Heat Pumps

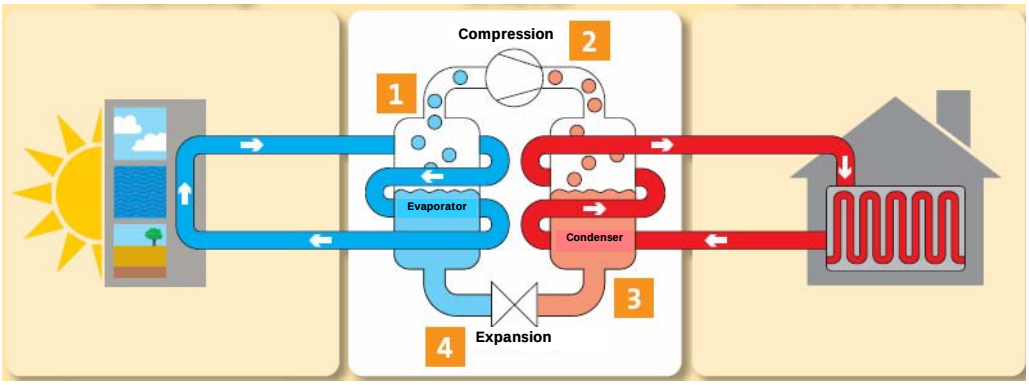
FREQUENTLY ASKED QUESTIONS

Dimplex heat pumps are the energy efficient, environmentally sound heating system of the future, providing a sustainable energy solution **that not only reduces the impact on the environment, but also helps to significantly reduce energy bills.**

How does a heat pump work?

Heat pumps supply more energy than they consume by tapping into the freely available, inexhaustible solar energy stored in the environment and converting this for use in a heating system.

Heat pumps use conventional refrigeration technology to absorb heat stored in the ground, the ambient air or in water and then raise this to a temperature level suitable for heating in the following way:



1. A large quantity of low grade energy absorbed from the environment is transferred to the refrigerant inside the heat pump (Evaporator). This causes the temperature of the refrigerant to rise, causing it to change from a liquid to a gaseous state.
2. The refrigerant is then compressed, causing its temperature to increase significantly.
3. A heat exchanger (Condenser) then extracts the heat from the refrigerant to heat water for central heating, underfloor heating or domestic hot water.
4. The refrigerant passes through an expansion valve, further reducing its temperature and turning it back into a liquid state.

How efficiently does this work?

Approximately 75% of the energy needed for heating comes from the environment. This means that for every 1kWh of electricity used to power the heat pump compressor, between 3 and 4 kWh of heating energy are produced, giving the heat pump an efficiency of up to 400%. Because such a high proportion of the heating energy comes from the environment, carbon dioxide emissions from heat pumps systems can be reduced by as much as 50% over a gas based system.

What is the difference between ground source and air source heat pumps?

Ground source heat pumps

Ground source heat pumps absorb heat stored in the earth through ground collectors – flexible pipes that are buried in the earth either horizontally or vertically. A mixture of water and anti-freeze is circulated through the pipes, which draws heat from the ground as it circulates through the ground loop.

Horizontal collectors are normally buried approximately 1.2m below the ground and spaced around 0.75m apart. Vertical boreholes are typically up to 100m deep. They require less space and provide the most efficient form of heat extraction, however they are more expensive to install than horizontal loops. The third option is a “slinky”, effectively a coiled horizontal collector. This is a good compromise between performance and space saving.

Due to the consistency of the ground temperature below the surface, ground source heat pumps are able to provide a consistent level of heat output and efficiency throughout the course of the heating season.

Air source heat pumps

Air source heat pumps extract heat from the ambient air and can be installed either inside or outside. They have the distinct benefit that the heat source is easily accessible without the need for buried collectors, making them suitable for a wider range of applications, particularly retro fit or where ground space is limited.

The efficiency of air source heat pumps is slightly lower than ground source due to the constant fluctuation in air temperatures, however Dimplex air source heat pumps are designed to work at temperatures as low as -20°C so are still able to extract heat from the air at normal UK winter temperatures.

Because they require no expensive ground collectors, air source heat pumps are considerably cheaper to install than ground source units.

Heat Pumps

FREQUENTLY ASKED QUESTIONS (cont)

What size heat pump will I need? How much space will be needed for a horizontal collector for a ground source heat pump?

The size of heat pump and amount of space required for a horizontal ground collector (the most popular type for domestic applications) will vary depending on:

- The heat load of the building (kW)
- The amount of energy the ground conditions are able to give up

To calculate the approximate amount of ground collector area required:

1. Calculate the heat pump output required by multiplying the total floor area (m^2) by the specific heat loss (W/m^2)
2. Assuming a CoP of 4 for the ground source heat pump, multiply the heat loss by 0.75 to calculate the amount of energy that needs to be extracted from the ground (the compressor provides the balance).
3. Divide the result by the heat extraction rate from the ground (assume 20W/m of pipe).
4. Multiply the length of pipe required by 0.75m (the correct spacing between the pipes) to calculate the area required.

Example: 250m^2 low energy (35W/m^2) new build house:
250 x 35 = 8750W heat loss. x 0.75 = 6,563W to be extracted from the ground. Divide by 20W/m of collector pipe = 328m. x 0.75m pipe spacing = **246m^2 of land area required.**
Example for a typical 250m^2 4 bedroom home:

Floor area of building (m^2)	**100**	**150**	**200**	**250**	**300**	**350**	**400**
Land area required (m^2):							
Low energy new build (35W/m^2)	98	148	197	246	295	345	394
High comfort new build (45W/m^2)	127	190	253	316	380	443	506
Improved retro fit (60W/m^2)	169	253	338	422	506	591	675
Unimproved retro fit (80W/m^2)	225	338	450	563	675	788	900

How much does a heat pump cost to install?

	Ground Source Heat Pump - Horizontal	**Ground Source Heat Pump - Borehole**	**Air Source Heat Pump**
Dimplex heat pump (11kW)	SI 11 MS	SI 11 MS	LA 11 MS
Heat pump cost	3500	3500	5600
Ancillary items (hot water cylinder, buffer tank, manifolds, etc)	2040	2040	1250
Ground collector and installation (including ground works)	2000	4000	-
Heat pump installation and commissioning	2500	2500	1400
Total (excluding grants)	**10,040**	**12,040**	**8,250**

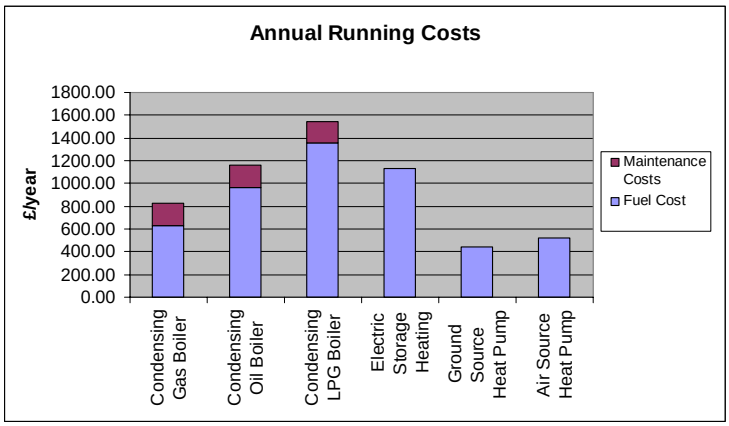
What will the running costs be? What is the payback?

Running costs
Example running costs for a typical 250m^2 4 bedroom house, new build. Running costs are for space heating and hot water.

Maintenance costs for gas, oil and lpg boilers are based on British Gas 3 Star service, including annual safety inspection.

Heat pump running costs assume 70% of heating load on E10 off peak tariff.

Payback
In addition to running and maintenance cost savings, because a heat pump has a reasonable life expectancy of 20-25 years - typically twice that of a gas boiler - the investment costs are spread over a longer period and the ownership costs over the working life of the system are demonstrably lower.



What grants are available?

In England and Wales, the Low Carbon Buildings Programme provides grants of up to £1200 to individual householders for the installation of ground source heat pumps. At present grants are not available for air source heat pumps, however these are expected to become available by the summer of 2007.

In Scotland, grants are available for both ground source and air source heat pumps to a value of up to 30% of the installation cost or a maximum of £4000.