Gas Absorption
Heat Pumps
Future proofing your heating and hot water

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Gas Absorption Heat Pumps (GAHPs) provide the ideal solution for heating UK buildings

A Gas Absorption Heat Pump (GAHP) is a renewable heating solution that uses existing infrastructure and gas supply at a very high efficiency of up to 150% to deliver significant fuel bill savings.

Illustration shows a typical layout of a Gas Absorption Heat Pump (GAHP) in a domestic dwelling
What is a Gas Absorption Heat Pump?

A Low Carbon Solution
GAHPs are an ideal low carbon heating solution. Like all heat pumps, GAHPs essentially work like an air conditioning unit in reverse, capturing low grade heat from the surrounding environment including; heat from the sun, air, water or soil, and converting it into high grade heat for space heating and domestic hot water. However, while an electric heat pump uses an electric driven compressor, a GAHP uses gas (or LPG) to drive the heat transfer process.

Who Develops it?
A number of companies develop a wide range of highly efficient GAHP products in the UK with diverse sizes and technical characteristics suitable for commercial, industrial and community infrastructure. The technology is commercialised both in the ‘on’ and ‘off’ gas grid sectors. Indeed, LPG fuelled GHP systems are readily available for the off-gas grid market in the UK.

How does this simple solution work?

The Government’s Heat Strategy, published in March 2013, attributes a prominent role to GAHPs as a means of decarbonising heating. One of two modelling scenarios undertaken for the purposes of the Heat Strategy indicates that GAHPs need to be the dominant heating solution from 2025 onwards if the UK is to meet binding decarbonisation targets.

The following description of GAHP operation is based on the Government’s Heat Strategy document (p.5, Evidence Annex):

GAHPs use the same operating principles as for other heat pumps capturing energy from a low temperature heat source and upgrading it for use in space heating and domestic hot water production. However, in GAHPs, the electrically driven compressor is replaced by a separate device, powered by heat from gas combustion. Within the compression device, vaporous ammonia – typically used as a refrigerant – from the evaporator mixes with water and is pumped to a generator where it boils and flows on, in a vaporous state to the condenser.

Illustration shows a typical installation of a centralised GAHP in an apartment building.
Saving money and cutting CO₂ emissions

GAHPs present an established heating solution that combines the advantages of two common heating technologies, gas boilers and heat pumps. As a result, GAHPs provide numerous benefits over and above traditional and other renewable heating systems.

Energy efficiency

With an energy efficiency of up to 150%, a GAHP can be up to 50% more efficient than a high efficiency condensing boiler. Such economical use of gas (or LPG) ensures a reduction of up to 50% in energy bills and CO₂ emissions.

Cutting running costs

Right from the day of installation, a GAHP can cut energy bills and carbon emissions with no loss of comfort or warmth in the home. GAHPs can do this in a hassle free manner using current gas supply and, if required, work in tandem with other energy saving solutions such as solar thermal.

Graphs assume annual heat demand of 30,000 kWh
The many benefits of GAHPs

Reducing environmental impact whilst maintaining comfort, the benefits don’t stop there because GAHPs:

**Deliver high temperature heat while maintaining high efficiencies**
This is achieved without the requirement to install large radiators or an auxiliary heating system for exceptionally cold days. As a result GAHPs can be readily retrofitted within your existing heating system (pipes, radiators, valves). Retrofit is the “challenge”: 95% of heating consumption in 2020 will be in buildings that exist today. GAHPs substantially provide the best solution available to drastically reduce their CO₂ footprint.

**Have very low environmental and noise pollution levels**
GAHPs use environmentally friendly naturally occurring refrigerant, to generate heat and do not rely on polluting Hydrofluorocarbons. GAHP also has a lower operating noise than other renewable solutions. According to the study carried out for the purposes of the EU Ecolabel scheme, GAHP is the technology with the lowest levels in PM, NOx and OGC among all other renewable heating technologies tested.

**GAHPs can deliver DHW function (up to 70°C) with efficiencies higher than a regular boiler**
Possible even in absence of sun irradiation and without backup function. GAHPs can operate with ambient air as the energy source even at the lowest of temperatures, without compromising efficiency and comfort. GAHPs are also capable of reverse operation to provide cooling in the summer, so doing away with the need for a separate air conditioning unit – savings on space, installation and maintenance costs.

The availability of GAHPs

GAHPs are the most efficient available gas (or LPG) fired heating solution, capable of reducing environmental impact across a range of building sizes. In Europe installations include domestic properties, multiple residences (flats, social housing), commercial and industrial applications.

A number of companies commercialise a wide range of air source, water source and ground source GAHPs in the UK non-domestic sector including Baxi, British Gas, Calor Gas and Worcester Bosch. These products are currently available at several capacity versions (40kW all the way up to 300kW) according to the type of installation and performance required.

More GAHP products for the domestic sector are currently developed by several major players and are due to be launched shortly to address household heating needs in European markets, including the UK.
GAHP Case Study

The following UK case study is based on a ground source GAHP application. However, it should be noted that air source GAHP applications are also available without any compromises in performance or comfort. Air source GAHP efficiencies are equally high making the need for drilling boreholes redundant in many instances. The education sector is championing the uptake of heat pumps in the UK, providing an important showcase for the fast growth of the heat pump market. This is the successful case of the Open University Milton Keynes. The 2000 sq metre sustainable new-build development that forms part of the Walton Hall campus.

**The heating system**

13 boreholes have been drilled to a depth of 100+ metres to install a ground loop system feeding 4 Robur GAHPs + ground source renewable energy GAHP GS with a capacity of 140kW heat output, providing heating and domestic hot water as well. The operation of the GAHPs is very simple and reliable: the thermal energy absorbed by the earth is enhanced by the refrigeration cycle.

**Advantages**

The 4 heat pumps provide up to 40.9% utilisation of ground source renewable energy, exceeding peak efficiencies of 169% and 40.9% reductions in annual heating costs and in CO$_2$ emissions compared to condensing boilers. Every year the 4 Robur GAHP GS installed at the Open University save 20.4 Tons of CO$_2$ emissions, equivalent to those absorbed by 2,856 trees or those produced by 8 green cars.

Renewable heat incentive and role of GAHPs

According to the Government’s Heat Strategy, GAHPs, as the most efficient gas utilising heating solution, have the potential to play a significant long-term strategic role as the UK endeavours to decarbonise its heating supply. GAHPs are unique as they utilise gas to generate renewable heat. The recently published EU guidelines on calculating renewable energy for heat pumps, confirm that GAHPs are a renewable technology and establish a methodology to calculate the renewable energy that they generate towards legally binding renewable targets.

However GAHPs will not be able to deliver the long-term strategic potential, foreseen in the Government’s Heat Strategy, without a solid policy support framework. Support now is important to kick start this market and hedge against a slower than anticipated phase out of gas as the predominant heating fuel without contradicting renewable and CO$_2$ reduction objectives. In all conditions this technology delivers higher efficiency than a condensing boiler. GAHPs are the key solution to improving fossil fuel systems by maximising their efficiency and reducing emissions. They would do so, while supporting renewable targets with no additional infrastructure investment or loss of comfort.

An essential element of support is inclusion in the Renewable Heat Incentive, on par with other renewable heating solutions. That would generate the necessary certainty and incentive to deliver this unique available solution to market in the UK.
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