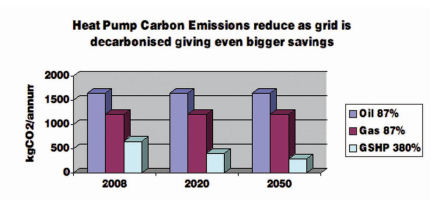
Heat pumps – save more carbon

Brian Kennelly, Managing Director of EarthEnergy Limited, **the country's leading geothermal company specialising in the design and installation of ground source heat pump systems for heating and cooling buildings.**

DO heat pumps really save carbon use? That is the startling question that has been raised in various papers and reports. Behind the issue the undisputed fact that heat pumps rely on electrical power and, it continues, by and large electricity means carbon outputs. These discussions are not academic.



Understanding true, life time carbon operating performance of ground source heat pumps makes them one of the most attractive renewable energy technologies for new school buildings. Heat pumps have already made huge proven carbon savings and their potential to increase this is clear to all in the industry, an objective analysis is timely.

To understand the argument over carbon use, I would suggest three factors need to be looked at in depth. Firstly, the carbon intensity of electricity generation (in simple terms how much input is from fossil fuels). Next, how will the generation picture change over time and lastly what is the real experience of heat pumps in operating efficiency and hence their electrical input.

How much carbon now?

One argument in particular that has been used to assert that GSHP systems do not reduce Carbon emissions makes the assumption that the electricity supply to the compressor and pumps of a ground source heat pump should be assumed to all come from a coal fired power station (with a carbon intensity of 0.56 $kgCO_2$/kWh) as opposed to the blended mix of generators online at the time that the GSHP is in use.

The power market and the balancing supply/ demand activities determine which generators are online at any moment while a GSHP is in use; and that actual emissions associated with that energy consumption will vary depending on the demand on the grid. At times when nuclear, wind, electricity imported from France and gas combined cycle plants make up the generation mix, the associated emissions are very low, resulting in an average grid carbon intensity of 0.43 $kgCO_2$/kWh.

... and how much tomorrow?

Ground Source Heat Pump Systems have a recognised average operating life of around 40 years. So the future of electrical generation is the key argument.

Today's CO_2/kWh argument pales into insignificance when it is recognised just how much the UK electricity supply grid will de-carbonise over the next 20-30 years as a direct result of Government policy. The underlying fact is that we have a national commitment to vital energy technologies, a nuclear replacement programme, carbon capture and storage, and a legally binding renewables target to meet, primarily through our available resources on a large scale i.e. wave and wind.

Despite the publication of two Energy White Papers in 5 years, there are no Government figures for where it expects grid carbon intensities to settle each year between now and 2050, in order to meet overall carbon reduction targets. However there are some sign posts. Eurelectric, the professional association which represents the common interests of the electricity industry at pan-European level, has addressed exactly this carbon reduction issue in their 2007 report*. The analysis demonstrates that a low-carbon generation portfolio can be based on secure energy sources and that the average CO_2 content of European energy production could decrease to 0.13 gCO_2/kWh in 2030, a reduction of around 75% from the assumed present 'coal only' figure of 0.56kg CO_2per kWh.

By 2030, a ground source heat pump driven by this forecast electricity supply mix will be able to heat a school with a small fraction (around 80% reduction) of the CO_2 emissions made by current oil or gas heating.

What can heat pumps deliver?

A typical ground source heat pump system installed by a specialist contractor such as EarthEnergy Limited, in a school building has an average annual efficiency of 380% and an overall system life of 40 years (actual ground loop life expectancy is greater than 100 years).

Taking a prudent view of grid de-carbonisation, it is realistic to expect the carbon intensity to reduce to 0.20 $kgCO_2$/kWh over the next 15 years, giving a lifetime average 0.25 $kgCO^2$/kWh for the electricity supplied to the heat pump. This gives a carbon saving of 65% compared to a condensing gas boiler, some three times greater than the figure often used.

EarthEnergy Limited have installed ground source heat pumps in over 40 schools and other educational buildings across the country. With this track record the company is confident that this technology is wholly appropriate to meet the demanding standards for carbon reduction in new schools.

*** "The Role of Electricity – A New Path to Secure, Competitive Energy in a Carbon-Constrained World" – March 2007".**