

# 10 initiative



## Initiative 10: Residential

<b>Introduce technology to support the Code for Sustainable Homes.</b>
<b>The Modern Domestic House – a detailed review of space and hot water requirements.</b>
<b>Highlight the advantages of heat pumps over gas boilers.</b>
<b>Remove support for the introduction of air conditioning into homes.</b>
<b>Introduce heat pumps into the supply chain for the refurbishment of existing housing stock.</b>
<b>Accelerate thinking throughout the supply chain.</b>

**In the next decade the Government is proposing that all new houses should be ‘carbon neutral’ in their energy usage as a direct plan to mitigate the effects on climate change and help the UK Government meet the target of reducing carbon emissions by at least 60% by 2050.**

The Government target of building 200,000 new homes each year is a direct response to demographic changes in the UK. Just over 180,000 new homes were built last year – adding to the 26m+ households in the UK.

A major cause of climate change comes from the energy we use to heat, light and run our homes. With at least 75% of UK properties still expected to be in use in 2050 the effect of policy on both new housing and the refurbishment of existing housing stock is very important. If we build the homes we need, then by 2050, as much as one-third of the total housing stock will have been built between now and 2050.

## **The end of the gas boiler?**

The engrained thinking of using 'wet systems' (gas boilers with water heated radiators) for heating needs to be revisited both environmentally and economically. The efficiency of gas boilers pales when compared to using a heat pump boiler. Importantly, the UK-owned supply of gas will cease shortly and the UK will then be dependent upon foreign gas supply – some of it from regions prone to instability.

The momentum for change will become unstoppable as the global sustainability agenda grows stronger. In the same way that steam was phased-out in industrial production by oil and analogue is being overtaken by 'digital' across multiple platforms, it is the view of Mitsubishi Electric LES that the days of gas usage, particularly in the UK, are numbered – the writing is on the wall and a more sustainable way to heat our homes to be introduced. And quickly.

## **Combined heat and power – a nice idea in principle**

Combined heat and power systems (CHP), and their smaller domestic versions (Micro CHP) have recently been slated as a method of improving energy efficiencies. CHP is an important element in the Government's new energy policy, as set down in the Energy White Paper. This confirms the Government's belief that CHP has an important role to play in meeting the White Paper aims – this is at a time when there is evidence that both house builders and power companies are questioning the future usage and reliability of CHP.

## **It's all about the efficient use of clean electricity**

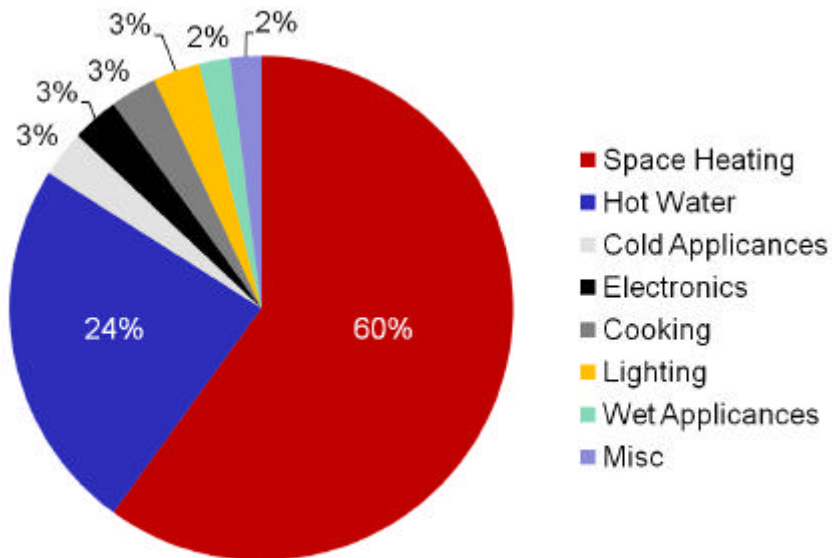
In Mitsubishi Electric LES' view it is the best-possible use of electricity that the goal.

Cleaner forms of electricity from either nuclear or renewables (either grid or on-site) are better employed in the residential sector by driving efficiencies at the point of use. The optimisation of grid electricity is key to the future of any sustainable policy. Mitsubishi Electric LES' Green Gateway Initiative is focused on driving new technology, already proven in the commercial sector, into the residential sector.

By pure volume, this is where the Company can deliver the most significant single source of CO<sub>2</sub> reduction.

### Home Information Packs and energy performance

Energy Performance Certificates are hoped to encourage households to cut consumption. This is important as the domestic sector is a critical area for focus and is responsible for 27% of the UK's CO<sub>2</sub> emissions – largely from energy for heating, hot water, lighting and appliances. Additionally, and of equal concern to policy makers, is that energy demand in the domestic sector grew 17.5% from 1990 to 2003 – an average 3 bedroom UK home produces around 5.6 tonnes of CO<sub>2</sub> per annum.



The balance of space heating and generation of hot water is significant – this is why it is essential to address energy consumption and technology that can reduce the effects on CO<sub>2</sub> generation immediately.

### Introduce technology to support the Code for Sustainable Homes.

The Code for Sustainable Homes has been introduced to drive a step-change in sustainable home building practice. It is a standard for key elements of design and construction which affect the

sustainability of a new home. It will become the single national standard for sustainable homes, used by home designers and builders as a guide to development, and by home-buyers to assist in their choice of home.

Compliance with the Code was mandatory for publicly funded homes in England from April 2007, but will be voluntary in the short term within the private sector. It is likely that compliance may become mandatory for all new homes in England as early as 2008.

### **The transfer of knowledge and adoption of continental practices**

Mitsubishi Electric LES has traditionally operated in the UK in commercial markets, however in other countries and in particular Western Europe, the Company has supplied domestic heating products to an increasing number of new home builders. The timing of the Code has highlighted the unique opportunity that the Company has to transfer its knowledge and product set into the residential sector.

Whilst many of the Company's plans under the Green Gateway Initiative have a smaller, cumulative effect on the overall reduction of CO<sub>2</sub> emissions – the effect that its technology can have in the residential sector is very significant indeed.

In the short-term, Code compliance is voluntary but home builders are encouraged to follow the principles set out in the Code because the Government is considering making assessment under Code standards mandatory in the future. However, market exposure has demonstrated to the Company that some local councils are already implementing planning decisions in-line with, or exceeding, the Code.

For the companies associated with the building of new homes the challenge is significant – this is why Mitsubishi Electric LES is moving quickly into this market. The Government wants to introduce a 25% reduction on 2006 Part L requirements by 2010, increasing to 44% by 2013 and culminating in 'zero carbon' homes by 2016.

The Company is now building momentum behind its push into the residential sector for its highly energy efficient heat pump technology.

Heat pumps are movers of heat energy – they upgrade naturally occurring low temperature heat into useful high temperature heat. This technology is already well known in the air conditioning market.

and in countries such as Sweden and Switzerland, heat pumps are often used as a primary source for heating and hot water. Heat pump technology is very flexible, with excellent energy efficiency and CO<sub>2</sub> reduction potential.

The Company has commissioned specific technical data to analyse, for the first time, the energy usage in a modern domestic home and how new techniques can dramatically affect energy use and accelerate the UK Government's plans for CO<sub>2</sub> reduction in the residential sector.

### **The Modern Domestic House – a detailed review of space and hot water requirements.**

The following key data addresses a 3 bedroom semi-detached house built to 2006 building regulations.

Modelled using the latest software techniques, commissioned exclusively by Mitsubishi Electric LES, the Company has specifically produced this study to put forward an evidence-based case against the continued use of gas boilers and to build the case for solutions that are made possible through free cooling & heat recovery.

#### **Annual heating requirements**

Water heating load, assuming 160 Litres per day @ 55°C	3,066 kWh
Space heating load with standard trickle vent	5,093 kWh
<b>Total</b>	<b>8,159 kWh</b>

#### **Heat with condensing Gas Boiler of 93% efficiency**

Gas consumed	8,811 kWh
CO <sub>2</sub> emitted	1,674 kg

#### **Heat with Heat Pump with annual COP of 3.02**

Electricity consumed	2,703 kWh
CO <sub>2</sub> emitted	1,162 kg
<b>Saving in CO<sub>2</sub> emissions using a heat pump</b>	<b>512kg (31%)</b>

### Further reducing heat load

By making the house air tight (not using trickle vent systems) and ventilating with heat recovery equipment the space heating load of the building can be reduced by 39%.

### Add heat recovery ventilation

New annual space heating load	3,128 kWh
Additional power for ventilation	328 kWh

### Cooling homes when the summers become hotter and longer

As climate change affects the length and heat of the summer periods there is often an argument made for domestic air conditioning. This question is dealt with in greater detail shortly, however, heat recovery plant also has the ability to operate in bypass mode to provide free cooling from the ambient air during the summer period.

As house insulation increases the threat of over heating in summer rises. This results in the direct potential to increase sales of air conditioning into the domestic environment – this is absolutely not supported by Mitsubishi Electric LES.

Without any form of cooling, the Company's independent model indicates that UK night time bedroom temperatures will exceed 24°C for up to 164 hours per year – approximately 20 days per year.

**With the free cooling function active 24°C will not be exceeded in any of the bedrooms between 10pm and 6am. Mechanical Air Conditioning is therefore not necessary to maintain night time comfort.**

### 2016 building regulations and improved insulation

As we move towards 2016, building insulation levels will further increase with an expected reduction in space heating load. Based on our model we will see space heating loads reduce by over 50% during the next 10 years.

Ventilating the house will become more important as insulation and air tightness increases. The forecast number of hours when a bedroom will exceed 24°C during night time will rise to 690 without any active ventilation strategy. Assuming heat recovery ventilation is used and the free cooling mode activated the number of night time hours above 24°C is zero.

The advantages of using a heat pump for the space heating will increase as electricity generation becomes cleaner. Electricity generated for a renewable source can provide zero emission heating and provide greater than 3kW of heat for each 1kW generated.

### **Highlight the advantages of heat pumps over gas boilers.**

1.6m+ Domestic Gas Boilers are sold in the UK every year. Modern gas boilers are efficient, but the technology has reached the summit of its possible energy efficiency. Heat pumps are more efficient than gas boilers and Mitsubishi Electric LES plans to promote heat pumps into the domestic sector heavily – the sustainable advantage is significant.

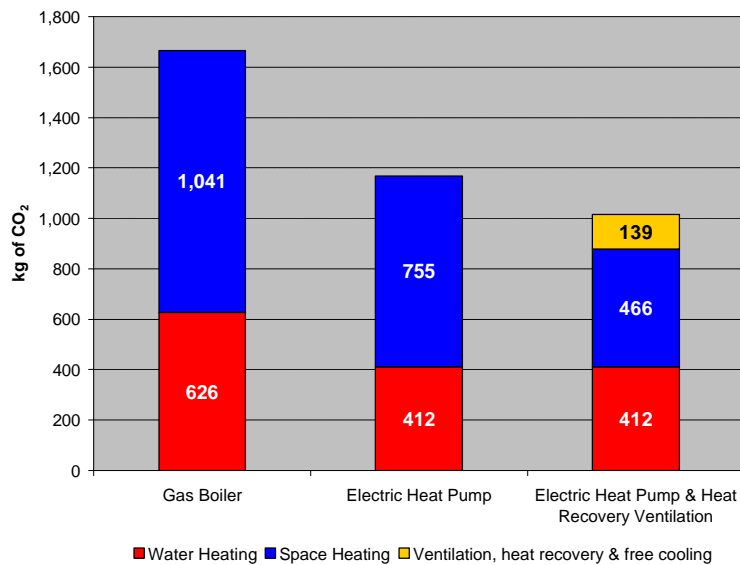
Heat pumps can reduce carbon emissions for heating domestic heating by over 30% compared to gas boilers. Adding heat recovery ventilation can further reduce heat loads by up to 39% reducing the requirement to use energy to heat the building. As detailed earlier, the free cooling function of these products can then prevent the need to install mechanical cooling for night time comfort saving future potential increases in energy consumption.

The case is compelling and to this end the Company will shortly commence an education programme to share its technology with decision makers in the house building sector.

New build houses differ from existing houses as the required heat load is much smaller at approximately 8,000 kWh/year, compared to existing houses which require approximately 17-18,000 kWh/year. This is due to improved insulation and construction methods. With new houses energy requirements can be met with a heat pump for water and space heating. As shown in the last bar in the graph

below by using heat recovery, such as Mitsubishi Electric LES' Lossnay, for free cooling during the night as required, can further reduce the energy use.

**New Build: Annual Heating CO<sub>2</sub> emissions for a 3 bed semi detached house built to 2006 building regulations**



**Remove support for the introduction of air conditioning into homes.**

Is there a necessity for cooling in the UK domestic housing market? This is the simple question that Mitsubishi Electric LES started with – the Company drew the simple answer that there is no compelling argument to support the case for mass adoption.

As detailed earlier, with the free cooling function of a Lossnay-type system active – 24°C will not be exceeded in any bedroom between 10pm and 6am. Mechanical Air Conditioning is therefore not necessary to maintain night time comfort.

There is momentum from certain quarters of the air conditioning market focussed on developing a market for domestic cooling. Even though Mitsubishi Electric LES garners significant revenue from air conditioning, the Company does not wish to promote any growth in the domestic sector in the UK.

Earlier in this document the case has been made for using ventilation to supply mechanical cooling as required – the Company is adamant

that this stacks-up both technically and ethically in the domestic sector.

There are 2 key questions surrounding this debate:

1. Does the °C increase attributable to global warming equate to an excuse for triggering domestic cooling?
2. Will the UK Government allow domestic cooling products to be sold in volume?

In answer to the first, even with the projected increase in land temperatures it will not be necessary to introduce air conditioning into homes – unless they are in properties located in ‘heat islands’ such as large city centres, into flats, apartments and other housing developments that locate people within close proximity to each other.

Answering the latter – Mitsubishi Electric LES considers that it will only be a matter of time before Government policy makers review all areas of power usage within domestic properties and introduce legislation through taxation and personal carbon allowances that will conclude the argument for itself.

### **Introduce heat pumps into the supply chain for the refurbishment of existing housing stock.**

At first sight, new homes might seem an ineffective target for cutting CO<sub>2</sub> emissions because they account for a relatively small percentage of the total building stock. However, they are currently in sharp focus.

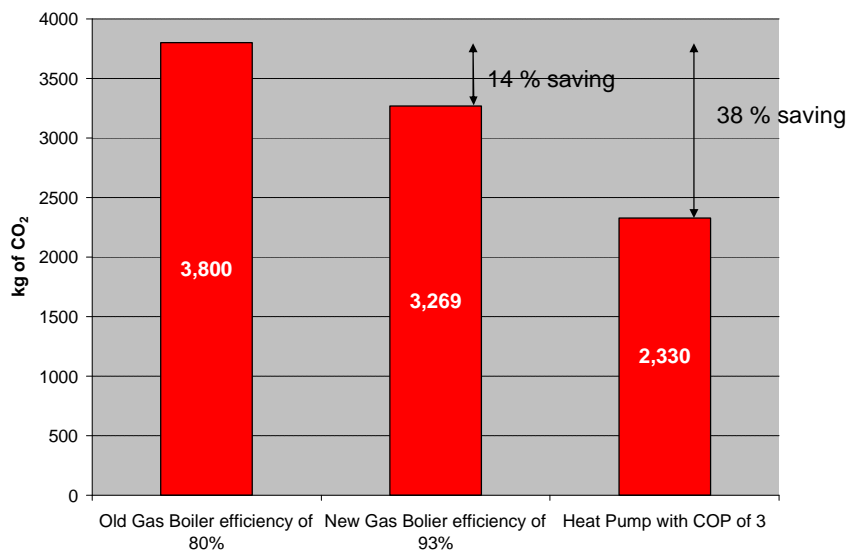
The next in line will be existing housing stock. Within the recently delayed Home Information Packs the energy consumption of homes was the key point of differentiation being introduced with the policy.

Whilst the policy has struggled in the media and professional circles – the fundamental thrust behind the policy is sound (i.e. does an energy inefficient home warrant the same market valuation as one that is?).

Mitsubishi Electric LES is focused on developing the domestic refurbishment market in order to make heat pumps more pervasive in specifiers, installers and end-users’ thinking.

Looking at existing houses, there would be a 14% reduction in CO<sub>2</sub> emissions for replacing an old gas boiler (with an efficiency of 80%) with a new gas boiler (with an efficiency of 93%). The reduction is more substantial if the old gas boiler is replaced with a heat pump with a COP of 3, with a 38% reduction in CO<sub>2</sub> emissions, as shown in the graph below:

**Existing Houses: Replacement of average house system**

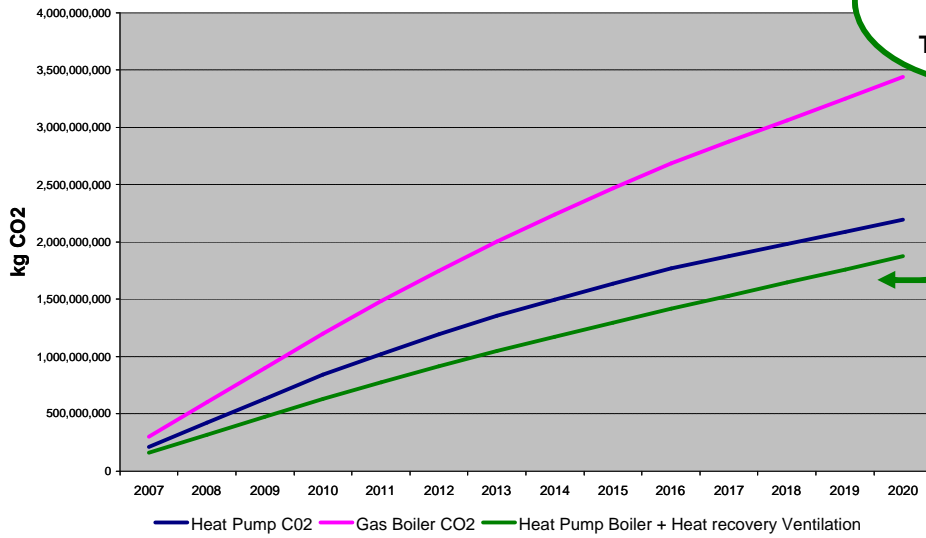


### **Accelerate thinking throughout the supply chain.**

The Company is currently finalising the technical data that it requires to finalise the information presented to specifiers and buyers of heat pump technology. Thereafter Mitsubishi Electric LES will grow its sales & marketing programmes into the sector – delivering new product sales via specifier, distributor and end-user sales promotion.

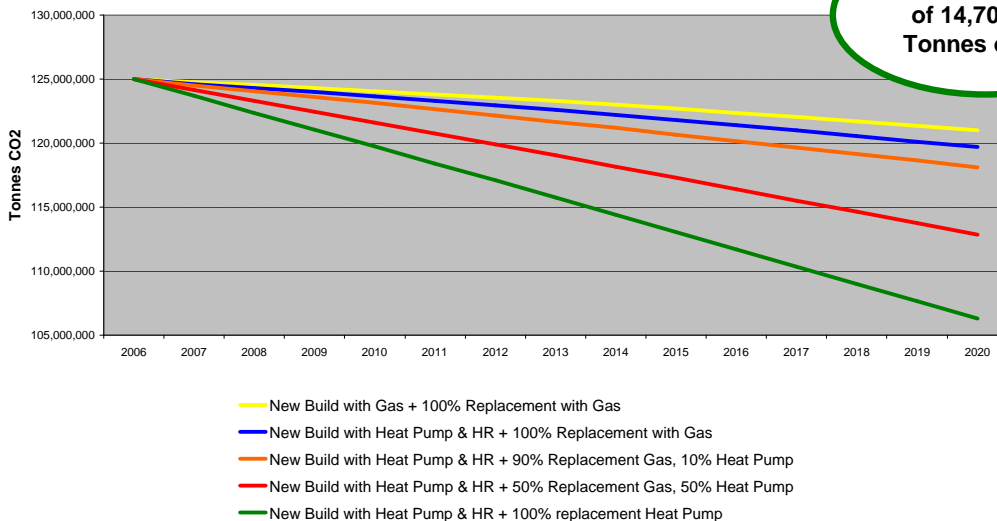
**Expected outcomes from this initiative:**

**Cumulative CO<sub>2</sub> from heating 180,000 new houses per year**



Potential saving of 1,565,000 Tonnes of CO<sub>2</sub>

**Cumulative CO<sub>2</sub> emission reductions new build & refurbishment for domestic heating**



Potential saving of 14,700,000 Tonnes of CO<sub>2</sub>