

# ecodan<sup>®</sup>

Renewable Heating Technology

The perfect solution for **Low Cost, Low Carbon**  
**Domestic Space and  
Water Heating**

Helping you to comply with   
**The Code for Sustainable Homes**



**The name  
Mitsubishi is  
synonymous  
with excellence**



Known the world over, Mitsubishi is a trusted global leader associated with a variety of products and services. Founded in 1921, the company known today as Mitsubishi Electric, quickly rose to the forefront of the heating and cooling industry, a position we still enjoy today.

As a leading manufacturer of energy efficient heat pump systems, we constantly strive to meet and exceed the increasing demands placed on our industry. The drive to reduce energy consumption and the impact its use has on the environment is crucial and increasingly important to us all. Energy efficiency, has long driven Mitsubishi Electric to spend millions of pounds and huge amounts of resource on researching and developing the solutions of the future.

## Responsible manufacturing

Mitsubishi Electric boasts an explicit commitment to sustainable business practices such as energy and resource efficiency, minimising ecological impacts and reducing greenhouse gas emissions. All our factories are

ISO14001 registered, the international standard that ensures that our manufacturing processes ensure optimum environmental performance and tight control on waste. Mitsubishi Electric's manufacturing facility in Livingston, Scotland produces our range of air source heat pumps for the UK and European markets.

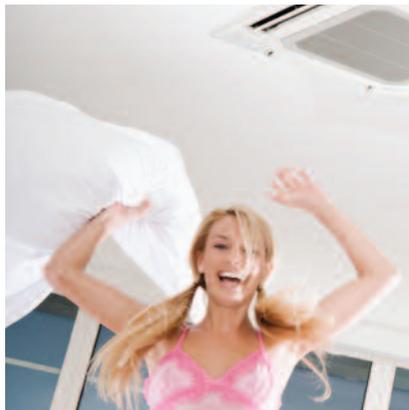
We have also gone further than any accepted minimum standards. Our global Environmental Vision 2021 provides a goal for a lower emission future that influences all our policy decisions.

Our UK Green Gateway Initiative takes this vision even further as it looks to install behavioural change in our own operations and our wider sphere of influence with contractors, consultants and end users. It looks to highlight the advantages and opportunities provided, by ensuring all our activity is undertaken with consideration to the environment.

We are also proud to be a partner within Sustainable Energy Europe, whose stated aim is to raise awareness of energy use in Europe.



**Providing perfect solutions for today and the future**



# Recognising the need to change our approach to energy use

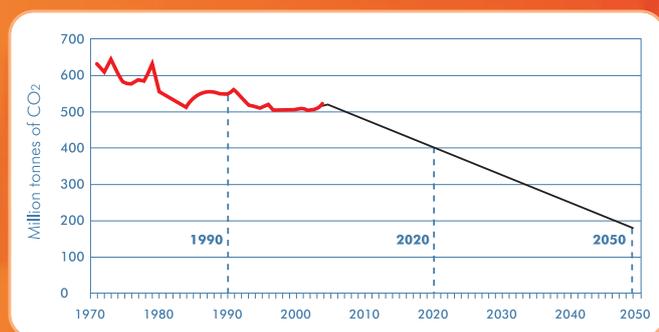
**Global warming is a reality that we must all now face and as legislation drives the increased use of sustainable energy, the need for energy efficient homes, with minimum CO2 emissions is greater than ever.**

Recent rises in energy bills adversely affect us all. With costs set to continue to rise and natural energy resources proven to be diminishing, it is crucial that we consider alternative, more efficient means of providing and utilising energy.

## Reducing the impact on our environment

Global warming is confirmed as being closely linked to carbon emissions and as a result, the UK Government has determined that this country will play a major part in helping to reduce such emissions. The Government introduced the Sustainable Energy and Climate Change Bill with the long-term goal being to cut CO2 emissions by 80% from 1990 levels by the year 2050. New legislative powers and improved ways in which CO2 reductions are monitored and reported will also be introduced.

Total CO2 Emissions



Source: International Energy Agency

## Making a difference - home by home

The Scottish Government's two year pilot study "**The Scottish Renewable Heating Pilot**" carried out in conjunction with the Energy Saving Trust (EST) to evaluate the impact on fuel poverty of using renewable based solutions and has stated the following:-

### Principle key findings:

"Air Source Heat Pumps were found to provide the greatest overall value for money in terms of households lifted from fuel poverty per £1m capital spend"

### Recommendations within the study also state:

"When correctly specified and installed, with adequate levels of support provided to allow households to understand how to use the systems cost-efficiently, heat pump technologies are an effective, cost-efficient way to tackle fuel poverty. In particular, where householders are considering their options under future fuel poverty programmes, they should be offered advice on the comparative benefits of Air Source Heat Pumps, including the potential for savings on energy costs over the longer term."

# 27% of the UK's CO2 emissions come from domestic heating, lighting and appliances

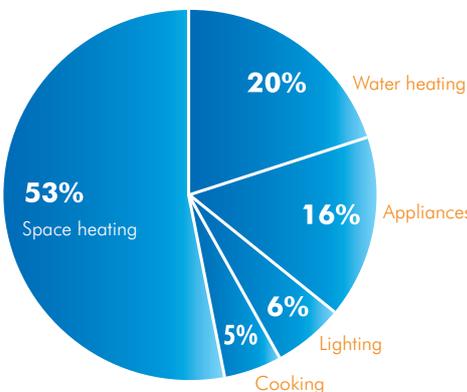
As energy used in buildings is responsible for almost 50% of the UK's carbon burden, the commercial and residential building sectors are under close scrutiny as far as energy efficiency is concerned.

That said, more than a quarter of the UK's CO2 emissions are as a direct result of us heating, lighting and running appliances in our homes.

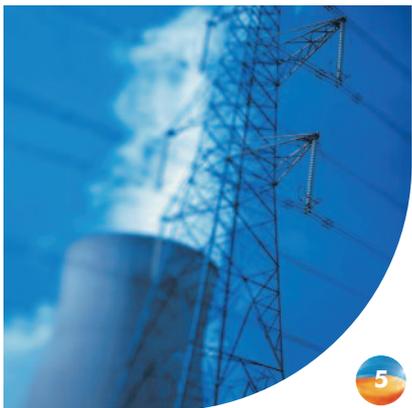
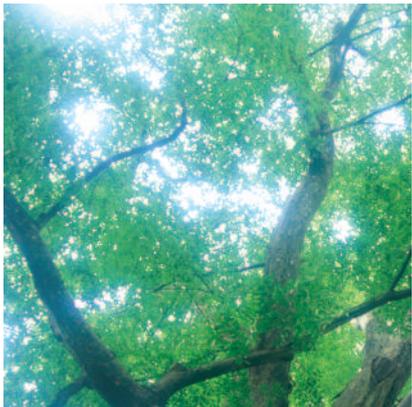
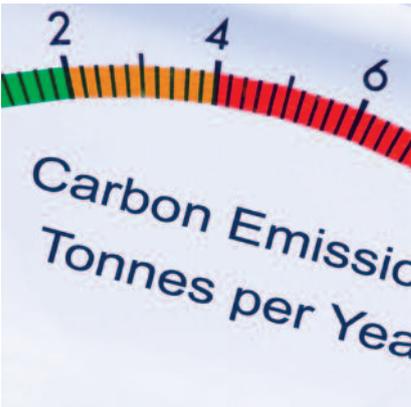
Domestic space and water heating produce over 70% of an average home's CO2 emissions, therefore reducing these is of paramount importance. It's no surprise, that in order to reduce CO2 emissions, we need to focus our efforts on seeking new, more effective means of heating homes.

Central and local government are using legislation and strict guidelines to ensure that homes are as energy efficient as possible. In the social and private housing sector, designers, builders and installers increasingly need to utilise new and advanced technologies to ensure they meet the new rules designed to cut CO2 emissions and make better use of energy.

The average UK household produces over 5 tonnes of CO2 per year, with a typical breakdown being:



**We need to reduce the requirement for heating and ensure we heat by the most efficient means possible**



# The future of domestic heating

**Like all new technologies, air source heat pumps are an investment in the future. Developers, housebuilders and homeowners want to be assured that the technology they purchase today will be relevant and useful for many years to come. Mitsubishi Electric's Ecodan air source heat pump has been designed with the future very much in mind.**

More and more legislation is forcing housebuilders and homeowners to consider energy use in their properties. Part L of the Building Regulations sets targets for carbon emissions from homes and these targets are set to rise over the next five to ten years. Ecodan air source heat pumps are at the cutting edge of low-energy performance and will enable homes to meet these targets long after they are built.

The recent Home Information Pack also takes into account the energy used in domestic properties and homeowners using Ecodan air source heat pumps will know that their energy use will always be less than homes with traditional gas-fired boiler systems, or electric heating.

A growing number of local authorities include targets for use of renewable energy sources on new-build sites. Currently, these targets can range from 10% to 20% of a planned site's predicted energy that must be sourced from on-site renewables. It is sensible to minimise energy use in the dwellings on such sites to keep the requirement for high capital cost renewables to the minimum. Ecodan air source heat pumps cut the energy needed by homes, reduces the burden on renewable sources, and helps to minimise the carbon footprint of the site overall.

To meet our 2020 15% renewable energy target, the Government needs to develop new ways of generating renewable energy in all sectors, including heat. Heat generated from renewable sources accounts for only 0.6% of total heat demand - this may need to rise to 14% to hit our binding EU targets. Common examples of renewable heat technologies include: air and ground source heat pumps, biomass fuelled stoves and boilers, solar-thermal water heaters and combined heat and power (CHP) plants which are fuelled from renewable sources.

The Government's aim is to make the Renewable Heat Incentive (RHI) as accessible, flexible and user-friendly as possible to potential investors in renewable heat at all scales, right down to individual householders. The incentive payments are expected to be funded by a levy on suppliers of fossil fuels for heat. The RHI is expected to be in place by April 2011.

# The challenges:

Rising energy costs

Increases in UK fuel poverty

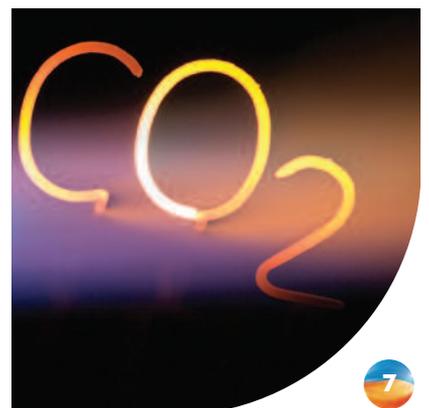
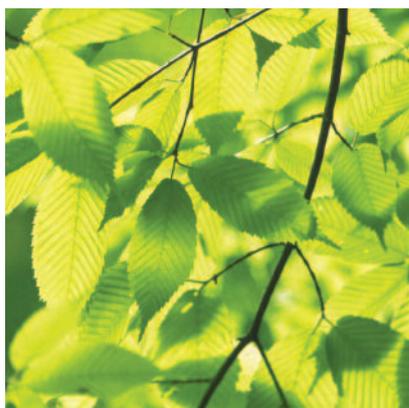
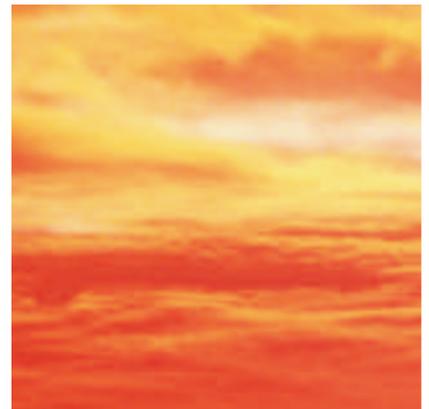
Gas and oil based solutions have a limited life span - need to plan for long term future

Global and national pressures to be more environmentally responsible

Increasing demand from homeowners and housebuilders for renewable energy

The Code for Sustainable Homes legislative requirements for new build properties to reduce CO<sub>2</sub> emissions

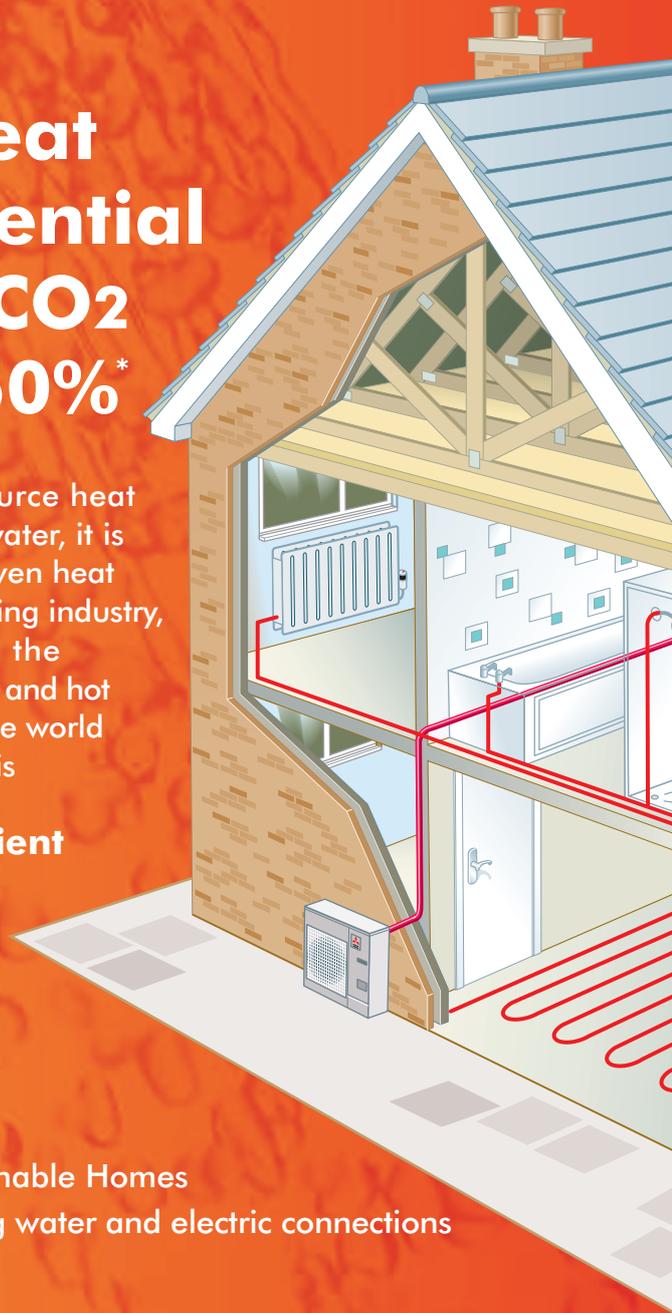
**Ecodan air source heat pumps are at the cutting edge of low-energy performance**



# The solution:

## Ecodan<sup>®</sup> air source heat pumps have the potential to reduce a home's CO<sub>2</sub> emissions by up to 50%\*

By simply using a Mitsubishi Electric Ecodan air source heat pump to provide domestic space heating and hot water, it is possible to greatly reduce CO<sub>2</sub> emissions. Using proven heat pump technology widely used in the heating and cooling industry, Ecodan upgrades naturally occurring energy from the air and uses this to provide domestic space heating and hot water. Heat pump technology has been used around the world for decades and Mitsubishi Electric have developed this technology for domestic application to produce **Ecodan - one of the most advanced, efficient heating systems available today.**

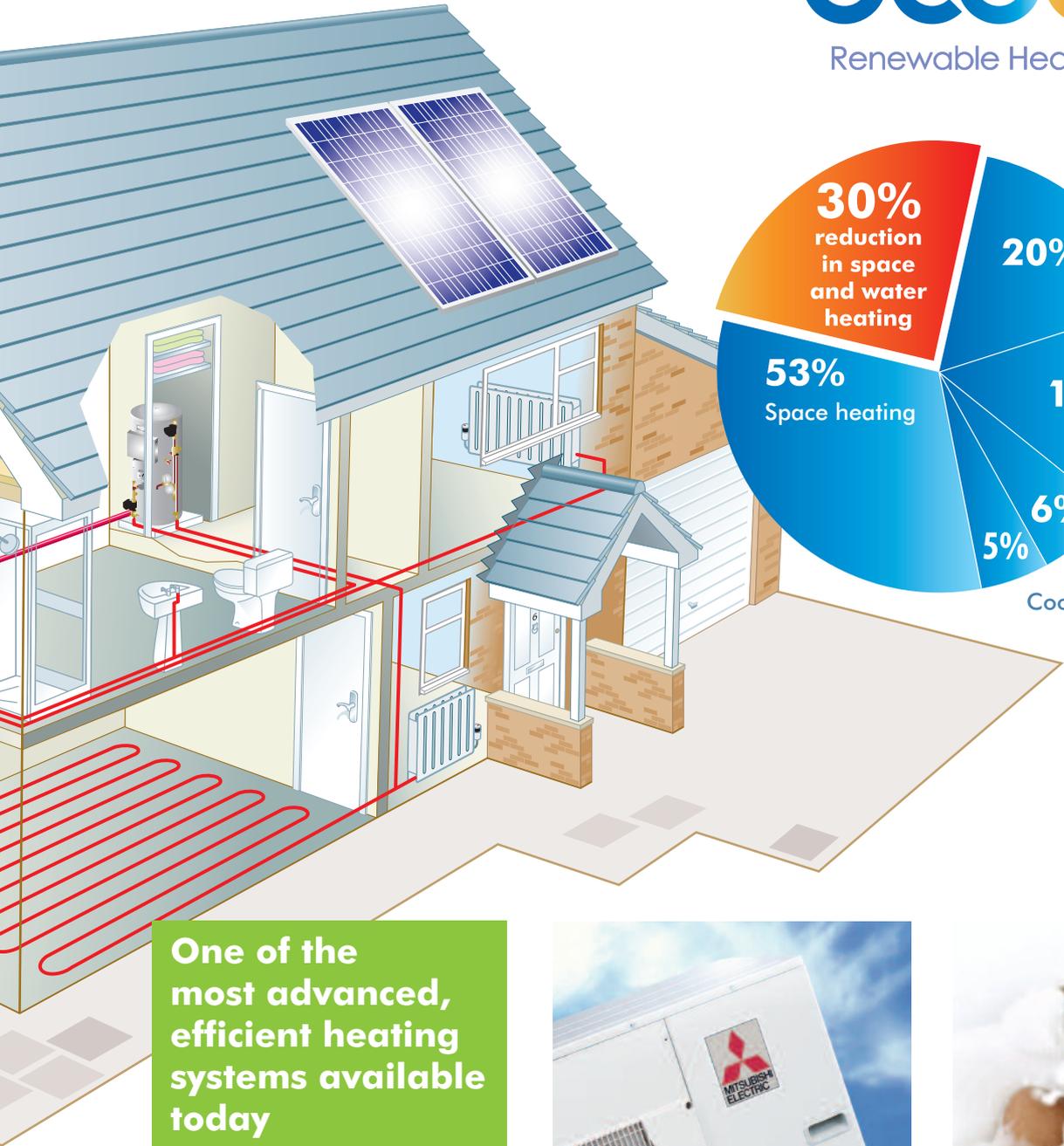


## Outstanding benefits:

- 30 - 50% reduction in CO<sub>2</sub> emissions
- Helps to achieve Level 3 of the Code for Sustainable Homes
- Easy to install - self contained unit only requiring water and electric connections
- No gas supply, flues or ventilation required
- No need for groundwork or external pumps
- Single phase power supply with a low starting current
- 3 phase option available (14kW)
- Low running costs
- Low maintenance
- Even higher running cost savings and CO<sub>2</sub> reductions with under floor heating systems
- Designed for domestic use
- Low noise - market leading 45dBA at 1 metre\*\*
- Reduced VAT to 5% for domestic applications

\*These savings are based on a 4 bedroom house of standard construction built in 2000. The Ecodan replaced an 80% efficient A rated gas boiler.

\*\*Based on a 5kW model



One of the most advanced, efficient heating systems available today



# Ecodan<sup>®</sup> works in both new and existing homes

## New Homes

CO<sub>2</sub> emissions reduced by **30%**

There is currently a substantial under supply of housing in the UK. In order to meet the demand for new homes, the housing sector is set to increase its build rate by 23% over the next 20 years. This means that by the year 2050, over a third of the UK's housing stock will have been built inside of four decades. The Government is therefore focussed on using this growth as the ideal opportunity to cut energy use and water consumption in homes and is introducing legislation and guidelines in support of this.

## Existing Homes

CO<sub>2</sub> emissions reduced by **50%**

The potential for reducing CO<sub>2</sub> emissions as well as the energy demands of existing homes is even greater than with that of new build. Existing energy use is likely to be much higher than in a new build, due to lower insulation levels and older heating systems with low efficiency.

Existing homes have the potential to benefit from Government grant funding. Please refer to the latest Micro Generation Listing. **For further details and the latest information regarding any grants, please visit [www.greenbooklive.com](http://www.greenbooklive.com)**

**As a further incentive for home owners to consider systems such as the Mitsubishi Electric Ecodan, the cost of VAT is reduced to only 5% in recognition of air source heat pump status as a low carbon technology as opposed to the standard rate of VAT applicable on all traditional heating systems.**

# The Code for Sustainable Homes

Introduced in 2006, The Code for Sustainable Homes is part of the growing body of legislation aimed at reducing CO2 emissions. Using a rating system of one to six stars to depict the overall sustainable performance of a house, with one star being above the standard of the current Building Regulations.

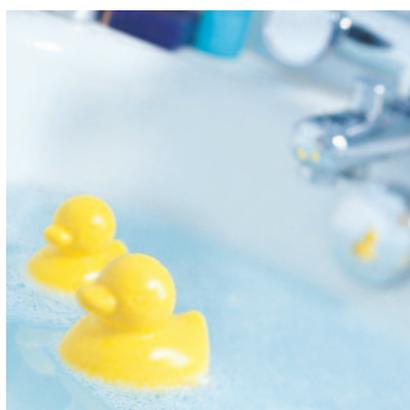
**Code Level 3 CO2 emission reductions can be achieved by the deployment of Ecodan air source heat pumps. In conjunction with notional energy saving methods such as improved thermal insulation, Code Level 4 can also be achieved.**



## CO2 Emissions Reduction Targets

CO2 Emissions	
Code level (Stars)	Percentage improvement on Part L 2006
1*	10%
2**	18%
3***	25%
4****	44%
5*****	100%
6*****	Zero Carbon

**Simple to install, cost effective, heating solutions from Mitsubishi Electric**



# Why Ecodan<sup>®</sup> is more efficient than other forms of heating solutions

With conventional boilers, 1kW of input energy provides less than 1kW of output energy or heat. With Ecodan air source heat pumps, every 1kW of input energy is converted into an average of 3.3kW\* of output energy or heat, making it more than three times as efficient as conventional boilers and a natural choice for low cost heating and hot water.

The Co-efficient of Performance (COP) of a heat pump is the ratio of the heat delivered, divided by the power consumed. The modern heat pump technology used in Ecodan and given in this example has a seasonal COP rating of 3.3.

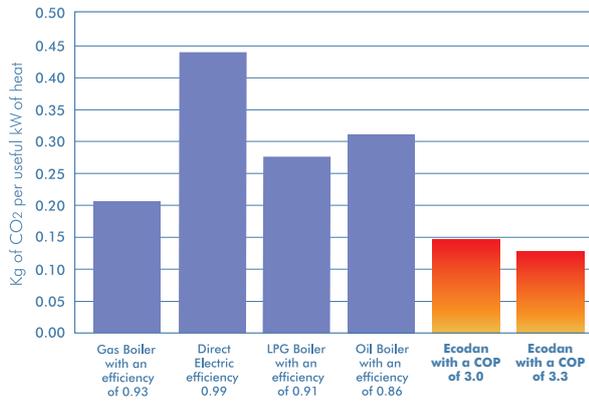
By 2016, over 720,000 tonnes of CO<sub>2</sub> emissions per annum could be saved if all the 200,000 residential properties built each year installed heat pumps. If a heat pump also replaced 10% of the gas boilers sold each year in existing properties, the potential annual saving would increase to over 2 million tonnes of CO<sub>2</sub> by 2016.

By transforming the energy found naturally in outdoor air and using it to help provide cost effective heating, we've already established the efficiency of Ecodan and the fact that it 'upgrades' energy. Take that one step further and consider using Ecodan powered by electricity from a renewable energy source such as wind, solar or tidal and you could have a heating system that is zero carbon rated.

Another advantage with Ecodan is it's ease of installation and design flexibility. A perfect answer to those wide areas of the UK that are not perhaps on, or likely to be on the National Gas Grid. This negates the need to consider the more costly options of oil or direct electric systems and removes the need to negotiate the enormous expense and disruption of extending the National Gas Grid. Whatever the location, simply install Ecodan and enjoy efficient, effective heating and hot water at a fraction of the alternative cost.

\*Based on seasonal performance case study data.

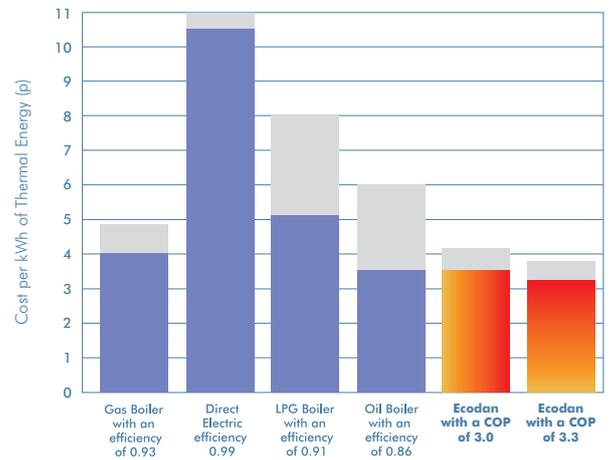
## CO2 emissions for various heating systems



Fuel	CO2 levels per KW
Oil	0.26
LPG	0.25
Gas	0.19
Electricity*	0.43

\*Government figure for UK long term average grid output

## Running costs for various heating systems



Prices in the above running cost graph are based on BG standard tariff gas and electricity prices as of June 2009. Oil price based on figures from [www.boilerjuice.com](http://www.boilerjuice.com) June 2009.

From the high energy costs of July 2008 as illustrated in grey, current prices have reduced as indicated. However informed opinion indicates energy prices will continue to rise on average.

The future of domestic space heating and hot water

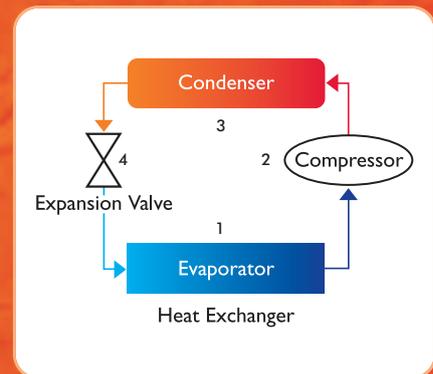


# Ecodan® - how it works

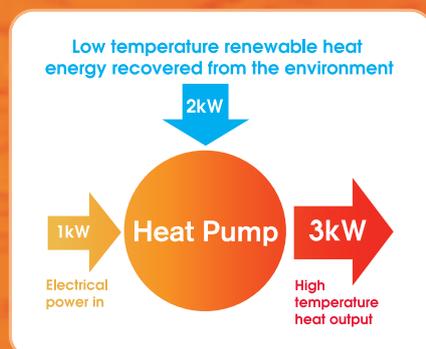
The advanced heating technology used in air source heat pumps make them ideal for use in the UK's ambient temperatures and hence perfect for the domestic market.

The technology inside the air source heat pump is similar to any domestic refrigerator, which uses a vapour compression cycle. The main components in the air source heat pump are the compressor, the expansion valve and two heat exchangers (an evaporator and a condenser).

- 1 Refrigerant in the evaporator is colder than the heat source. This causes the heat to move from the heat source (in this case the outside air) to the refrigerant, which then evaporates.
- 2 This vapour moves to the compressor and reaches a higher temperature and pressure.
- 3 The hot vapour now enters the condenser and gives off heat as it condenses.
- 4 The refrigerant then moves to the expansion valve; drops in temperature and pressure; and then returns to the evaporator.



## What makes Ecodan® unique?



### Inverter-driven technology

At the heart of Ecodan is a modern, inverter-driven heat pump compressor which converts free energy from the air and upgrades it to higher temperatures suitable for heating. The inverter control regulates the system so that heat output modulates to match the exact capacity required, meaning the heat pump will only consume the exact energy needed at any given time and thus increase efficiency further.

# The performance characteristics of Ecodan®

## Low starting current

All Ecodan units operate on a standard single phase power supply and have a low starting current of 5 amps, which reduces power requirement further still. In addition a 3-phase option is available on the 14kW unit.

## Low noise levels

Crucial to residential applications, the Ecodan range offers some of the lowest noise levels available.

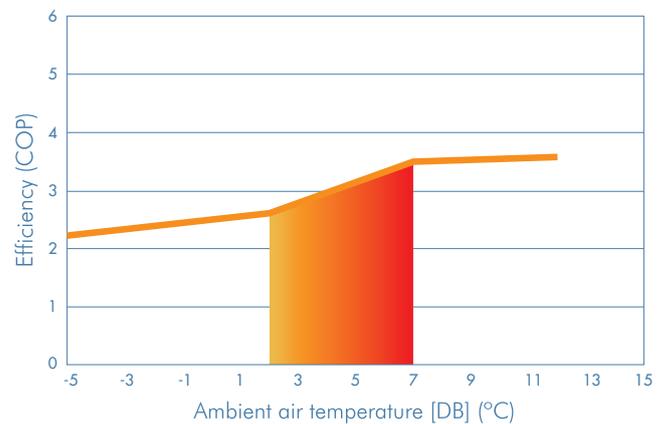
## Easy to install

The Ecodan heat pump is a self contained unit which only requires water and a single phase power supply.

## Highest efficiency

With the UK's ambient temperatures, Ecodan is perfectly designed to operate at optimum performance throughout the year. Ecodan can generate hot water up to 60°C, it also has the ability to operate in the unlikely event of the outside temperature plummeting to -20°C.

## COP ratings against typical UK heating range



Ecodan efficiency against ambient temperature using average flow temperature of 45°C. Shaded area shows typical UK heating range (2°C to 7°C) at which COPs of 3.1 to 3.7 are achievable.

**Ecodan®  
air source  
heat pumps  
are perfect  
for the UK  
domestic  
market**



# Ecodan<sup>®</sup> in operation

Ecodan air source heat pumps are ideal for use in a variety of house sizes or styles and its carefully developed control system is designed to work perfectly to provide hot water to either traditional radiators or under floor heating systems.

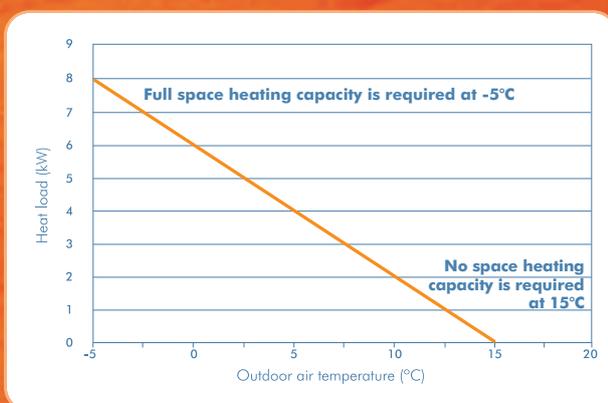
Traditionally heat pumps have been seen as only suitable for under floor heating, however with the advanced control system of Ecodan and its ability to provide optimum variable flow temperature control, radiators can now be easily provided with the hot water they need and prove to be a very efficient option.

## How the delivery of heat differs when comparing Ecodan to traditional radiator systems

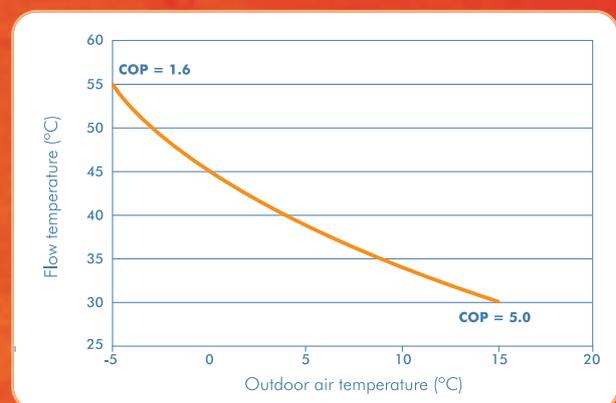
Capacity control in radiator systems, with a fixed flow temperature is controlled by Thermostatic Radiator Valves (TRV). These operate by turning the radiators on and off to maintain the desired comfort level. For example at 2°C, with 55°C flow temperature, the radiators will be on 50% of the time and off for the other 50% of the time.

The Ecodan will vary the flow temperature automatically, based on the ambient temperature to keep the house warm. Operating at these lower flow temperatures significantly improve efficiency.

### Typical heat load of a house to achieve indoor comfort



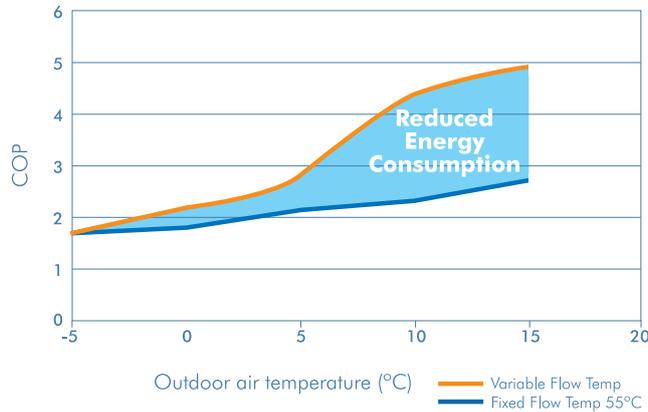
### Flow temperature requirement vs outside air temperature



## Reduced energy consumption

Energy savings of over 30% are achieved by using a heat pump with a variable flow temperature as opposed to a fixed flow temperature.

### Efficiency comparison with fixed and variable flow temperature



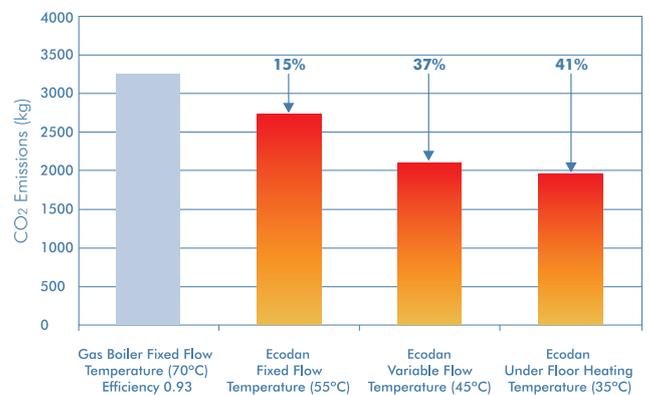
When installing a heat pump with a fixed flow temperature of 55°C, annual running costs for a three bedroom house are comparable to a traditional gas boiler. If variable flow temperature with radiators are used, the running cost savings are over 20% and even greater for under floor heating systems.

## Improved level of comfort

In using lower flow temperatures a more consistent heat output is achieved, Ecodan therefore gives a greater level of comfort, lower CO<sub>2</sub> emissions and reduced running costs when heating the home.

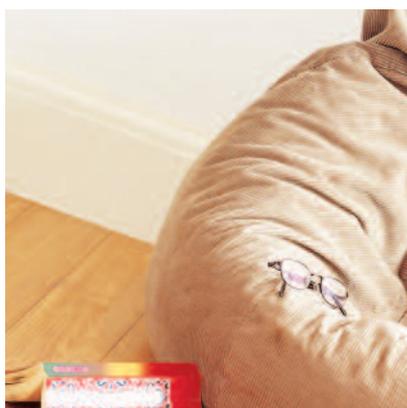
This is an alternative to high temperature radiators that give on-off bursts of heat in a bid to maintain the desired room temperature. Homes with suitably sized radiators can now enjoy a constant, controlled living environment, whilst benefiting from reduced running costs and lessening the impact on our environment.

### Annual CO<sub>2</sub> emission reductions for a three bedroom house



**Greater comfort, lower CO<sub>2</sub> emissions and running costs reduced by between 20-30%**

dependent on age and type of boiler replaced. Savings also dependent on local gas and electric tariffs.



# The Ecodan® range

Our comprehensive Ecodan range is designed to suit a wide number of applications, from a small flat to a six bedroom house and will cater for the varying requirements of both new build and existing homes.

## W50

The smallest capacity unit in our Ecodan range is the W50 which is 5kW and is perfect for use in new build applications due to their modern day thermal efficiencies. Able to work at variable capacities between 1.5kW and 5kW the W50 is ideal for many applications ranging from smaller existing homes or flats to medium sized newly built homes.



## W85

Currently the most popular unit in our Ecodan range is the W85 which is proving ideal for use in both newly built homes and existing homes too. The Case Studies in this brochure show how effective the W85 has proven for the two very different applications. Able to work at variable capacities between 2.7kW and 9kW the W85 offers the widest scope to cater for the majority of applications.



## HW140

Catering for applications with a greater demand for a more powerful unit is the HW140. With the potential to operate between 4.2kW and 14kW, our most powerful unit is perfectly suited to provide effective heating and hot water for larger, existing homes that do not benefit from the thermal efficiencies of today's homes. This unit is also available as a 3-phase option.



**The European Eco-label** also known as "the Flower" due to its flower logo denotes products and services with superior environmental performance. Products bearing the label are certified to meet EU-wide environmental criteria, and compliance is independently verified by an approved body. The Eco-label scheme is voluntary and represents products with class leading environmental performance. It is available for many consumer and commercial product groups and now includes heat pumps. The Ecodan range of products met this criteria in January 2010.

# The Ecodan® Approved Packaged Systems

To ensure that you get the best performance and enjoy the full range of benefits that Ecodan has to offer, we recommend you install an approved packaged solution. We have carried out extensive research and development to ensure we can maximise Ecodan's unique performance. To take full advantage of Ecodan, install an approved packaged system that teams Ecodan with the ideal water storage cylinder and perfect control system.



## Using alternative water storage tanks with Ecodan®

Whilst we recommend using an approved packaged system, Ecodan will also work with most other leading brands of water storage cylinders and controls. The space heating ability will operate in much the same way as with

the packaged system, but it's important to note that the production of hot water may vary. We therefore recommend that careful consideration is given to the specification of the hot water storage cylinder, in order to maintain optimum efficiency of the water heating cycle.

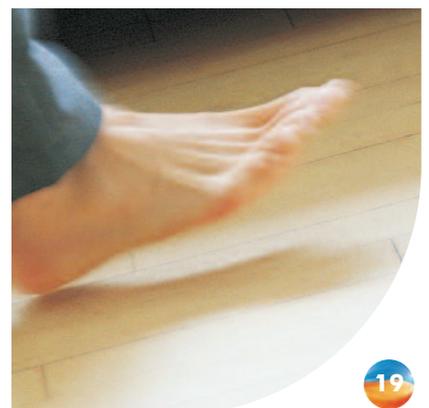
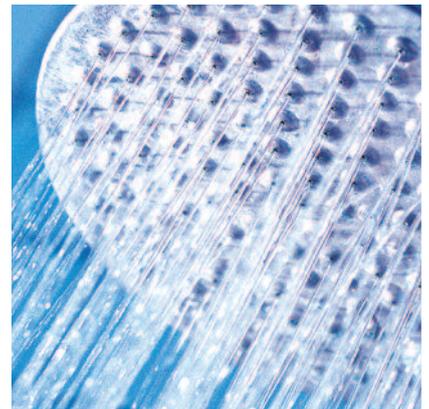
## Optimum control

The Ecodan controller is specifically designed to ensure that space heating operates at optimum efficiency. The controller is also designed to readily interface with standard S plan valve configurations for central heating and hot water systems. This enables Ecodan to be used with other suitable hot water tanks and under floor heating systems.

To combat the ineffective 'On/Off' approach of heating systems, our inverter driven technology means we can offer Flow Temperature Control. Put simply, this enables the system to vary the flow temperature of water depending on the demand for heat - quickly reacting to outdoor weather temperatures and making it hugely energy efficient. Here are some examples of the features our control systems can offer:

- Outside weather compensator
- Programmable flow set point temperatures
- Inverter driven compressor
- Able to interface with standard S plan central heating

**Perfect for providing domestic space heating and hot water**



# Recognising the potential for Ecodan<sup>®</sup>

# The Microgeneration Certification Scheme (MCS)

The Microgeneration Certification Scheme (MCS) is owned by the department for Business, Enterprise and Regulatory Reform (BERR formerly the DTI). It is designed to evaluate products and installers against robust criteria for microgeneration technologies, providing greater protection for consumers and ensuring that the Government's (ie. taxpayers) grant money is spent in an effective manner.

This new scheme will underpin BERR's grant scheme, the Low Carbon Buildings Programme, and grants will be available to applicants using both products and installers certified under MCS. Other initiatives, such as the proposed stamp duty land tax relief for new zero carbon homes, are also likely to use MCS in the future. MCS has replaced the product and installer registration schemes (Clear Skies and PV programme).

## The aim is to:

Help build a rapidly growing Microgeneration industry based on quality and reliability

- Help to substantially reduce the UK's dependency on fossil fuels and cut CO<sub>2</sub> emissions
- Assure customers that products and installers meet, and continue to meet, robust standards
- Grow the Microgeneration industry

With the MCS certified Ecodan range and using Accredited Ecodan Installers registered under the MCS, homeowners will be eligible to benefit from grants under the fore mentioned scheme.

For further detail on how to apply and the latest information regarding the MCS please visit [www.greenbooklive.com](http://www.greenbooklive.com)



Certificate Number: MCS HP0002  
Product Reference: PUIZ-W50VHA-(BS)  
PUIZ-W85VHA2-(BS), PUIZ-HW140VHA2/YHA2-(BS)



# BRE tested

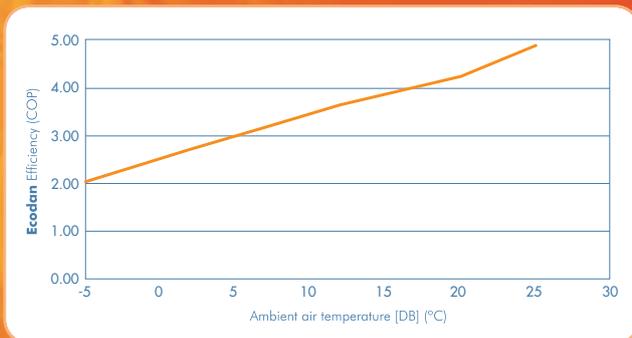


Independent testing on the Ecodan system has been carried out by the BRE. The BRE is a world leading testing, training and certification organisation, specialising in the testing and certification of construction related products.

Performance tests of an 8.5kW Ecodan air to water heat pump were carried out at BRE for Mitsubishi Electric according to the requirements of BS EN 14511. The tests were carried out in BRE's HVAC test facility's environmental chamber. The testing method involved heating 180L of water from 12°C to 55°C confirming heating performance down to -5°C. The findings were excellent.

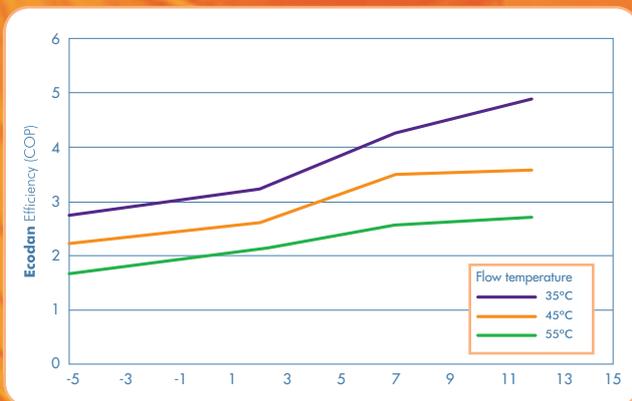
## Using data to calculate the seasonal performance of Ecodan®, the findings are:

**BRE test data - hot water cylinder heat up**



Note: Compressor speed 4 = 6kW output

**BRE test data - Ecodan efficiency test**



Ambient air temperature (DB) (°C) Note: Compressor speed 7 = 9kW output

## Lab Test Results

**Water heating**  
**COP 3.2 (tank to 55°C)**  
**Space heating COP 3.6**  
 (variable flow temperature)

**Average overall**  
**COP of 3.45**

Compressor Speed 7 heat output kW			
Air Dry Bulb temp	35°C	45°C	55°C
12	9.1	9.1	9.8
7	8.8	9.3	8.8
2	8.0	8.3	8.25
-5	7.75	8.1	7.25

# The Environment and Energy Awards



The Mitsubishi Electric Ecodan air source heat pump system has been recognised for its carbon saving potential at the Environment and Energy Awards 2008 - winning the coveted Environment Energy Product / Service category. The judges praised our far-sightedness, saying that whilst air source technology was not new, the company had "Packaged Ecodan into a neat unit that could prove acceptable to the environmentally-savvy domestic user who want to do their bit to cut carbon emissions".

It's a well known fact that one of the easiest ways of achieving a significant reduction in CO<sub>2</sub> emissions would be through the greater use of heat pump technology. Ecodan's heat pump technology extracts free energy from the surrounding air to reduce energy consumption, resulting in significantly reduced CO<sub>2</sub> and domestic fuel bills. This award recognises that Ecodan easily competes with all other available forms of air source heat pump and acknowledges our efforts to provide households with a simple and straightforward way of achieving reliable heating and hot water whilst significantly reducing CO<sub>2</sub> emissions.

## Further awards and recognition for Ecodan:



Ground and Air Source Power Award

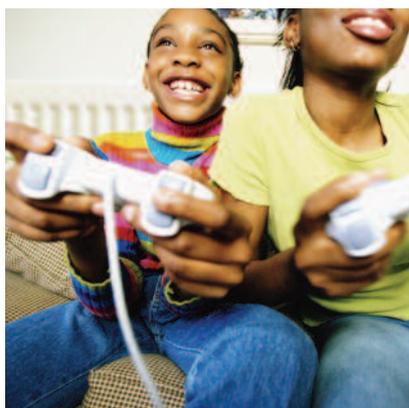
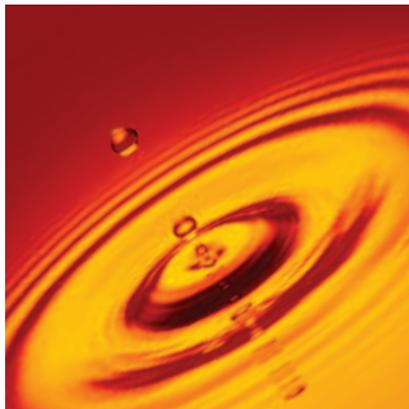


Building Services Product Award



Technology Award

**Award  
winning  
efficiency**



# Case study

## Refurbishment

A four bedroom house in Bedfordshire is the first home in the UK to benefit from the new, revolutionary Ecodan air source heat pump. As a result CO<sub>2</sub> emissions from the home's heating system were reduced by **50%** and the overall carbon emissions from the property by an impressive **34%**.

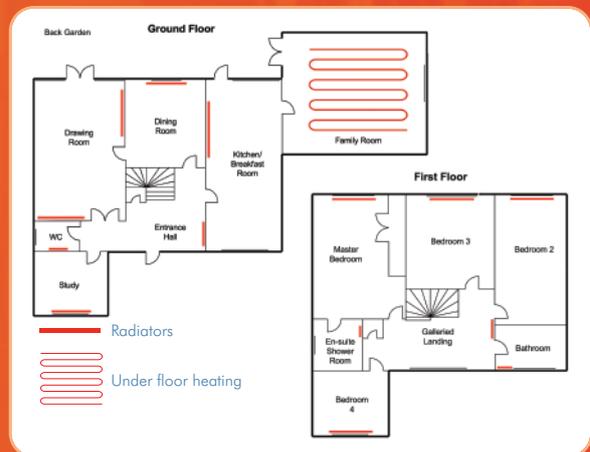
The homeowner sought to reduce his carbon footprint and by installing Ecodan was able to do so, whilst at the same time, providing an ideal case study for the advanced heating system in operation.

Built in 2000, the four bedroom detached house has double glazed windows as well as loft and wall insulation. The existing heating system was previously run by an 80% efficient gas boiler providing 23.2kW of heat output from an input of 29kW. Based on the existing radiators it was calculated that the total heat output of the radiators was 13.4kW under standard boiler conditions with a flow temperature of 70°C and the hot water demand of the home totals 140 litres per day.

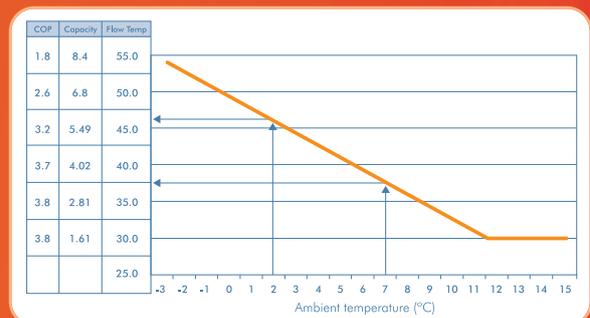
Using the Ecodan air source heat pump, the heat load of the house was calculated to be 8kW. Operating at a flow temperature of 55°C the heat output of the radiators will be 8.4kW, confirming that Ecodan is fully capable of meeting the heating demand of the house, using the existing radiators. In addition, one area of the house was changed to under floor heating.

The heat load of a house varies with ambient temperature. Traditional systems would vary the output from the radiators by turning them on and off frequently with Thermostatic Radiator Valves (TRV's), in order to meet the fluctuating demand.

As the ambient temperature increases, the heat load of the house decreases. The highly efficient Ecodan varies radiator heat output by changing the flow temperature, ensuring the highest level of COP possible. With average UK winter temperatures ranging between 2°C and 7°C, Ecodan operates at average flow temperatures between 35°C and 45°C providing the highest levels of energy efficiency.



### Flow temperature vs ambient temperature



When comparing the existing gas boiler to using Ecodan to provide domestic space heating and hot water, the reduction in CO2 emissions from the home are startling. The Ecodan with a seasonal COP of 3.3 emits 0.13kg of CO2 per kW of heat provided to the house, compared to the 80% efficient gas boiler, which emits 0.24kg of CO2.

This works out to 1,619kg of CO2 emitted per year when using Ecodan, as opposed to a massive 3,040kg of CO2 using the existing gas boiler. This clearly demonstrates a reduction of 50% with the help of Ecodan.

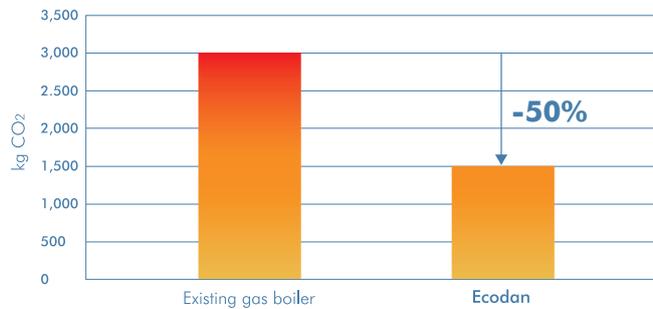
When taking into account this property's CO2 emissions, including that from lighting, appliances, space and water heating, the existing gas boiler accounted for 73% of the

total CO2 emissions. This is dramatically reduced when using Ecodan, with the total CO2 emissions reduced by 34%.

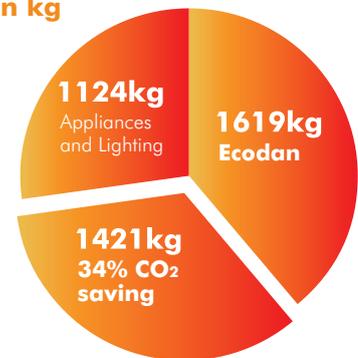
The annual gas bill to operate the existing gas boiler was £560. The estimated electricity running costs of the Ecodan are £358, which represents a saving of £202 (36%) per year. These figures are based on first year run costs 2007/08.

In the past there was an issue with the noise levels of air source heat pumps. The newly developed Ecodan however, offers one of the lowest possible nominal sound levels at 49dBA. External noise levels on the patio at the back of the house with the unit in operation were measured at 39dBA. This is very quiet when you consider that a modern computer has a noise rating of 37 to 39dBA, proving that sound levels are no longer an issue with the introduction of the advanced Ecodan system.

### Heating CO2 emissions



### Whole house CO2 savings in kg



**50%**  
reduction in  
CO2 emissions

**41%**  
reduction in  
running costs

First heating quarter



# Winter trials prove Ecodan<sup>®</sup>'s credentials

Live trials of Mitsubishi Electric's award-winning Ecodan over the past winter have clearly demonstrated that the low-carbon heating system lives up to expectations and is more than capable of dealing with whatever the British weather throws up. All three different models in the range have been put through their paces in four different locations around the UK. The properties include a 3-bed terraced house, a 4-bed semi, a large 5-bed detached home, and the BRE Visitor's Centre in Watford. Of the houses, only the 3-bed property was newly built, with a retro-fitted Ecodan unit replacing the traditional heating system in the other two.

## Real data not lab data

Temperatures in the UK dropped to -9°C and -10°C at times throughout the period of the test which meant that Mitsubishi Electric was able to put theory into practice and demonstrate that Ecodan air source heat pumps really will work efficiently in the depths of winter.

We can now categorically state that Ecodan will deliver the performance necessary to cope extremely well throughout the British year and demonstrate that this has been achieved in a variety of different properties and heating configurations.

The units in the properties delivered COP's ranging from 3.0 to 3.33, despite some of the lowest recorded outdoor temperatures for decades. A level of 3.33 shows that 2.33kW of renewable energy is being harvested from the surrounding air for every 1kW of electricity used and Ecodan is therefore operating at an efficiency level of 333%.

All of these have hit much higher COPs at some point over the winter, but Mitsubishi Electric has averaged them out over the whole period so that people can have complete faith in the figures quoted. Ecodan air source heat pumps really are ready to become the most viable, mass-market alternative to gas and oil-fired heating.

## As 'plug and play' as you can get

Unlike many other air source heat pump systems, Ecodan has been specifically designed for the UK market and deliberately tailored to be easy to install by a suitably qualified plumber or installer who has been on the special one-day course.



# Case studies

## 5-bed refurbishment

The Ecodan system installed in this large 5-bedroomed house near Newcastle, Tyne and Wear, delivered an average winter COP of 3.25 with an average ambient outdoor temperature of 4°C.

The 14kW Ecodan system has been retrofitted to the property and supplies both combined space heating and all hot water requirements for the 1999 detached house. This is home to a family of four including two young children aged four and six. Over the winter period, the owners have reported savings in running costs of between a half and two-thirds when compared to the previous LPG boiler.

No of bedrooms	Five
Age of property	1999
Previous heating system	22kW-rated LPG boiler
Replaced with Ecodan	14kW unit
Radiator upgrade	Unchanged
Average	COP 3.25
Average outdoor temp	4°C
Running cost reduction	50 - 66%
CO2 reduction	50%

## 3-bed new build

Developers must be mindful of the standards for newly built properties in the Code for Sustainable Homes, which is where Ecodan can help houses achieve Level 3 and 4.

The 5kW Ecodan system on this new, 3-bedroomed end-of-terraced property in Langford, Hertfordshire has achieved an average COP of 3.25 over the winter against an average ambient temperature of 7°C. The family of three have a new baby and the home is heated by traditional radiators with the smallest of the Ecodan range (the 5kW) providing all the heating and hot water required.

No of bedrooms	Three
Age of property	2008
Previous heating system	None
Replaced with Ecodan	5kW unit
Radiator upgrade	Unchanged
Average	COP 3.25
Average outdoor temp	7°C

**50%  
cut in  
running  
costs**

5-bed refurbishment



# Support Network & Warranty

In support of the Ecodan system, we've put in place all the before and after sales service you'd expect from a leading manufacturer such as Mitsubishi Electric. We recognise that our continued success relies heavily on having satisfied customers who experience high performing products that are efficient, effective and most importantly reliable. By investing 5% of our total turnover into research and development of new products and services, we aim to provide just that.

## Accredited Ecodan® Installers (AEI)

Our Heating Partner Programme is an initiative that's designed to raise standards throughout the heating industry and our way of ensuring our customers receive an assured, uniform and professional service on which they can rely. For total confidence in our products and service, the installation of the Ecodan system must be carried out to the highest standards and should only be fitted by a highly trained, Mitsubishi Electric Accredited Ecodan Installer. All accredited installers have received specific, in depth training by experienced engineers, covering all aspects including Sales, Technical, Installation, Commissioning and Maintenance. To see a comprehensive list of AEI installers please visit:

[www.mitsubishielectric.co.uk/heating](http://www.mitsubishielectric.co.uk/heating)



## State of the art training

Mitsubishi Electric provide the highest level of training designed to enable engineers to design, install and maintain our advanced systems. All courses are taught by experienced engineers with a wealth of knowledge of our product range, the industry and all current legislation.

Located around the UK, our training facilities boast, training and demonstration suites where theory and practice is readily explained, providing the perfect setting in which to gain in-depth knowledge of our products. As part of the course, attendees are given useful heat pump and radiator sizing software tools to assist in the design of the system.

## Warranty

Homeowners can benefit from an exceptionally high value 3 year warranty on the Ecodan air source heat pump system. It's important to note however, that the warranty will only be honoured subject to the following conditions:

- To validate the warranty, the purchase of Ecodan must be registered with Mitsubishi Electric
- The system must be installed and commissioned by a Mitsubishi Electric Accredited Ecodan Installer
- Annual maintenance must be carried out as agreed and all maintenance reports must be made available to Mitsubishi Electric on request

**The  
low carbon  
alternative  
to traditional  
boilers**



## Air Source Heat Pumps



Ecodan Specifications		PUHZ-W50VHA	PUHZ-W85VHA2	PUHZ-HW140VHA2	PUHZ-HW140YHA2
Dimensions (mm)	Width	950	950	1020	1020
	Depth	330+30*	330+30*	330+30*	330+30*
	Height	740	943	1350	1350
Weight (kg)		64	77	134	148
Airflow (m <sup>3</sup> /min)		50	55	100	100
Nominal sound level (dBA)		45 <sup>▲</sup>	48 <sup>▲</sup>	53 <sup>▲</sup>	53 <sup>▲</sup>
Low noise mode (dBA) @ 7°C		40	42	46	46
Guaranteed operating range	(Outdoor)	-15~+35°C	-20~+35°C	-25~+35°C	-25~+35°C
Electrical Supply		220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	380-415v, 50Hz
Phase		Single	Single	Single	3
Running current (A) [Max]		5.4 [13]	10.3 [23]	14.9 [35]	5.1 [13]
Fuse Rating (MCB sizes BS EN 60947-2) (A)		16	25	40	16
Heating A2/W35	Capacity (kW)	5.0 (1.5-5)	8.5 (2.6-8.5)	14.0 (4.2-14.0)	14.0 (4.2-14)
	COP	3.13	3.17	3.11	3.11
	Power Input (kW)	1.60	2.68	4.52	4.52
	Nominal flow rate (L/min)	14.3	25.8	40.1	40.1
Heating A7/W35	Capacity (kW)	5.0 (1.5-5)	9.0 (2.7-9)	14.0 (4.2-14.0)	14.0 (4.2-14)
	COP	4.10	4.18	4.25	4.25
	Power Input (kW)	1.22	2.15	3.31	3.31
	Nominal flow rate (L/min)	14.3	25.8	40.1	40.1

\*Grille ▲At distance of 1m from outdoor unit

Nominal operating condition

Heating (A2/W35) Outside air temperature (dry) +2°C  
 Outside air temperature (humid) +1°C  
 Water temperature (inlet/outlet) +30/+35°C

Nominal operating condition

Heating (A7/W35) Outside air temperature (dry) +7°C  
 Outside air temperature (humid) +6°C  
 Water temperature (inlet/outlet) +30/+35°C

# A new era in the provision of domestic space and water heating

The Mitsubishi Electric Ecodan air source heat pump is designed to meet the demands of today's and tomorrow's domestic hot water and heating requirements. Simple to install, cost effective for the end-user and with outstanding energy efficiency, Ecodan is ideal for housebuilders, developers, installers and homeowners.



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[www.greengatewayinitiative.co.uk](http://www.greengatewayinitiative.co.uk)



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