



**BAXI -SENERTEC UK**



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## **TAKING EFFICIENCY TO THE LIMIT WITH GAS ABSORPTION HEAT PUMP TECHNOLOGY**

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Up until now, Building Regulations and planning consent requirements for new buildings have driven the UK commercial sector to adopt LZC solutions. However, there is a vast stock of existing public and private commercial buildings in the UK with heating and hot water systems that would greatly benefit from the application of heat pump technology. The recent introduction of Display Energy Certificates is an early measure by Government to focus on the need to make public buildings more energy efficient. However as part of the UK Low Carbon Transition Plan, the Renewable Energy Strategy (RES) published on 15<sup>th</sup> July 2009 sets out the

path towards achieving the UK target of 15% of our overall energy consumption to come from renewable sources by 2020. Currently, heating accounts for approximately half of the UK's carbon emissions and only 1% of heating comes from renewable sources.

In order to stimulate the uptake of renewable energy technologies, the government is committed to introducing "clean energy cash-back" for renewable electricity and heat which will be delivered through the Feed in Tariff (FIT) and Renewable Heat Incentive (RHI.) The scheme should support a range of technologies including air, water and ground source heat pumps, as well as solar thermal and renewable CHP.

Consultation on the detail of this scheme is coming to an end and the Government is working to have the RHI up and running in April 2011.

### **A Variety of Options for LZC**

The UK heating industry for many years has had proven renewable and LZC technologies to utilise, but the need for global carbon reduction and security of UK energy supplies supported by government measures such as these, means they can now be a commercially viable part of commercial heating systems in the UK. Solar thermal systems can be used for retrofit applications but there is not always sufficient space for the solar arrays at the necessary orientation or angle of inclination. Mini-CHP can also be retrofitted into an existing heating system provided there is sustained demand for heat and electricity. Ground source heat pumps tend to be better suited to new build applications due to the considerable area of ground or depth of borehole required in order to retrieve the heat.

Air source heat pumps are usually located outdoors; this can be on the roof of a building or any small unused patch of ground nearby. As well as offering flexible siting options, air source heat pumps are not only suitable for low grade heating applications, they can provide a low carbon solution to assist in the production of hot water .

### **Air to Water Heat Pump Technology for Pre-heat**

Using a system which is similar to a reverse refrigeration process, the unit consists of four main components; evaporator, compressor, condenser and expansion valve. Refrigerant is circulated around these components, changing state as it transits through the four elements of the cycle. The unit captures latent heat from the outside ambient air to evaporate the refrigerant passing through the source side heat exchanger. A second load side heat exchanger transfers heat from the high pressure, high temperature discharge side of the refrigeration compressor into the heating/hot water circuit. Where the LZC technology does not entirely replace the primary heating appliance, air source heat pumps can be used in pre-heat applications.

In an existing hot water system, it could be used to raise to a higher temperature the mains cold water feed to, say, a direct gas fired water heater, coupled with an indirect cylinder, using natural gas to raise water from the cold inlet at 10°C to a stored water temperature of 60°C.

An air source heat pump used to pre-heat the cold water inlet in this way would reduce the amount of fuel input required to raise the water to the set point temperature.

For instance, if the air source heat pump circuit is controlled to deliver a flow temperature of 40°C and a return temperature of 30°C, i.e. a temperature differential across the indirect coil of 10°C, a potable water temperature of up to 30°C in the pre-heat cylinder should typically be achieved. This would result in a higher water inlet temperature into the direct-fired water heater, reducing fuel consumption in the region of 40% and making a significant impact on the carbon footprint of the hot water system.

The performance of the heat pump is a function of the ambient air temperature and the outlet temperature of the water on the load side of the system. The coefficient of performance (CoP) of an air source heat pump is typically in the region of 3.0 to 3.5, based on an ambient air temperature of 2°C and a load (water) temperature of 35°C. Although air source heat pumps are capable of achieving higher water temperatures of up to 55°C, generating water for heating or hot water at this temperature would significantly reduce the CoP. Relying on ambient air means seasonal variations will affect performance, but during the considerable proportion of the year when temperatures are above 2°C, the CoP will be higher. Air source heat pumps can, therefore, make a significant contribution to reducing the carbon footprint of existing buildings.

### **Taking Technology a Step Further**

Air source heat pump technology has just become more exciting with the recent introduction of the Gas Absorption Heat Pump into the UK. Just as the conventional appliances save space through flexible outdoor siting options, the packaged gas absorption heat pump has all major components

of the refrigeration cycle contained within a single casing and is also suitable for outdoor, even rooftop, installation. However, it offers the additional advantage that it operates as a primary heat source thereby saving the plant room space that would otherwise be taken up by a boiler.

The unit comprises a sealed circuit which contains an ammonia water solution which is the refrigerant and, unlike chemical refrigerants used in air to water electric heat pumps, causes no harmful effects to the ozone layer. Being a naturally forming chemical, the ammonia water mix offers a zero ozone depletion potential (ODP) and a zero global warming potential (GWP) figure. This appliance scores exceptionally well in relation to BREEAM ratings and is particularly relevant for larger schools, hospitals in 180 NHS Trusts and all organisations affected by the Carbon Reduction Commitment (CRC) energy efficiency credits scheme.

### **Ultra Low Emissions with Exceptional High Efficiency**

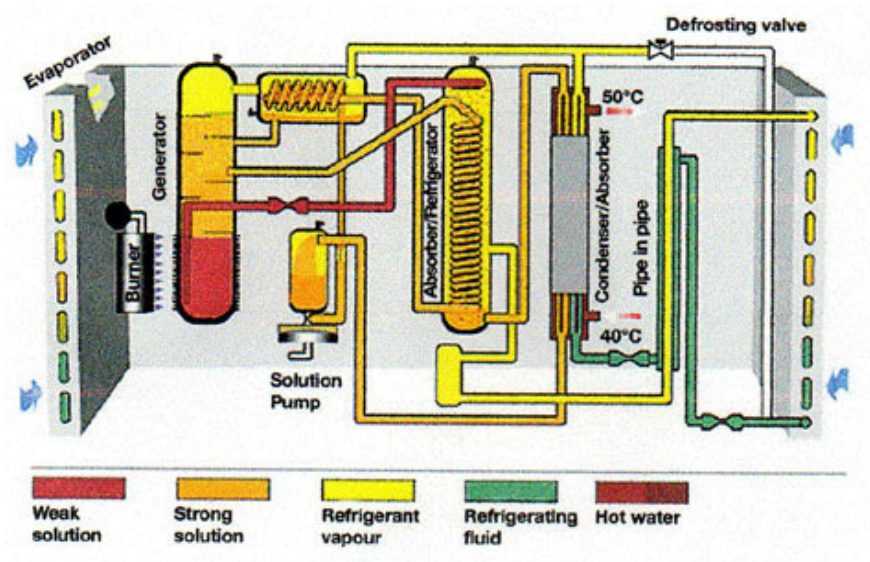
Instead of using electricity to power an induction motor to drive the refrigeration compressor, the gas absorption heat pump uses a gas burner to initiate and sustain the refrigeration cycle, assisted by the available energy from the surrounding ambient air. It then uses the heat generated to supply low temperature hot water heating systems and/or for the production of domestic hot water via an indirect cylinder. As the carbon emission factor for gas is lower than grid supplied electricity; 0.193 kgCO<sub>2</sub>/kWh compared to 0.56 kgCO<sub>2</sub>/kWh, the gas absorption heat pump offers improved emission reduction benefits compared with traditional electric heat pumps as well as lower operating costs.

Being a gas appliance, the performance is measured in efficiency terms rather than CoP and varies according to the available ambient air temperature and water flow temperatures. The gas absorption appliance newly available in the UK offers efficiency figures of around 144% (A7°C, W35°C), gross CV of fuel and after deduction of the parasitic loss. This means it achieves the efficiency level of A+++ under the EuP Directive at these operating temperatures.

Any plant room, whether in a new or existing building, where this technology is utilised, either as a sole heat generating appliance or as a lead boiler, will be equipped with an ultra low carbon source of energy.

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A-Cubed Gas Absorption Heat Pump

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