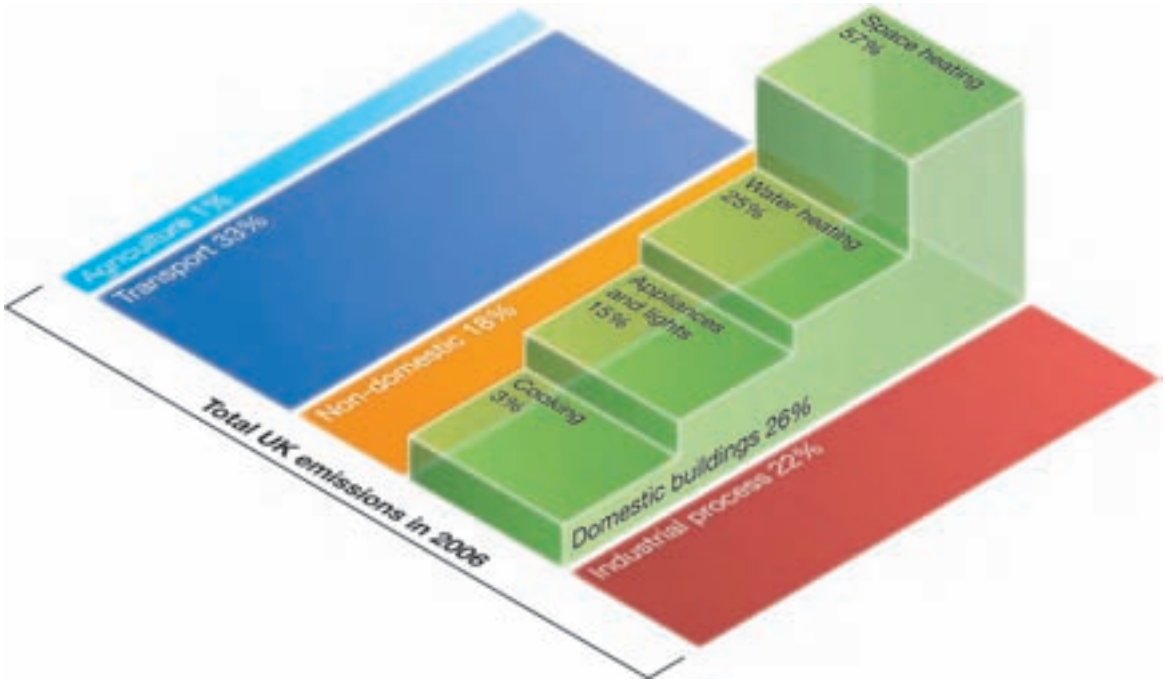
Adequate domestic insulation is crucial. Once this is in place we feel the effort to deliver solutions must focus on reducing the energy required for heating.

17 www.sd-commission.org.uk/news.php/344/ireland/regulation-incentives-and-behaviour-change-key-to-sustainable-refurbs

18 www.building.co.uk/england-sees-102830-new-homes-built-in-2010-%E2%80%93-we-built-more-in-1875/5013562.blog

19 DECC Pathways 2050, Page 95

20 Digest of UK Energy Statistics, 2008



Carbon un-captured: Total UK emissions in 2006 highlight that domestic properties account for 26% of this total. They also clearly show that heating is the major energy user in domestic properties.

Homes to-be-built – moving towards zero carbon

Meeting the Code for Sustainable Homes and achieving the zero-carbon definition by 2016 represents a massive challenge for UK builders. However, this challenge is far from impossible to achieve; applicable technologies are proven and available now. Skills exist to fit these technologies and legislation coupled with incentives is setting the scene for their deployment.

Achieving better buy-in

Persuading architects to include alternative heating technologies in their designs means overcoming technical, cultural and aesthetic hurdles. Increased education and consumer buy-in makes it easier for different and more environmentally beneficial solutions to be incorporated. For example, designing under-floor heating into homes allows heat pumps to be used to their maximum performance. With early participation and dialogue, we can continue to promote low-carbon principles and the costs of implementation will reduce significantly.

For a home to be zero carbon, the people who live in it must also play their part. Maintaining the integrity of the building's fabric and running steady, comfortable heating temperatures – rather than allowing temperatures to dramatically peak and trough – helps to optimise efficiencies. Heat pumps and PV panels are now commonplace components of a home's systems – and are increasingly seen by homeowners as environmental badges of honour.

Mitsubishi Electric knows the challenges and energy-saving opportunities faced by architects, designers, consultants and homeowners. We already have a dedicated team working with building engineers and consultants to ensure our expertise is shared with the professional community.

Lisa Finnegan, Homeowner

"I was surprised at how easy it was to make the switch to a heat pump in my home. It works smoothly, controls just like before and still does everything I need."

Ashley Honey, Engineer for ACS Renewables, a heat pump installer

David Knibbs, Managing Director said:

"It made sense to add heat pumps to our product portfolio. The demand is there, the training is available and it is not rocket science!"

Gary Salter, Asset Manager Surveyor, Cottsway Housing Association

"Meeting zero-carbon for new builds will be tough, but better environmental performance matters and our customers think so too."

Commercial buildings – a sizable opportunity

Many of our commercial buildings face major legacy issues. But this sector faces unique challenges besides. No two commercial properties are the same, in terms of their construction or use. With new builds also needing to be "zero carbon", bespoke solutions will be increasingly required in the future.

Existing commercial buildings – big opportunities and quick wins

"Non-domestic buildings offer significant opportunities to reduce the UK's carbon footprint," say the Carbon Trust. It's a view that's hardly surprising given the age of these structures and the perilously slow rate at which they're being renewed. Almost one third of the country's commercial and industrial building stock dates back to before 1940;[21] each year, the number of non-residential buildings in the UK increases by only a small amount. In our view, cost-efficient carbon-reduction measures, including insulation, heat pumps and PV, offer a ready solution.

Chief Executives are increasingly aware of the need for sustainable housekeeping practices. Legal requirements and pressure to comply with corporate social responsibility (CSR) are upping the ante. A report showed that 93% feel that sustainability will be critical to the success of their companies while 91% said that they would incorporate new technologies such as renewable energy provision.[22] It's clearly time for organisations to include the working environment in their business plans.

Breaching the barriers

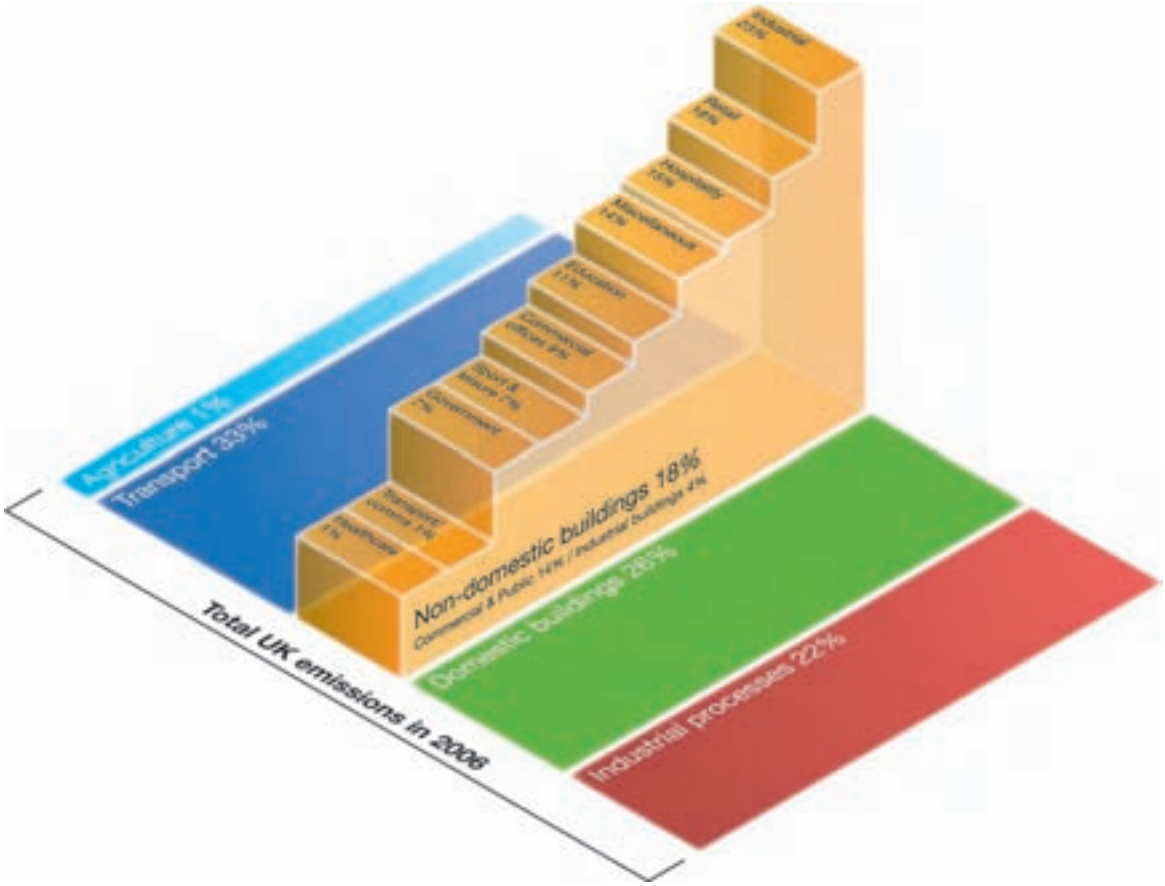
Nonetheless, there's a relative lack of action – as recognised by the All Party Parliamentary Urban Development Group in its report Greening UK Cities' Buildings. This makes recommendations for both public and private sectors to reduce the energy use of existing non-domestic buildings. It focuses on three key barriers: the availability of information; the economics of retrofitting – including the dilemma felt by owners and occupiers as to who should pay for new heating technologies; and physical barriers such as the age and location of buildings. In particular, the report emphasises how better measurement, greater awareness and systematic management can help owners and occupiers to realise quick wins at almost no additional cost.

Cooling and ventilation accounts for just 11% of a typical commercial building's emissions.[23] However technological advances over the last 10 years mean it now has a major role to play in increasing efficiencies. Older systems using outdated refrigerants are ripe for replacing with newer solutions, achieving lower running costs and reduced carbon emissions at the same time. Given that the demand for cooling is set to rise, driven by a greater number of air-conditioned offices and shops, such recent advances are timely indeed.

21 Carbon Trust – Building the Future Today report, page 31

22 http://www.ethicalcorp.com/stakeholder-engagement/future-sustainable-growth-capitalism-works

23 BRE, Carbon Trust Analysis



Getting down to business: in 2006, commercial, public and industrial buildings accounted for 18% of total UK emissions. Varying in size and application, commercial premises demand correctly applied solutions in every case.

Government aspirations are for all non-domestic new builds to be zero carbon by 2019. As we reach to meet this target, our heating, cooling, ventilation and power technologies need to factor in the fabric and general use of individual buildings. Enhancements to the heating supply – with increased electrification and more use of renewable technologies – are set to play a particularly important role.

Commercial buildings to be built – anticipating the zero-carbon requirement

New non-domestic buildings offer the greatest potential of all for lowering CO_2 emissions in that they can design low carbon thinking in from the very beginning, especially given that a further 900,000 such buildings are expected to be in place by 2050. In 2008's Budget, the Government announced its aspiration to see zero-carbon schools from 2016 and zero-carbon public buildings from 2018, with all other non-domestic buildings to follow suit from 2019.

Such targets, along with regulations such as Parts L and F of the building regulations for commercial new build and refurbishment, help concentrate minds on the required change.

Moreover, technological advances are enabling developers of commercial new builds – unhampered by the huge problems associated with old building stock – to focus more intensively on meeting the Government's targets. Improved air tightness and insulation ensure a building's infrastructure is stable, creating an efficient platform for services that reduce energy demands for heating, cooling and ventilation.

Bespoke and combined solutions get the job done

Formidable challenges remain. Whitehall and increasing numbers of local authorities are raising the legislative bar. Moreover, there's no such thing as a "typical" commercial building. More so than in the residential sector, bespoke solutions are required which not only take into account the fabric and general use of a building, but also the specific behaviours of the people who occupy it. It's unrealistic to expect improved building standards alone to make all the savings required.

Mitsubishi Electric provide many of the solutions which, when applied to new commercial buildings help them to meet the latest standards and offer reductions in run cost and emissions unobtainable with more traditional solutions. Applying different heating solutions and cooling systems that recover heat for use in other areas, heat-recovery ventilation and PV makes it easier to reach the coveted zero-carbon standard.

Alan Chisholm, Engineering Manager,
Property and Store Development, Marks & Spencer

"Environmental concerns are increasingly critical to our business decision-making. It's great to work with a supplier that thinks the way we do."

Peter Rolton, Chairman Rolton Group,
Strategic Renewable Energy Advisors

"This document comes at a critical time for our industry and represents exactly the sort of call to action that is required. It is not just technology, but strategic thinking about its application in the built environment that has to change, and Green Gateway starts this process."

Harriet Evans, Mitsubishi Electric's
Corporate Solutions Manager

"Our corporate clients require effective solutions which deliver a real and measurable long term environmental benefit as well. Green Gateway provides a framework for ensuring that we respond to their need to drive emissions out of their businesses."

Join in –
become part of the solution

Today the opportunity to help shape the UK's energy future is greater than ever. So too is the need for more dialogue, collaboration and unity of purpose across the heating, cooling, ventilation and power solutions supply chain. We invite you to join Mitsubishi Electric in forging the way ahead.

Electrifying the future

Now is the time for action. Massive challenges associated with our energy use, including climate change, fuel security and fuel poverty, confront the UK. Our buildings must be part of the solution, yet many of these are old and energy inefficient whilst new-build rates are slow. Through legislation, incentives and increasingly aware individuals, Government and corporate energy users are all demanding change.

Our responsibility is to inform those within and beyond, the heating, cooling, ventilation and power technologies supply chain about the necessity of change and the capacity of today's technologies to fill the breach.

The way we do business

Across all our operations, Mitsubishi Electric is guided by Green Gateway's five key and inter-connected principles:

- Doing the right thing – to help ensure unity of purpose across the sector, responding to market changes and addressing our own footprint.
- Increasing energy Efficiency, specifically through: equipment selection that takes a whole lifecycle view; ensuring energy-efficient solutions are deploying more intelligent monitoring, reporting and control functions.
- Reducing Carbon emissions: specifically through innovating more efficient heating, cooling and ventilation products; removing the direct use of fossil fuels; recovering waste heat to use elsewhere; and replacing equipment in a timely manner.
- Promoting the use of Renewable energy technologies: in particular the optimal mass-market solution of heat pumps – which are environmentally beneficial, highly scalable, economical and publicly acceptable – supported by PV.
- The way we do business – through Green Gateway, Mitsubishi Electric seeks to engage all the key players, to integrate solutions at every stage, broaden expertise and help our sector move forward as a whole.

We feel these five principles represent best practice for the sector as a whole. Moreover, it is clear to us that by changing the way we do business, applying our "ECR" approach and factoring this thinking into every stage of a product or system's life – from specification to disposal – we can develop and deploy the right technologies to assist in creating more sustainable buildings. Even though individual solutions may vary from application to application – with many commercial buildings, in particular demanding a bespoke approach – these must always be viable over the longer term.

Become part of the solution

For those involved in our industries, the future has never looked so challenging. But the solutions do exist; you can make a world of difference. We welcome your contribution to the debate. So if you're affected by changing environmental guidelines or keen to learn more about alternative energy technologies, please get in touch with us on 01707 282880 or email green.gateway@meuk.mee.com

For further information visit
www.greengateway.mitsubishielectric.co.uk

This publication has been created by Mitsubishi Electric to assist policy-makers, technology strategists and other professional readers to compare the merits of some of the various technologies and solutions currently available in the UK market for heating, cooling, ventilating, controlling and powering buildings.

Mitsubishi Electric is a producer of heat pump products and other heat pump systems components, ventilation, controls and photovoltaic systems for the UK market. Unless stated otherwise, all views expressed and conclusions drawn are those of Mitsubishi Electric.

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If you are an end-user considering the purchase of any system incorporating any technology product or product types featured in this publication, Mitsubishi Electric recommends that you should obtain further technical information and seek independent professional advice.

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Printed in September 2011
SAP Number: 245560

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