Your heat pump proposal

Thanks for choosing Green Building Renewables for your heat pump installation!

A heat pump will give you reliable, even and comfortable heating, will use much less energy than a boiler, and will greatly reduce your carbon footprint.

Please read the enclosed quote carefully. It covers in detail the components we will be installing, describes how the system works, shows how the system will meet the heating requirements of your property, and lists the costs for the work.

We're always happy to help answer questions, so please get in touch if there is anything you aren't sure about.

John Dawson
Green Building Renewables

This proposal is for:

Elia

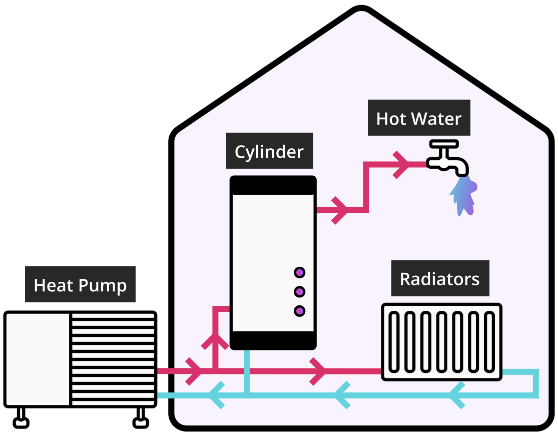
7
Co2 8bz

Prepared	10 January 2025
Valid for	30 days

Contents

Your system

The system we propose includes a heat pump (Samsung R290 5kW), a new hot water storage (UK Cylinders 120L FlowCyl Standard Cylinder), and all the other components necessary to plumb the heat pump and hot water storage components into your heating system. We have also specified 3 additional radiators which will help your new system run more efficiently.



Samsung R290 5kW

The EHS Mono R290 uses R290: a refrigerant with a much lower GWP (only 3) compared to other refrigerants. It boasts a reliable heating performance due to its larger heat transfer area, enabling it to deliver a 100% heating performance in temperatures as low as -10°C

ENA Registration Number: SAMSG/00790/V1
Sound Power Level: 55.0 dB
Proposed flow temperature: 50°C
Heating SCOP at 50°C: 3.78
Nominal Output: 5.00 kW
Actual Output at 50°C*: 4.95 kW
*at outside design temperature of -2.3°C

UK Cylinders 120L FlowCyl Standard Cylinder

High quality stainless steel cylinders manufactured in the UK. Designed to work with a heat pump to achieve maximum performance, with capacities ranging from 120L to 600L. Fully insulated with 50mm 100% CFC and HCFC free polyurethane and built with a 100% recyclable silver casing.

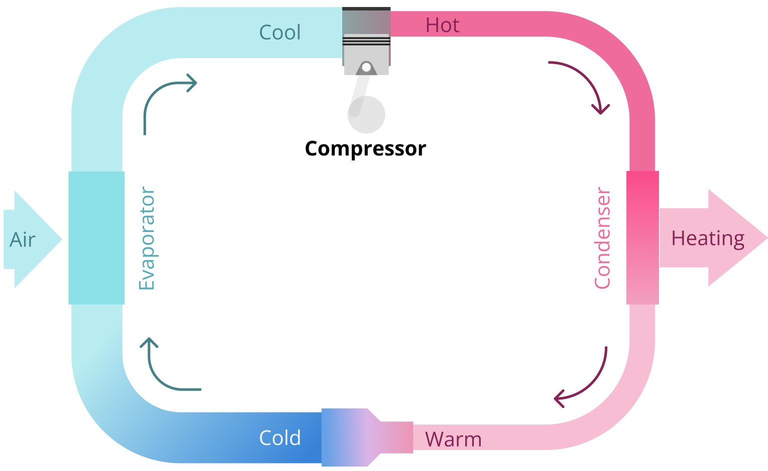
Nominal Capacity: 120ℓ
Weight: 27 kg (empty), 145 kg (full)
Standing heat loss: 1.06 kWh/24h
Dimensions: 545 × 545 × 915 mm
Electric immersion heater size: 3 kW
ERP Band: B

Heat Pumps Explained

A heat pump uses electricity to move heat from the outside of a building to the inside. It works on the same principle as a fridge.

In a heat pump, a compressor is used to pressurise a refrigerant, making it hotter - in the same way that a bicycle pump generates heat when it compresses air. The hot refrigerant is passed through a heat exchanger that draws off the heat for use in your house.

The refrigerant (now much cooler) is then passed though an evaporator nozzle, which allows it to expand. As the pressure decreases the refrigerant cools even further - in the same way that aerosols get cold when compressed air is released from a can.



The beauty of heat pumps is that a relatively small electrically-driven compressor can move large amounts of heat. The ratio between the electrical energy input and the heat output is the coefficient of performance (CoP). This will vary over the course of a year: the heat pump will be more efficient in the summer when the difference between the inside and outside temperatures is less.

However, even in the winter the heat pump will use far less energy than a direct electrical heater or a gas boiler to produce a given amount of heat.

How efficient will my system be?

378%

From our model of your property, we expect your system to have a Seasonal Coefficient of Perfomance (SCoP) of 3.78.

That means for every kWh of electrical energy you put into the heat pump, you will on average get 3.78 kWh of heat.

Will I notice a difference?

Boilers typically run for short periods at very hot temperatures, and cycle rapidly on and off.

Heat pumps work more efficiently if they run at lower temperatures for longer periods, so your radiators will feel cooler than they used to but will be on for more of the time. We have based our calculations on a radiator temperature of 47.5 degrees.

You don't need to worry though - we've carefully sized your system so that you should always have enough heat to keep your house warm.

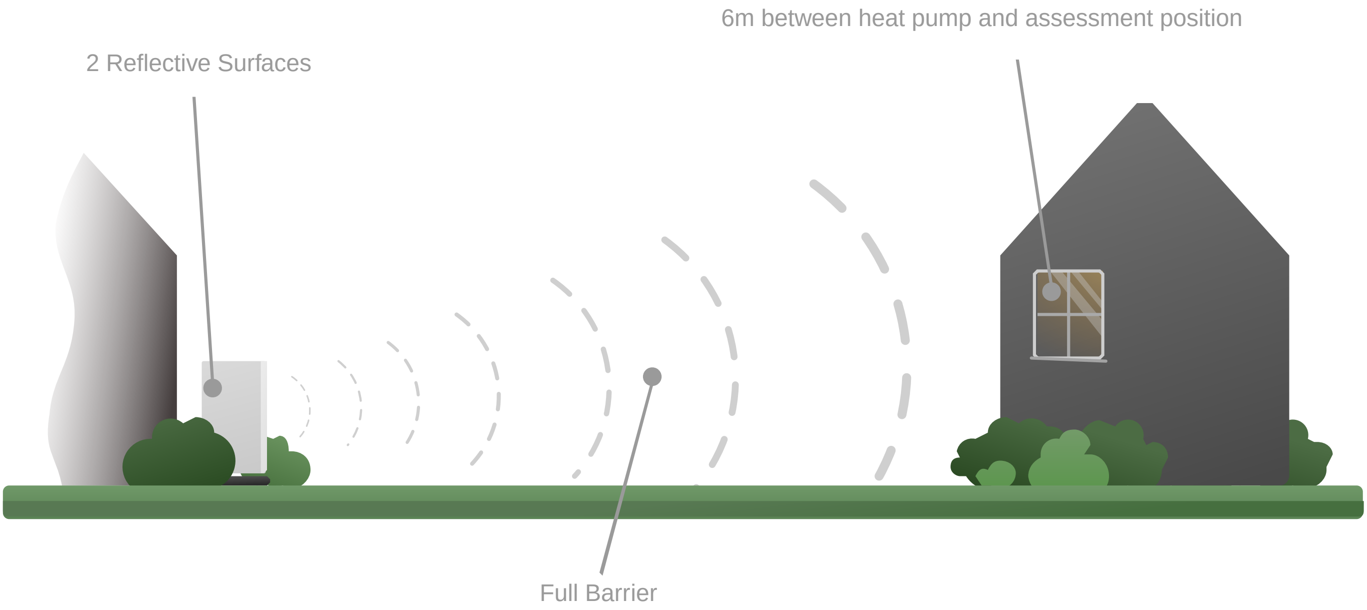
People who have heat pumps usually say they really like the more even heat that a heat pump system gives you compared to a gas boiler.

Sound check

Before your heat pump can be installed, we need to check that the noise it creates will not disturb your neighbours. Modern heat pumps are quiet, but are best not sited very close to doors or windows that may be open.

The sound check assesses how much sound from the heat pump will be transmitted to neighbouring properties. If the maximum sound level is less than 42dB then the installation can proceed without a planning application under the 'permitted development' rules.

Full details on the method used can be found in the MCS020 document on the MCS website.



MCS020 Sound Level Calculation

1. Sound power level	**55.0 dB**
2. Sound pressure level	**Q4 (two reflective surfaces)**
3. Distance from heat pump to assessment position	**6 m**
4. dB Distance reduction	**-20 dB**
5. Barriers between heat pump & assessment position	**Yes**
6. Sound pressure level @ assessment position	**25 dB**
7. Background noise level	**40 dB**
8. Difference between 6 & 7	**15 dB**
9. Decibel Correction	**0.1 dB**
10. Final Result	**41 dB**

Sound requirements met

The maximum sound pressure at the assessment position is expected to be 41dB. This is below the permitted limit of 42dB.

Appendix

Inputs

Property Details

Year built	Pre 2000

Design Data

Outside Design Temp – ODT	-2.3°C
Degree Days (DD)	2254
Mean air temp – MAT	10°C
Altitude	29m

Building Requirements

Space Heating load	2953W
Total area of building	50.42m²
Average Watts per metre square heat loss	59W/m²

Appendix

Heating check

We have checked that every room in your property will still be warm enough after the installation of the heat pump.

We've surveyed every room to work out the total expected heat loss through the ventilation, roof, walls, floors, windows and doors, at the specified room temperature. We've then compared this with the heat that the heat emitters will produce to ensure that every room will be warm enough. Radiators that will be removed are displayed with a lighter shade.

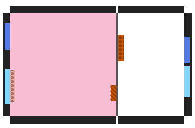
The output power of each radiator is calculated using:

The proposed flow temperature	**50°C**
The dT	**5°C**
The mean water temperature	**47.5°C**

Ground floor

Living room

Area: 15.80 m² Heat loss: 68 W/m² Design Temp: 21°C Air changes: 1.5/hr



✓ Sufficient heating 1154 W / 1078 W

Radiator	Status	Size	Output
P+	Removed	W1200 x H500 mm	594 W
K2	As Surveyed	W600 x H600 mm	447 W
K2	New	W1200 x H450 mm	707 W

Assumptions

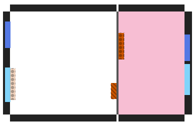
We have assumed an outside design temp of **-2.3**°C. This is based on tables of typical minimum winter temperatures in the UK.

We have used different design temperatures for different types of room. Bathrooms are typically kept warmer than living spaces such as lounges, kitchens and bedrooms for example, while utility spaces can be kept at a lower temperature. Kitchens and bathrooms also have more ventilation than other rooms, so we have allow for more heat loss through air exchange to these rooms.

Most heat loss from a property is through the building fabric however. We have provided a floorplan with a list of the materials we have used for the model along with a measure (U-value) of their insulating properties.

Kitchen

Area: 9.78 m² Heat loss: 61 W/m² Design Temp: 18°C Air changes: 2/hr



Sufficient heating 665 W / 601 W

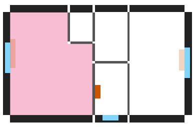
P+ — As Surveyed

W1000 x H600 mm — 665 W

First floor

masterBedroom

Area: 11.11 m² Heat loss: 46 W/m² Design Temp: 21°C Air changes: 1/hr



Sufficient heating 575 W / 513 W

K1 — Removed

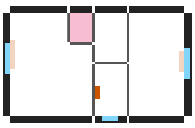
W1100 x H600 mm — 475 W

P+ — New

W1000 x H600 mm — 575 W

cylinder Store

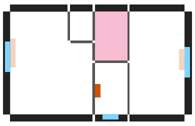
Area: 0.93 m² Heat loss: -42 W/m² Design Temp: 16°C Air changes: 1/hr



Sufficient heating 0 W / -39 W

Landing

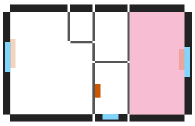
Area: 2.28 m²   Heat loss: 14 W/m²   Design Temp: 18°C   Air changes: 2/hr



✓ Overridden: heat requirements met by excess of the surrounding areas	0 W / 31 W

Study

Area: 8.13 m²   Heat loss: 62 W/m²   Design Temp: 21°C   Air changes: 1.5/hr



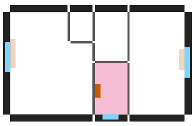
✓ Sufficient heating	530 W / 508 W

K1	Removed
W800 x H600 mm	346 W

K2	New
W900 x H450 mm	530 W

Bath

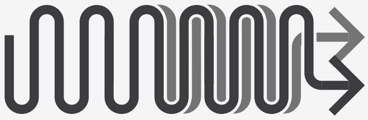
Area: 2.41 m²   Heat loss: 108 W/m²   Design Temp: 22°C   Air changes: 3/hr



✓ Sufficient heating	429 W / 261 W

K1	As Surveyed
W500 x H1600 mm	429 W

Why do I need new radiators?



Heat pumps work more efficiently at low flow temperatures - but at low temperatures small radiators may not have enough surface area to adequately heat a room.

With new, larger radiators you will use less energy to heat your property than if you used existing smaller radiators but had to run your heat pump at a higher temperature.

Appendix

Heat Pump Check

Your heat pump: Samsung R290 5kW

Total heat loss	**2953 W**
Area of building	**50.42 m^2**
Average heat loss	**59 W/m^2**
Output power of **Samsung R290 5kW** at the ODT and proposed flow temperature	**4950 W**

Heat pump meets demand

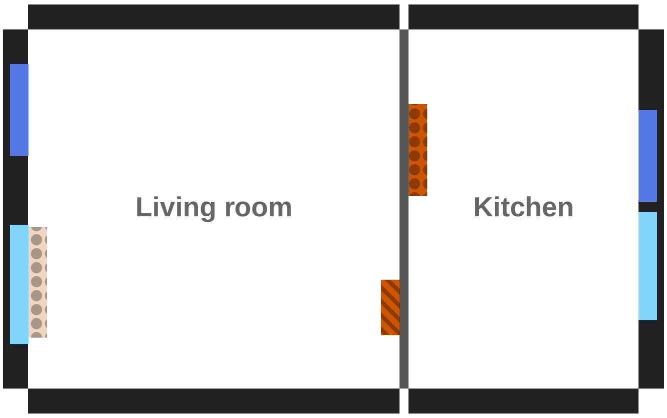
At the ODT -2.3 and proposed flow temperature 50°C, the total heat loss is less than the output power of the heat pump.

Appendix

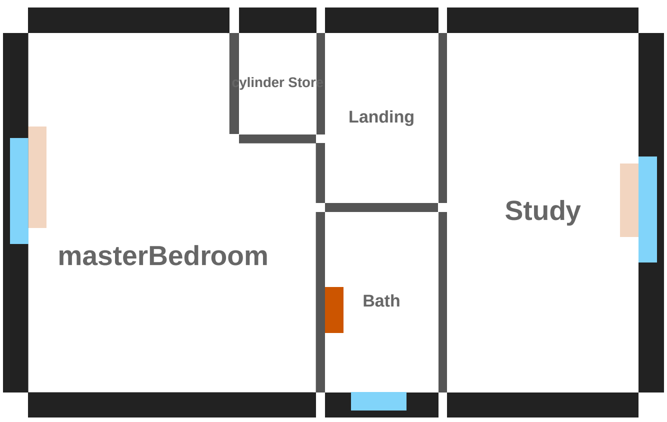
Materials

The list of materials surveyed in the building. Radiators that will be removed are displayed with a lighter shade. Floors, intermediate floors, roofs, roof glazing and dormers are not shown in the drawings but are displayed in the material list.

Ground floor



First floor



Window

PVC Double Glazed
U-value: 2.8

Door

PVC-U door double glazed
U-value: 2.8

Radiator

P+ - two panels, one fins

K2 - two panels, two fins

K1 - one panel, one fins

External Wall

Brick 102mm, mineral wool slab in cavity 50mm, 100mm standard aerated block (k=0.17), 13mm plaster
U-value: 0.45
Thickness: 275 mm

Internal Wall

Plaster 13mm, standard aerated block 100mm, plaster 13mm
U-value: 1.66
Thickness: 126 mm

Floor

Solid floor with 0mm of insulation

Intermediate Floor

Intermediate floors, boarding 19mm, airspace between joists, 9.5mm plasterboard
U-value: (up) 1.73, (down) 1.41

Roof

Pitched roof - Slates or tiles, sarking felt, ventilated air space, 300mm insulation between joists, 9.5 mm plasterboard
U-value: 0.12

Appendix

Hot Water Calculations

Heat pumps are able to produce heat energy for both your heating system and your domestic hot water (DHW). However, they are not capable of producing instantaneous DHW for your taps, baths and showers and so a thermal store is required.

MCS guidance states that this thermal store should be a minimum of 45ℓ per occupant. Based on this, we have selected a 120ℓ DHW store for your property and the details of the storage temps, reheat times and energy consumption are given below.

DHW calculations are based on the parameters given below. Actual energy consumption will vary with usage habits, variation in system settings and outdoor conditions.

DHW Storage Details

Make	**UK Cylinders**
Model	**FCHPD3120**
Nominal Capacity	**120ℓ**
Electric Immersion	**3 kW**
Dimension (L × W × H)	**545 × 545 × 915 mm**

DHW System Details

Hot water storage temperature	**50°C**
Supply water temperature	**10°C**
Flow temperature whilst providing hot water	**55°C**
Pipework efficiency	**80%**
Heat pump capacity output @ 55°C	**4.95 kW**
Number of occupants	**2**
Water consumption per person per day	**50ℓ**

DHW Calculations

Hot water storage reheat time	**85 min**
DHW Energy demand excluding Legionella	**1703 kWh/yr**
DHW Energy demand including Legionella	**1859 kWh/yr**
Mixed water volume @40°C	**160 ℓ**

Legionella Details

Legionella purge	**yes**
Legionella purge frequency	**weekly**
Legionella purge hours (weekly)	**1 hr**
Legionella heat source	**immersion**
Legionella purge energy demand	**156 kWh/yr**

Legionella

Legionella is an aquatic pathogen that thrives in warm stagnant water, and can cause diseases such as Legionnaires' when inhaled. In order for Legionella to multiply and grow to dangerous levels, it requires stagnant water and a temperature of between 20°C and 40°C. Eliminating either of these conditions will prevent it from growing and using most of your DHW capacity each day will likely prevent growth to dangerous levels. If you do store water at optimum growth conditions, then an anti-Legionella cycle (Legionella purge) will kill off any bacteria that might have formed by sterilising the water at a high temperature (70°C = instantly kills, 65°C = 100% in 2 mins, 60°C =100% in 30 mins).

Appendix

MCS Performance Estimate

Under the terms of the Microgeneration Certification Scheme we are required to give you an estimate of the energy consumption of your heat pump system using a standardised procedure based on values from your Energy Performance Certificate (EPC).

Energy Performance Certifcate (EPC) information

Does this estimate relate to a new build or proposal for extension or reduction in size of an existing building?	**Yes**
EPC Number	**0511-3021-7201-0752-0204**
Energy required to heat property	**6485 kW**
Energy required for hot water	**1859 kW**

New renewable system information

Type of system	**Air Source Heat Pump**
Manufacturer Name	**Samsung**
Manufacturer Model	**AE050CXYDEK/EU**
MCS Certification Number	**AE050CXYDEK/EU**
Flow Temperature	**50°C**
MCS SCOP Heating	**3.78**
MCS SCOP Hot water	**1.75**
Renewable system provides	**Heating and Hot Water**
Hot water immersion use	**None**
Size of hot water cylinder	**120 L**

Further Information

The Microgeneration Certification Scheme (MCS) is the UK's quality assurance program for certifying renewable energy products and installations.

MCS certifies both products (such as solar panels, wind turbines, and heat pumps) and the companies that install them, ensuring that products meet specific quality standards and that installations are performed by qualified and experienced professionals.

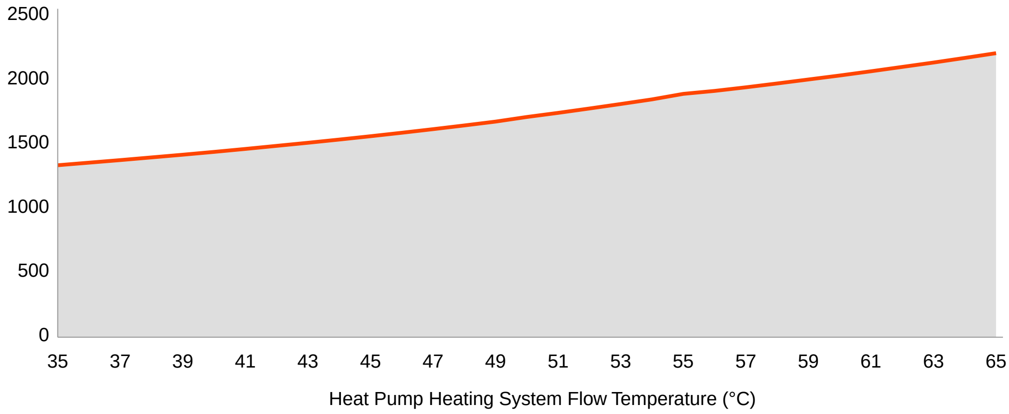
MCS also provides a mechanism for handling complaints or disputes related to certified installations.

MCS certification is a requirement for many incentive schemes, including the Boiler Upgrade Scheme grant for heat pump installations.

Estimates system performance / comparison (kWh)

	Heating	DHW	Total
Energy Requirement for the building			
Net energy required to heat property	**6485**	**1859**	**8344**
Existing system consumption	**7454**	**2374**	**9828**
New Heat Pump System Estimated Consumption			
Full Heat Pump System	**1716**	**1062**	**2778**

Electricity Consumption of Proposed Heat Pump for Space Heating versus Flow Temperature



MCS Key facts

Predicting the heat demand of a building, and therefore the performance and running costs of heating systems, is difficult to predict with certainty due to the variables discussed here. These variables apply to all types of heating systems, although the efficiency of heat pumps is more sensitive to good system design and installation. For these reasons your estimate is given as guidance only and should not be considered as a guarantee.

Seasonal Coefficient of Performance

MCS Seasonal Coefficient of Performance (SCoP) is derived from the EU ErP labelling requirements, and is a theoretical indication of the anticipated efficiency of a heat pump over a whole year using standard (i.e. not local) climate data for 3 locations in Europe. It is used to compare the relative performance of heat pumps under fixed conditions and indicates the units of total heat energy generated (output) for each unit of electricity consumed (input). As a guide, a heat pump with a MCS SCoP of 3 indicates that 3 kWh of heat energy would be generated for every 1 kWh of electrical energy it consumes over a 'standard' annual cycle.

Energy Performance Certificate

An Energy Performance Certificate (EPC) is produced in accordance with a methodology approved by the government. As with all such calculations, it relies on the accuracy of the information input. Some of this information, such as the insulating and air tightness properties of the building may have to be assumed and this can affect the final figures significantly leading to uncertainty especially with irregular or unusual buildings.

Heat Pump SCOPs

for Samsung R290 5kW

Flow Temperature	SCOP
35°C	**4.84**
36°C	**4.77**
37°C	**4.70**
38°C	**4.63**
39°C	**4.56**
40°C	**4.49**
41°C	**4.42**
42°C	**4.35**
43°C	**4.28**
44°C	**4.21**
45°C	**4.14**
46°C	**4.07**
47°C	**4.00**
48°C	**3.93**
49°C	**3.86**
50°C	**3.78**
51°C	**3.71**
52°C	**3.64**
53°C	**3.57**
54°C	**3.50**
55°C	**3.42**
56°C	**3.38**
57°C	**3.33**
58°C	**3.28**
59°C	**3.23**

60°C	**3.18**
61°C	**3.13**
62°C	**3.08**
63°C	**3.03**
64°C	**2.98**
65°C	**2.93**

MCS Factors & Impacts

We have identified 3 key types of factor that can affect how much energy a heating system will consume and how much energy it will deliver into a home. These are 'Fixed', 'Variable' and 'Random'. Most factors are common to ALL heating systems regardless of the type (e.g oil, gas, solid fuel, heat pump etc.) although the degree of effect varies between different types of heating system as given in the following table.

The combined effect of these factors on energy consumption and the running costs makes overall predictions difficult however an accuracy +25-30% would not be unreasonable in many instances. Under some conditions even this could be exceeded (e.g. considerable opening of windows). Therefore it is advised that when making choices based on mainly financial criteria (e.g. payback based on capital cost verses net benefits such as fuel savings and financial incentives) this variability is taken into account as it could extend paybacks well beyond the period of any incentives received, intended occupancy period, finance agreement period etc.

Factor	Impact
'Fixed' which include:	
Equipment Selection Performance figures (SCoP) from ErP data	**System Efficiency**
Energy Assessment via the EPC (e.g. assumptions as to fabric construction and levels of insulation; the variation in knowledge and experience of Energy Assessors)	**Energy Required**
'Variable' which are affected by the system design and include:	
Accuracy of sizing of heat pump- i.e. closeness of unit output selection (kW) to demand heat requirement (kW)	**System Efficiency**
Design space and ambient (external) temperatures	**Energy Required**
Design flow /return water temperatures, and weather compensation	**System Efficiency**
Type of Heat emitter (e.g. Under-floor; natural convector (e.g. 'radiator'), fan convector etc.)	**System Efficiency**
'Random' which cannot be anticipated and include:	
User behaviour:	
- Room temperature settings	**Energy Required**
- Hot water usage and temperature settings	**Energy Required**
- Occupancy patterns/times	**Energy Required**
- Changing the design HP flow temperatures	**System Efficiency**
- Ventilation (i.e. opening windows)	**Energy Required**
Annual climatic variations (i.e. warmer and colder years than average)	**Energy Required**

Energy Required

The heat energy output requirement of the system which directly impacts on running costs. This requirement exists regardless of the heating system chosen as it is the heat required to keep the space comfortable. Opening windows or increasing room temperatures will demand more heat output, which means more energy input but this would NOT directly affect the efficiency. Thus increased energy demand does NOT automatically mean reduced efficiency.

System Efficiency

The efficiency of the system has been directly affected and will therefore demand more input energy to achieve the same heat output thus increasing running costs. However, increased energy input does NOT necessarily mean lower system efficiency (see above).