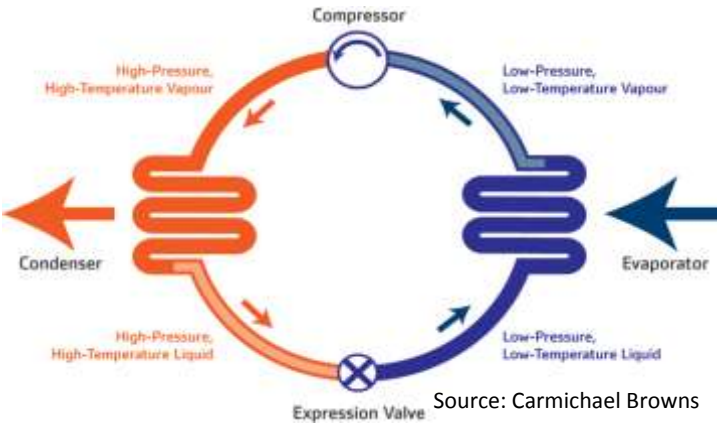
# Fact Sheet – Heat Pumps




Source: Carmichael Browns

The principle of heat pumps was first described by Lord Kelvin in the 1850s and recent developments have seen huge improvements in the technology. He recognised that everything contains heat even it feels cold to us (until it reaches 0° Kelvin or -273.15° Celsius, known as absolute zero). A heat pump lowers the pressure of the circulation fluid outside of the building (in fluids a drop of pressure causes a drop in temperature), the fluid's pressure is reduced until it is cooler than the outside temperature allowing energy to transfer into the circulation fluid. When re-entering the building the fluid is compressed, this increases the temperature of the fluid allowing it to be used for central heating and hot water. More simply put; a heat pump is a fridge in reverse.

The main types of heat pumps include:

- Ground Source Heat Pumps
  - Vertical – bore holes driven up to 100m into the ground
  - Horizontal – U-shaped or Slinky-shaped coils that are placed one to three metres below the ground
- Air Source heat Pumps – Typically seen on the side of roofs of buildings
- Water Source Heat Pumps – The external loop of the heat pump is submerged in water. This type can achieve the best seasonal performance factor (SPF).

In order to encourage uptake, the domestic and non-domestic government subsidies for Ground Source Heat Pumps (GSHP) doubled in 2014. The non-domestic Renewable Heat Incentive (RHI) tariff for GSHP over 100kW, for example, has increased from 3.9p/kWh to 8.7p/kWh[1]. These subsidies provide a 20 year inflation linked income.

Due to the increased subsidy heat pump systems can now be more attractive than biomass installations and become even more attractive if combined with on-site renewable electricity generation e.g. through solar PV, hydropower or wind energy.

To qualify for the non-domestic RHI the scheme must have a commercial setting or provide heat to more than one property. The domestic RHI is also available, this provides a higher annual income (RHI tariff is 18.8 p/kWh[2]) but for a shorter period (7 years).

The table below provides some indicative costs and payback periods. Pre-tax returns can be in the region of 12-20% depending upon current oil usage with heating bills decreasing by over 50% in many cases.

| GSHP Installation | Property Floor Area (typical insulation) | Ground Collector Area | Indicative Install Cost | Estimated Annual Fuel Saving (Oil) | Estimated Annual RHI Payment | Payback Period |
|---|---|---|---|---|---|---|
| 15 kW | 130m2 | 600m2 | £28,000 | £900 - £1,800 | £4,000 | 4-6 years |
| 50 kW | 550m2 | 2000m2 | £75,000 | £3,000-£6,000 | £5,600 | 6-8 years |
| 100 kW | 1100m2 | 4000m2 | £120,000 | £6,000-£12,000 | £11,000 | 6-8 years |
| 200 kW | 2200m2 | 8000m2 | £200,000 | £12,000-£15,000 | £22,000 | 6-8 years |

[1] https://www.ofgem.gov.uk/environmental-programmes/non-domestic-renewable-heat-incentive-rhi/tariffs-apply-non-domestic-rhi-great-britain

[2] https://www.ofgem.gov.uk/environmental-programmes/domestic-renewable-heat-incentive/about-domestic-rhi/tariffs-and-payments-domestic-renewable-heat-incentive



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## FAQ's

### How 'efficient' is a ground source heat pump system?

Modern systems can be highly efficient. For each kilowatt-hour (kWh) of electricity used to run the heat pump, approximately three kilowatt-hours of heat can be delivered to the building. This ratio is known as the Seasonal Performance Factor (SPF) or the Co-efficient of Performance (COP). The efficiency of a GSHP installation is dependent on the quality of the design, installation and utilisation of the solar recharge of the ground.

### What should I expect from a heat pump-powered system?

- GSHP efficiency rating (SPF) of 2.5 or greater in order to receive the RHI incentives
- Low maintenance, low running costs, low noise and out of sight; they are often referred to as 'invisible heating systems'
- High compatibility with underfloor heating systems due to a high coefficient of performance if it delivers to a large warm circuit rather than small high temperature circuits such as radiators.
- The heating controls that come with a heat pump can be complicated – insist on easy-to-use controls and a demo from the installer.

### Can a standard domestic electricity supply be used?

- Yes. Heat pumps are designed to run on a standard UK single phase supply. However, a three-phase supply is a preferable option and will generally be needed for systems over 15kW.

### What should you consider when replacing a conventional heating system with a heat pump?

Heat pumps typically heat water to 50°C, whereas oil, gas or biomass boilers will produce hot water up to 90°C. When considering a heat pump the installer should take into account whether the existing system has been designed to run at a higher temperature than a heat pump can support. Underfloor heating coils may need to be closer together and radiators may need to be larger in order to heat the building to the desired temperatures.

### Can a ground source heat pump be installed in an older property?

Yes, but your building must be well insulated for you to gain the most benefit. Money spent on upgrading insulation levels can save a considerable amount on the capital cost of a ground source heat pump system. Some older buildings may leak too much heat to be suitable for underfloor heating, or warm temperature radiators. Biomass systems are often better suited to older buildings.

### What service and maintenance requirements are there?

Annual maintenance requirements are relatively low for a heat pump, however as with any valuable plant, a ground source system should be covered by an annual maintenance agreement with the supplier. The pump can be expected to last over 20 years and the ground heat exchanger should have a lifespan of over 50 years.

### Can heat pumps provide cooling?

Yes, they are known as reverse-cycle heat pumps and they can deliver both heating and cooling. Cooling provided by heat exchange with cold ground is inherently more efficient than air.

### How large are ground source heat pumps?

A heat pump for a standard house is about the size of a large fridge. More powerful heat pumps for commercial buildings do not increase in size or price as much as they do in power output.



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January 2015