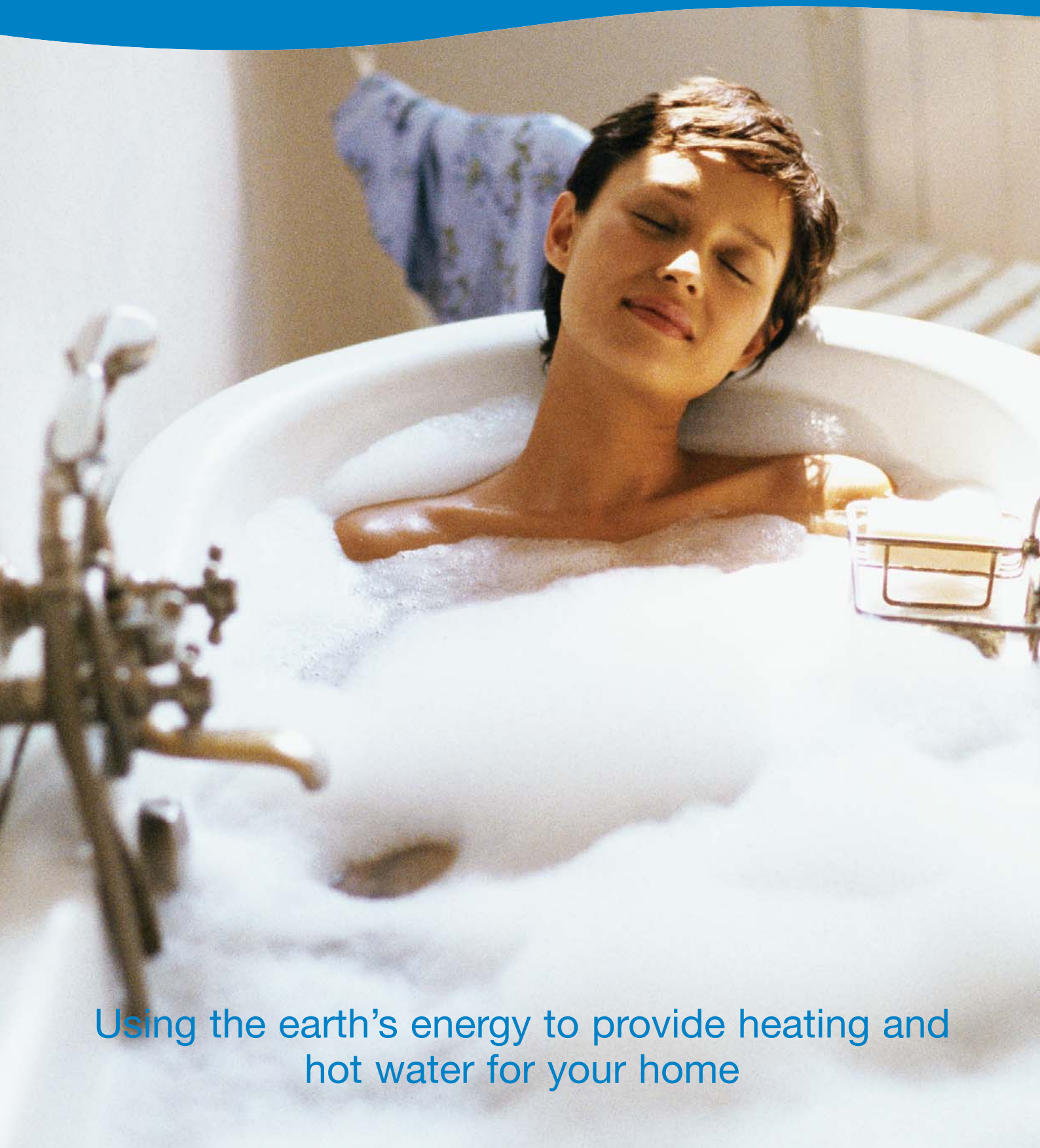
calorex®

Domestic Heat Pumps



Using the earth's energy to provide heating and hot water for your home

# Environmental home heating solutions to sav

Calorex Heat Pumps are the UK's leading manufacturer of heat pump technology with an unrivalled international reputation over 30 years for product design and development to the highest technical and engineering standards.

This reputation has arisen from the intrinsic reliability and quality of our products which continue to be specified in many specialist design and build applications around the world.

From our head office in Maldon Essex we have manufactured over 250,000 heat pumps and through our continued investment in research and development have now developed a range of heat pumps for specific use in the UK domestic housing market.

Our award winning products have to date provided more than 600,000 hours of precise technical operating data relevant to UK climatic conditions and domestic housing design. This unique performance data has been incorporated into our research and development programme.

# Harnessing nature's po

# e you money and help save the earth too!

With more domestic installations in the UK than any other manufacturer Calorex are market leaders in heat pump technology.

Our heat pumps are available from 3.5kW up to 12kW and are purposely designed to optimise energy efficiency in UK housing applications.

Calorex dual temperature heat pumps have been designed to operate in the most energy efficient way possible for the end user at all times.

Larger Calorex ground source heat pumps are designed with twin compressor circuitry. This helps optimise efficiency during part load conditions and ensures stable heating temperatures irrespective of system demands.

System controls are classically managed by a standard central heating and DHW programmer together with a room thermostat for thermal comfort.

Designed to optimise valuable living space, Calorex units are small, compact and function with very low sound levels.

Calorex heat pumps are unique in that they deliver domestic hot water (DHW) at 65ºC without any supplementary electrical resistance heating back up.

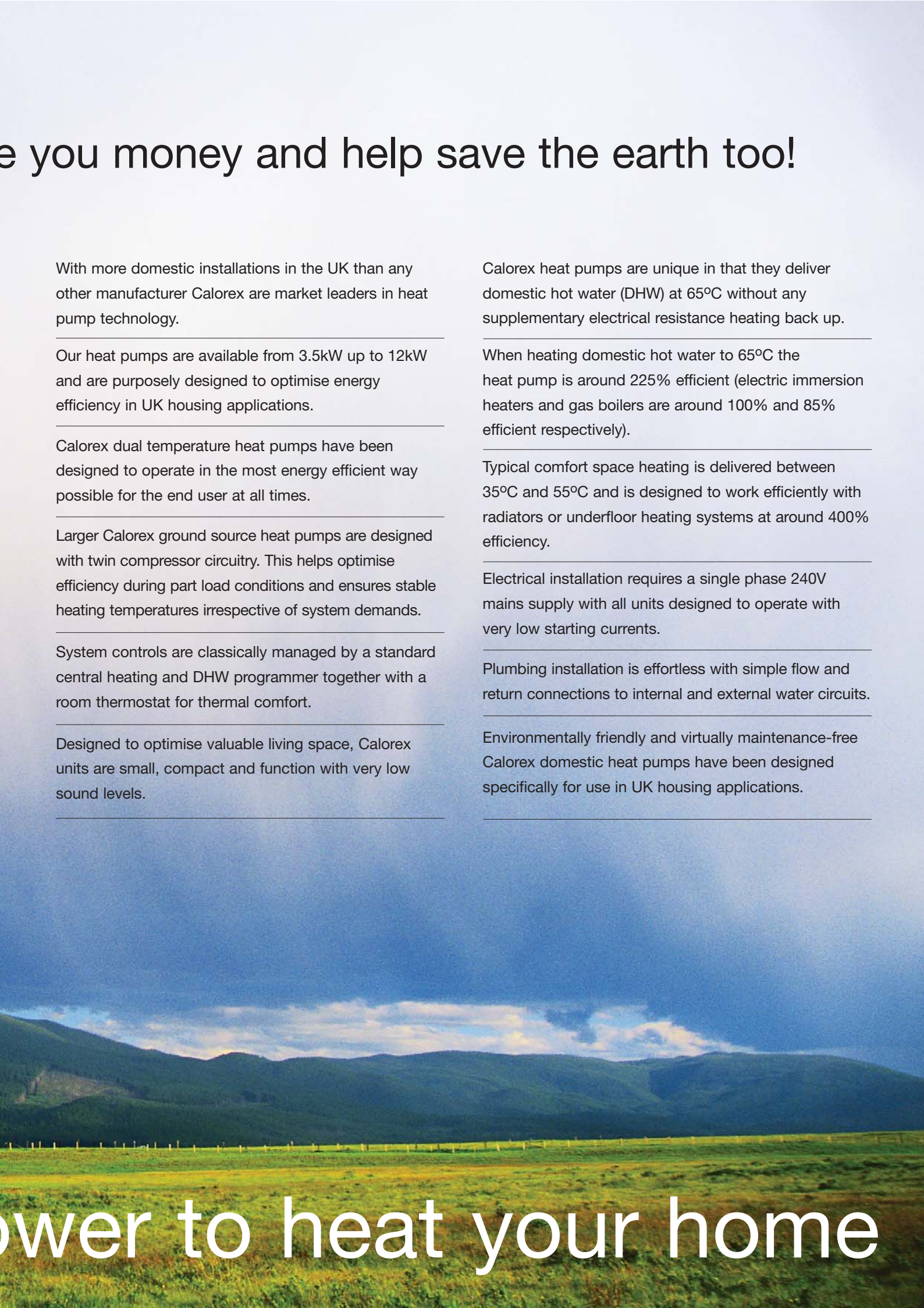
When heating domestic hot water to 65ºC the heat pump is around 225% efficient (electric immersion heaters and gas boilers are around 100% and 85% efficient respectively).

Typical comfort space heating is delivered between 35ºC and 55ºC and is designed to work efficiently with radiators or underfloor heating systems at around 400% efficiency.

Electrical installation requires a single phase 240V mains supply with all units designed to operate with very low starting currents.

Plumbing installation is effortless with simple flow and return connections to internal and external water circuits.

Environmentally friendly and virtually maintenance-free Calorex domestic heat pumps have been designed specifically for use in UK housing applications.



# ower to heat your home

# Ground Source Heat Pumps

**Natural heat from the ground**

The earth has the natural ability to absorb and store heat from the sun as well as heat from within the earth itself. In the UK, just a few meters below the surface we discover average temperatures between $8^0$C and $10^0$C.

This stored energy is a vast reserve of free low grade heat just waiting to be used.

Calorex ground source heat pumps work on the principle of extracting this low grade solar energy which is stored in infinite amounts in the ground around us and then upgrading this energy into useable high grade heat for the home.

This is achieved by placing a heat exchanger (ground collector) in the form of special grade pipe into the ground adjacent to the property and simply allowing it to absorb the solar energy from the immediate area around it.

The ground source heat pump circulates water (with a small amount of anti-freeze) through the ground collector. The water absorbs energy and then passes it to the heat pump where the energy is enhanced and transferred to the home heating system.

A combination of thermal dynamics, refrigeration and compressor technology ensures that this energy is upgraded sufficiently for sole use in the space heating and domestic hot water systems in the home.

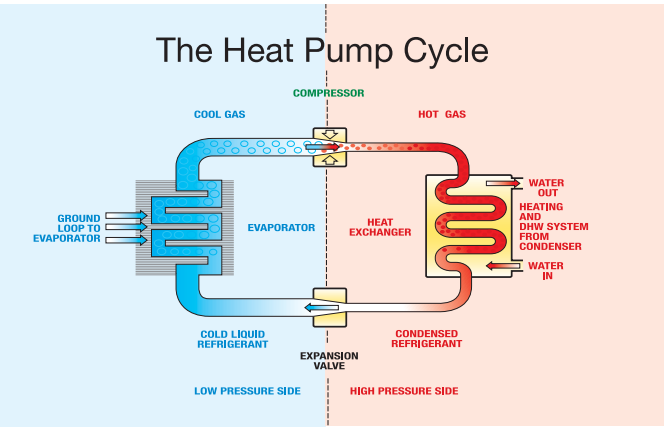
This extremely efficient technology has a proven track record, is environmentally friendly and exceptionally economical to run. This can be evidenced by the huge number of heat pump installations in countries such as Sweden, Switzerland, France, Germany and the USA.

## And best of all…it's free!

Yes…It is free, untaxed and truly sustainable

A typical Calorex unit will produce 4kW of heat for every 1kW used to operate the heat pump giving a typical efficiency of 400%.

Compare this 400% efficiency (usually referred to as coefficient of performance or COP) to an electric




Calorex heat pumps are charged with non toxic, non combustible, bio-degradable, CFC free refrigerant which has no detrimental environmental impact.

Photograph shows 5kW unit

the building load and heat pump.
With unprecedented increases in UK energy costs in recent years and with 2006 seeing some of the biggest rises in history, energy efficiency and economy is on every agenda.

Heat pumps provide a significant hedge against consistent increases and volatile spikes in oil and gas prices. In fact the only running cost to account for is the electrical power required to run the heat pump.

Whilst almost 75% of the usable energy is being drawn from the ground this means that for every 4kW of energy required in the home only 1kW of energy is required to run the heat pump. This gives the heat pump a rated efficiency of 400%

In addition to these cost savings there are no annual maintenance or service checks to budget for as they are not required unlike a gas heating system.

resistance heater (100%) or a boiler (85%).

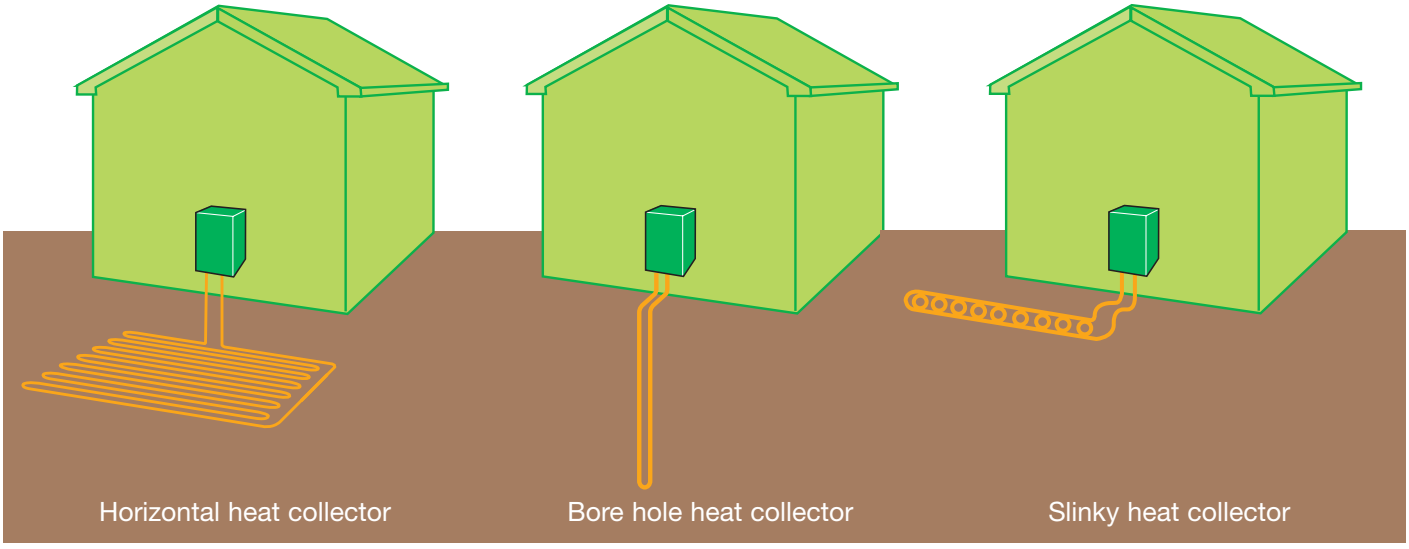
Ground source heat pump and heating system designs should be carefully integrated so as to optimise energy efficiency and performance. The characteristics of every installation require that all parts of the system are designed around the following principles:

**Building**
Consideration of the thermal characteristics of the property and end user requirements for space heating ~~and domestic hot water.~~

**Heat pump**
~~Output matched to the load requirements of the dwelling.~~

**Ground loop**
Paying particular attention to local geological conditions the ground loop must be designed to provide renewable and sustainable energy in line with the requirements of

A system designed appropriately should see the ground source heat pump enjoy an efficient lifetime of around 25 years with the ground loop collector having an expected life of around 100 years.




There are three principal methods of ground heat exchange arrangements for domestic dwellings in the UK. These being horizontal collectors, borehole collectors and slinky collectors.
Each method has a different energy yield which will vary significantly based on site location and local geology

*Please refer to back cover for guidance specifications*

# Air Source Heat Pumps

With more experience of air source heat pump manufacturing in the UK than any other company, the Calorex Heatseeker range has world class performance characteristics designed into their functionality.

This brand new range of Calorex domestic air source heat pumps has been developed with the benefit of 30 years manufacturing experience and a continuous product development programme which has produced more than 250,000 air source heat pumps that are now in use all over the world.

With particular attention given to UK climatic conditions, the Heatseeker range are the only products available on the market that have been designed specifically for use and operation in UK domestic housing.

**Product features include:**

- Range of 4.5kW, 9kW and 12kW units
- Dual temperature operation for maximum efficiency
- DHW heating temperatures of 65°C without any direct electrical resistance back up (no immersion heaters or flow boilers)
- Space heating temperatures variable from 35°C–55°C
- Works with underfloor heating or radiators
- Twin compressors in larger models optimise efficiency at all operating conditions
- Reverse cycle defrost: 4min per hour
- Operational to -15°C
- Simple installation: flow and return connections to buffer tank only
- Very low sound levels: no noise pollution
- Maintenance free: no expensive annual service requirements

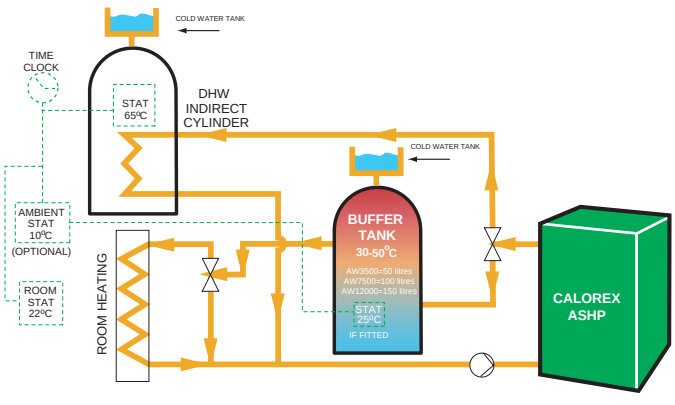

**Monovalent heating systems**

Ideal for new build, very well insulated properties or retro fitted in highly insulated existing dwellings with low temperature space heating requirements.

In this type of application the Heatseeker can be sized to provide 100% of the heating requirement on the coldest day of the year and all of the annual DHW requirement.

Fitted with a buffer tank, the Heatseeker can efficiently charge required volumes of water to service the dwelling heating and hot water loads and activate defrost cycles as rapidly as 4 minutes per hour when necessary.

**Typical monovalent heating system**



**Bivalent and integrated heating systems**

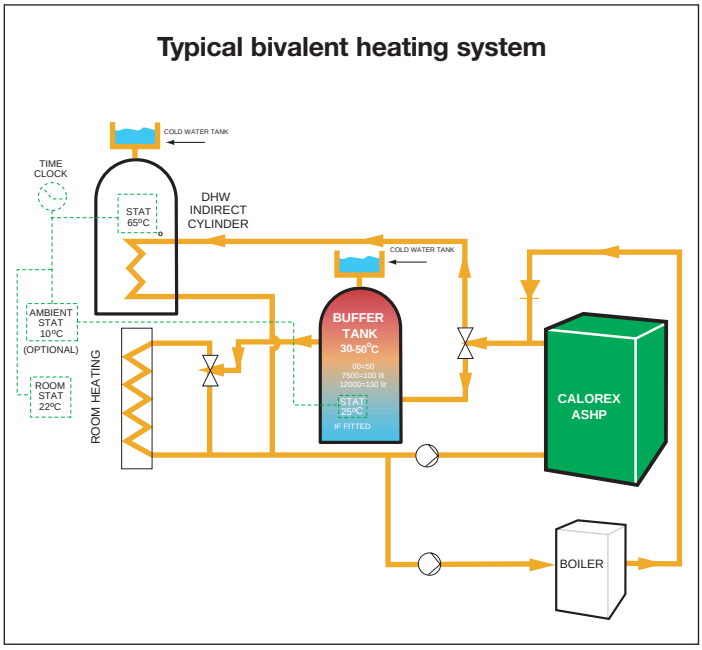
Heatseeker air source heat pumps are designed to allow straightforward integration with other traditional forms of fossil fuel heat sources such as gas and oil fired boilers.

Ideally suited for retro fitting to existing properties where end users have a desire to switch to renewable energy technologies and reduce their fuel bills whilst retaining their existing boiler as additional heating capacity.

In this type of application the Heatseeker can be sized to provide a variable proportion of the annual heating requirement (say 80%) with the existing boiler integrated to deliver the balance on the coldest days.

A bivalent system integrating a Heatseeker air source heat pump (as the primary source of heating) with a traditional gas or oil boiler offers an ideal solution where lower energy consumption and considerable carbon emissions savings can be achieved.

**Typical bivalent heating system**




This type of system design and application provides the end user with an ability to balance the initial capital cost of installation with the benefit of reduced running costs, significantly reducing capital payback periods against retro-fitting GSHP monovalent systems.

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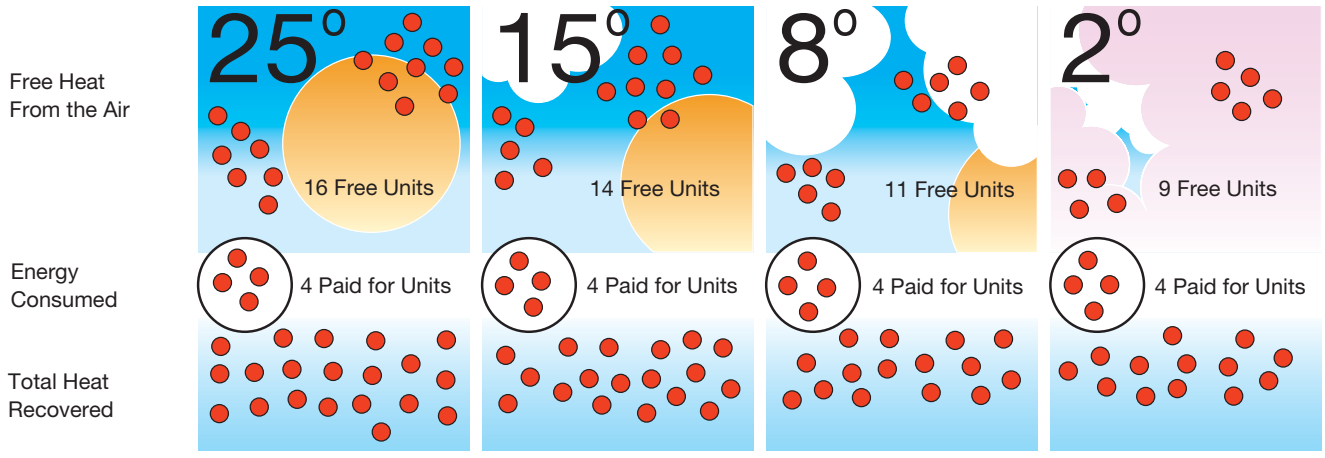
Designed for external use, Calorex air source heat pumps are one of the most cost effective methods of realising a renewable energy source as free energy is available at all times in the outside air and there is no necessity for disruptive and expensive ground collector installations as with ground source systems.

## Absorbing free energy from atmospheric air




| | | | | |
|---|---|---|---|---|
| | 20 units in the home | 18 units in the home | 15 units in the home | 13 units in the home |
| *C.O.P | 5.0 | 4.5 | 3.75 | 3.25 |

Total Heat Recovered ÷ Energy Consumed = Coefficient of Performance (C.O.P)

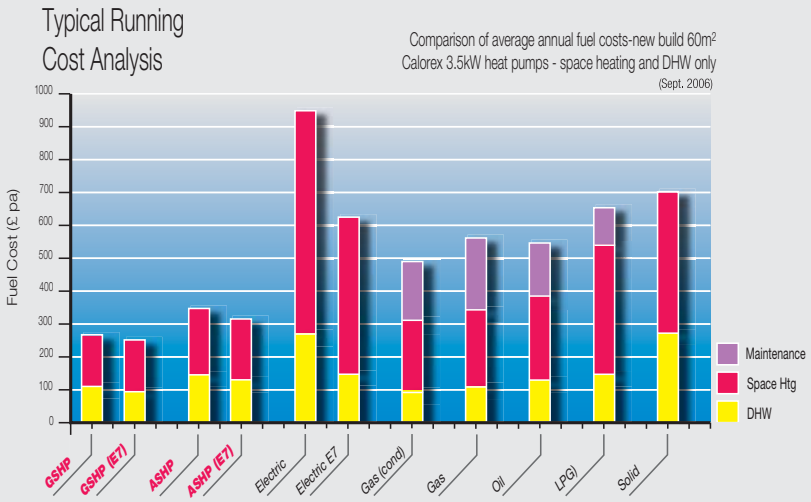
*Illustration calculated delivering 35ºC into dwelling underfloor heating system*

# System Characteristics

**Running Costs**

Fossil fuel energy sources are notoriously inefficient and are very costly for the homeowner to maintain. As the UK market leader of domestic heat pump systems, Calorex has collected more than 600,000 hours of measured performance data from heat pump installations in UK homes.

The adjacent table shows that Calorex heat pumps can provide 100% of heating and domestic hot water all year round at lower cost than any other fuel, radically reducing carbon emissions at the same time.

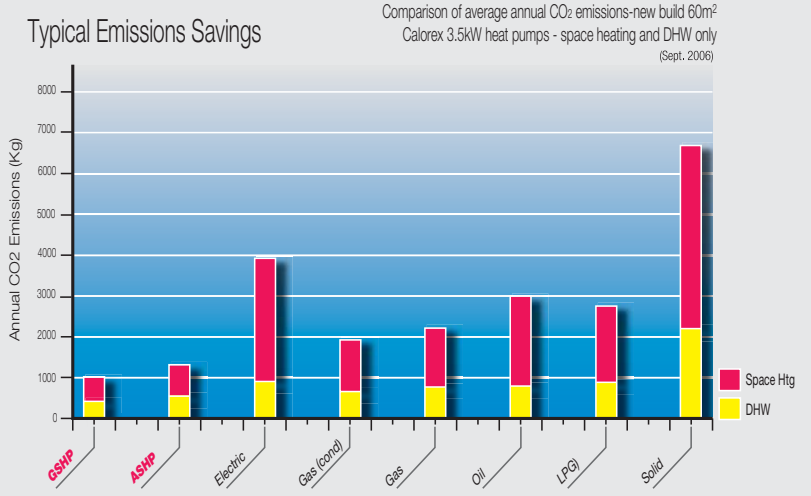



**Emissions**

Fossil fuel use has a particular detrimental effect to the environment as when these fuels are burned, carbon dioxide is released into the atmosphere contributing significantly to global warming.

Calorex heat pumps can extract around 75% of usable heating energy from the environment and can generally reduce carbon emissions compared to gas central heating systems by approximately 50%.

These savings are even greater when compared to other fuels as illustrated in the adjacent performance chart.

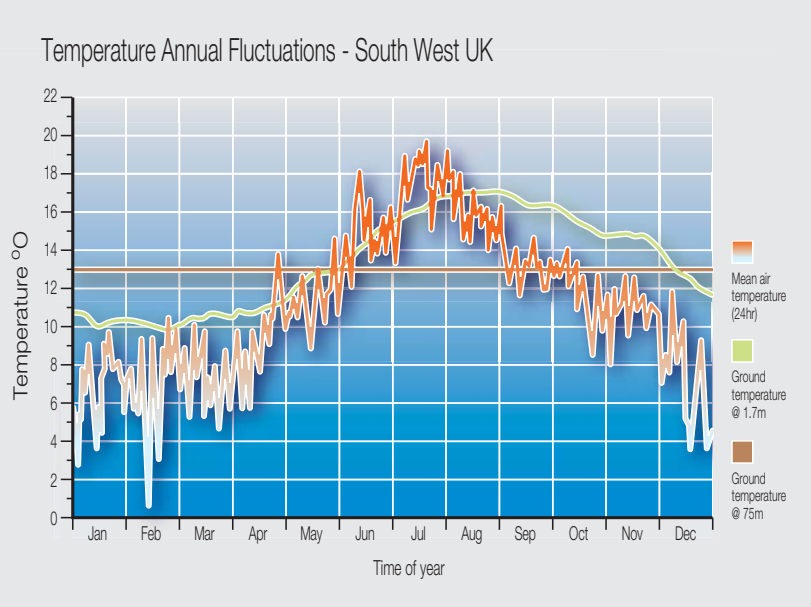



**UK Climate**

The UK Met Office and Climatic Research Unit, recently published that 2006 was the sixth warmest year on record, exceeded by 1998, 2005, 2003, 2002 and 2004.

The UK has an abundance of renewable energy as shown in the temperature graph which illustrates average daily air and below ground temperatures over a full year.

With Calorex ground source heat pumps the most efficient on the market and our air source heat pumps operating to extremes of temperature as low as -15°C, affordable renewable energy is available for you today with products manufactured in the UK.



# The Environment

With almost 30% of all UK carbon emissions coming from 24 million dwellings in the UK there are many opportunities to install heat pumps to help reduce these emissions.

Heat pumps maximise the freely available solar energy which is available everywhere in the UK and this energy is totally renewable and sustainable.

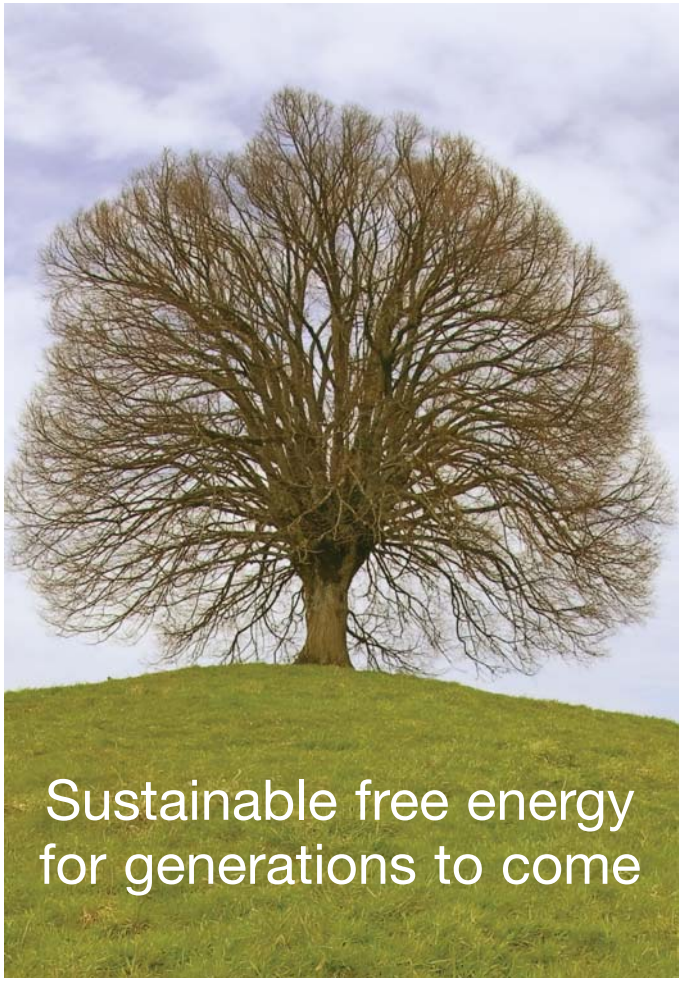
Traditional fossil fuel reserves in the UK such as oil and gas are fast becoming exhausted and at the time of going to print the dti estimate that these finite deposits could expire totally around 2016.

When fossil fuels are burnt to produce energy, carbon dioxide ($CO_2$) is released into the atmosphere and this in turn adds significantly to the global concerns over climate change.

A Calorex heat pump installed in the home as the sole source of heating and hot water can reduce $CO_2$ emissions to zero from the dwelling.

As there are no emissions from installation systems, no flues are required and there is no pluming or local pollution from the installation property. The cumbersome inconvenience and cost of fuel storage as with oil, LPG and solid fuel is also removed.

Heat pumps are now recognised by the Government's Standard Assessment Procedure (SAP) and show significant carbon savings over other forms of space and water heating.




# New Build and Refurbishment

Following the Energy White Paper 2003 the UK Government included legislation to:

Update Part L of Building Regulations and improve correlation between building design standards and actual performance.

**Planning legislation**
Many Local Authorities are now insisting on the provision of renewable energy as a condition of planning permission for new build projects.
Calorex Heat Pumps are the ideal solution to these requirements.

**Low Carbon Buildings Programme (LCBP2)**
Calorex ground source heat pumps qualify for funding under phase 2 of the LCBP via E.ON who are dti nominated framework suppliers under the scheme.

Calorex can arrange for LCBP2 quotes via E.ON which may result in funding support up to 35% of the total supply and installation cost for qualifying applications. Please contact our sales desk on 01621 856611 for details.

Technical Specification

# Air Source Heat Pumps

As with all heat pump technologies, system design and integration must be matched carefully to design day heat loss. Calorex technical support is available to offer guidance on 01621 856611.

| MODEL | UNITS | AW 4500 | AW 9000 | AW 12000 |
|---|---|---|---|---|
| **@ Air On 0°C, 90%RH*** | | | | |
| Output To Water (@ 55°C)# | kW | 2.97 | 6.0 | 8.2 |
| Electrical Input | kW | 1.54 | 3.12 | 4.26 |
| Output To Water (@ 35°C)# | kW | 3.39 | 7.0 | 9.5 |
| Electrical Input | kW | 1.11 | 2.31 | 3.14 |
| **@ Air On 7°C, 87%RH*** | | | | |
| Output To Water (@ 35°C)# | kW | 4.4 | 8.96 | 12.2 |
| Electrical Input | kW | 1.18 | 2.42 | 3.29 |
| **@ Air On 20°C, 60%RH*** | | | | |
| Output To Water (@ 55°C)# | kW | 6.1 | 12.2 | 16.6 |
| Electrical Input | kW | 1.78 | 3.57 | 4.85 |
| Output To Water (@ 35°C)# | kW | 6.3 | 12.6 | 17.2 |
| Electrical Input | kW | 1.37 | 2.75 | 3.75 |
| **ELECTRICAL DATA** | | | | |
| Electrical Supply Spec' 1 Phase | V/ph/Hz | 230V / ~1N / 50Hz | | |
| Minimum Supply Capacity 1 Phase | amps | 11 | 18 | 20 |
| Maximum Supply Fuse 1 Phase | amps | 15 | 25 | 30 |
| Max Starting Current S/Start (LRA) 1ph | amps | 27 | 27 | 31 |
| **AIR DATA** | | | | |
| Air Flow (Anem' @ air on grille. Wet evap') | $m^3/hr$ | 2800 | 3000 | 4000 |
| Fan External Resistance STD | mm WG | 0 | 0 | 0 |
| Fan External Resistance "F" | mm WG | 6 | 6 | 6 |
| **WATER DATA** | | | | |
| Water Flow ±20% | l/min | 7.5 | 15 | 20 |
| Pressure Drop (Water) | m hd | 1.2 | 0.7 | 0.9 |
| Water Connections | inches | 3/4" BSPM | 3/4" BSPM | 1" BSPM |
| Condensate Water Connections | mm | 3/4" BSPM | 3/4" BSPM | 3/4" BSPM |
| Typical Buffer tank sizes | litres | 50 | 100 | 150 |
| **GENERAL DATA** | | | | |
| Gas Charge (R134a) | kg | 3.4 | 7 | 8.5 |
| Sound Pressure Level @ 3m | dB (A) | 54 | 57 | 59 |
| **DIMENSION DATA** | | | | |
| Width (unpacked) | mm | 1140 | 1140 | 1570 |
| Depth (unpacked) | mm | 460 | 460 | 460 |
| Height (unpacked) | mm | 1500 | 1500 | 1500 |
| Weight (unpacked) | kg | 150 | 213 | 264 |

NOTES:- (1) Weight and Dimensions Nett. (2) Allow 500mm clearance to service panels.
(3) Minimum air temperature -15°C. (4) Water to have correct balance, See technical manual for details.
(5) Calorex reserve the right to change or modify models without prior notice.
(6) Performance is instantaneous (no allowance for defrosts)
(7) * = Outdoor Heat Exchanger, Inlet Temperature (8) # = Indoor Heat Exchanger, Inlet Temperature


rear elevation


front elevation

Technical Specification

# Ground Source Heat Pumps

As with all heat pump technologies, system design and integration must be matched carefully to design day heat loss. Calorex technical support is available to offer guidance on 01621 856611.

| MODEL | UNITS | 3500 | 5000 | 8000 | 12000 |
|---|---|---|---|---|---|
| **@ Source Water/Brine On 0°C*** | | | | | |
| Output To Water (@ 55°C)# | kW | 2·8 | 3·6 | 9·1 | 12·0 |
| Electrical Input | kW | 0·76 | 1·1 | 2·9 | 3·9 |
| Output To Water (@ 35°C)# | kW | 3·4 | 4·8 | 9·1 | 12·5 |
| Electrical Input | kW | 0·75 | 1·06 | 2·2 | 2·9 |
| **@ Source Water/Brine On 15°C*** | | | | | |
| Output To Water (@ 55°C)# | kW | 5·0 | 6·5 | 13·4 | 18·2 |
| Electrical Input | kW | 1·05 | 1·52 | 3·4 | 5·5 |
| Output To Water (@ 35°C)# | kW | 5·9 | 8·2 | 13·5 | 18·9 |
| Electrical Input | kW | 0·97 | 1·38 | 2·3 | 3·08 |
| **ELECTRICAL DATA** | | | | | |
| Electrical Supply Spec' 1 Phase | V/ph/Hz | 230V / ~1N / 50Hz | | | |
| Minimum Supply Capacity 1 Phase | amps | 11 | 15 | 25 | 32 |
| Maximum Supply Fuse 1 Phase | amps | 15 | 20 | 32 | 40 |
| Max Starting Current S/Start (LRA) | amps | 19 | 22 | 19 | 21 |
| **WATER DATA** | | | | | |
| Source(Ground) Water(Brine) Flow ±10% | l/min | 12 | 17 | 25 | 35 |
| Pressure Drop (Water/Brine) | m hd | 0.45 | 1.2 | 2.8 | 1.4 |
| Water Connections | inches | 3/4" BSPM | 3/4" BSPM | 3/4" BSPM | 1" BSPM |
| Process(Heated) Water Flow ±10% | l/min | 7.5 | 10 | 15 | 20 |
| Pressure Drop (Water) | m hd | 0.79 | 3.5 | 0.7 | 0.4 |
| Water Connections | inches | 3/4" BSPM | 3/4" BSPM | 3/4" BSPM | 1" BSPM |
| **GENERAL DATA** | | | | | |
| Gas Charge (R134a) | kg | 1.8 | 2.2 | 3.2 | 5.3 |
| Sound Pressure Level @1m | dB (A) | 44 | 45 | 48 | 52 |
| **DIMENSION DATA** | | | | | |
| Width (unpacked) | mm | 500 | 500 | 715 | 915 |
| Depth (unpacked) | mm | 444 | 444 | 465 | 465 |
| Height (unpacked) | mm | 850 | 850 | 945 | 945 |
| Weight (unpacked) | kg | 94 | 107 | 158 | 196 |

**NOTES**

(1) Weight and Dimensions Nett.
(2) Allow 500mm clearance to service panels.
(3) Calorex reserve the right to change or modify models without prior notice.
(4) * = Outdoor Heat Exchanger, Inlet Temperature.
(5) # = Indoor Heat Exchanger, Outlet Temperature.


5kW GSHP


12kW GSHP

# Typical GSHP Ground Collector Specifications for UK Domestic Installations

Ground source heat pump systems require that geological ground conditions and preferred heat extraction methods are considered strictly in association with the thermal load requirements of the load dwelling and the heat pump coefficient of performance. Geological conditions vary significantly around the UK and the following tables are presented solely as a guide to assist in pre – qualification formatting.

**Borehole Collector Heat Extraction Guide**

| Underground Geology | Specific Heat Extraction | |
|---|---|---|
| **General guideline values** | **1800 hours** | **2400 hours** |
| Poor underground (dry sediment) | 25 W/m | 20 W/m |
| Normal rocky underground with water saturated sediment | 60 W/m | 50 W/m |
| Consolidated solid rock with high thermal conductivity | 84 W/m | 70 W/m |
| **Individual rocks** | | |
| Gravel, sand, dry | < 25 W/m | < 20 W/m |
| Gravel, sand, saturated water | 65 – 80 W/m | 55 – 65 W/m |
| Strong groundwater flow in gravel and sand, for individual systems | 80 – 100 W/m | 80 – 100 W/m |
| Clay, loam, damp | 35 – 50 W/m | 30 – 40 W/m |
| Limestone (solid) | 55 – 70 W/m | 45 – 60 W/m |
| Sandstone | 65 – 80 W/m | 55 – 65 W/m |
| Acidic magmatite (e.g. granite) | 65 – 85 W/m | 55 – 70 W/m |
| Basic magmatite (e.g. basalt) | 40 – 65 W/m | 35 – 55 W/m |
| Gneiss | 70 – 85 W/m | 60 – 70 W/m |

Illustrated extraction values are approximate guides only. Actual values can vary significantly due to rock fabric such as crevices, foliation, weathering etc.

**Horizontal (flat) Collector Heat Extraction Guide**

| Ground Conditions | Specific Extraction Output | |
|---|---|---|
| **Underground Geology** | **For 1800 hours** | **For 2400 hours** |
| Dry, non- cohesive soils | 10 W/m$^2$ | 8 W/m$^2$ |
| Wet, non – cohesive soils | 15 – 20 W/m$^2$ | 12 – 16 W/m$^2$ |
| Cohesive (loamy) soils, wet | 20 – 30 W/m$^2$ | 16 – 24 W/m$^2$ |
| Water saturated sand/gravel | 40 W/m$^2$ | 32 W/m$^2$ |

**Calorex Slinky Collectors (direct from Calorex only)**

| House floor Area m$^2$ | Heat pump nominal output | Number of trenches required | Length of slinkies |
|---|---|---|---|
| Up to 90 | 3.5kW | 2 | 30 metres |
| 80-130 | 5.0kW | 2 | 40 metres |
| 100-200 | 8.0kW | 3 | 45 metres |
| 180-350 | 12.0kW | 4 | 50 metres |

**Comparative Examples**

| 240V single phase – for 1800 hours | | | | |
|---|---|---|---|---|
| Heat pump capacity | 3.5kW | 5.0kW | 8.0kW | 12.0kW |
| Borehole depth m | 60 - 80 | 70 – 90 | 140 – 170 | 160 - 190 |
| Groundhose length m | 150 - 200 | 200 - 300 | 2 x 200 – 2 x 300 | 2 x 250 – 2 x 350 |
| Calorex slinky collectors m | 2 x 30 | 2 x 40 | 3 x 45 | 4 x 50 |

The above information is offered as guidance only and Calorex recommend that professional technical advice is sought prior to design and selection of system components.

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