IEA Annex 28 – UK Market Analysis

Heat Pumps for space heating and cooling, and hot water heating

System configurations commonly used and available on the market

Heating optimised dedicated heat pumps for domestic space heating and domestic water heating are almost unknown in the UK. There is one manufacturer of swimming pool ventilation heat recovery systems which has a dominant market share. Around 500 air source reverse cycle "split" systems were sold in 2002 for domestic conservatories. There are at least three manufacturers developing heat pumps (IMI, Calorex and Kensa), but all that is available at the time of writing in 2003 is one manufacturers complete range of ground source heat pumps (Kensa Heat Pumps), and another manufacturer (Calorex) has two small models of ground source heat pumps. Air source heat pumps specifically for retrofitting into the space heating market are under development in a joint venture between IMI PLC and Kensa Heat Pumps which will result in the largest capacity for heat pump manufacture in the EU.

Paradoxiacally, almost all EU heat pump manufacturers depend upon a British company for their core product - the compressor - made by Copeland in Cookstown, Northern Ireland. New heating-optimised scrolls are now available from Copeland as a "first generation" design, with second and third generations under development, which arguably puts the UK at the forefront of dedicated heat pump R&D worldwide.

The market for commercial heat pumps is well established, with around 70,000 sold per year with the majority being small split systems.

No public or published data is available for heat pumps in the UK, and there is no effective method of comparing heat pump performance. The market is so small that there is as yet no significant concern regarding comparing efficiencies between manufacturers.

Heat Pump Standards & Testing

The most common standard referred to is BS EN255 parts 1,2 & 4. There is no independent test facility for heat pumps in the UK, although Kensa Heat Pumps possess a computer driven calorimeter capable of replicating a wide range of source and load water temperatures.

Outside of the R&D of the UK's heat pump manufacturers, there is little testing of heat pumps, or publication of data that indicates heat pump or heat pump component performance.

Few calculations for energy requirements outside of those required for BS EN255 have been performed by UK heat pump manufacturers.

UK testing for ground source heat pumps tends to use +5/45 deg C as source/load temperatures, rather than the 0 deg C quoted in BS EN255. This is because the UK has a warmer "maritime" climate rather than a colder "continental" climate and rather poorly insulated buildings, even for new-build.

Kensa have performed some limited testing of ground source heat pumps in cooling mode at a range of UK ground temperatures. Calorex have performed some limited testing of bivalent operation of their heat pumps.

Statutory Legislation

As ground source heat pumps are exempt from energy labels, no work has been completed in this field in the UK. Assumed COP's are for both air and ground source heat pumps are given in the "SAP" (Standard Assessment Procedures) for energy rating for houses.

The only legislation on minimum water storage temperatures with respect to legionella applies to large quantities of water stored in commercial buildings. However, there are proposals to legislate in this area, including some pan-European suggestions, and this may have an impact on future heat pump design.

Building standards are gradually improving, with a step-change in many aspects anticipated in the next revision of the building regulations in April 2005, after which all boilers must be of the condensing type. This is forcing new buildings to adopt low temperature distribution systems such as underfloor heating, all of which will help with sales levels of heat pumps.

Boundary Conditions

Standard meteorological data exists in many and varied forms for input into several commercial software products used to design building services. For example, Strathclyde University has developed its "ESP-r" software method, which contains very precise data for a wide range of locations in the UK, into which can be put ino many different models of buildings. It is then possible to try slotting into the building a range of heating and cooling technologies (both sources and distribution systems) to see how they compare and perform, and in particular to prove carbon savings. The "ESP-r" is being extended to include air source heat pumps (which are more sensitive to climate than ground source), for the first time, and in particular, this will enable the modeling of air source heat pumps in a range of climates and buildings with high and low temperature distribution systems across the UK. However, ESP is rarely used as a design tool. CIBSE publishes examplease of year weather data, based on the historical climate and also adjusted for possible climate change.

Building Standards

Building standards in the UK tend to implictly assume fossil fuel boilers. For example, it is currently a requirement to obtain building regulations approval before installing a new heating appliance. However, heat pumps do not rely on combustion and are therefore mostly exempt from legislation, meaning that there are little restrictions or standards that apply to their installation.

Space heating and domestic hot water has traditionally been provided by fossil fuel boilers which have the ability to provide water at around 80 deg C. Surprisingly, there is little requirement for controls to limit the stored DHW temperature to the recommend 65 deg C.

Most buildings in the UK are heated intermittently: that is, the heating is truned off at night. Weather compensation is unknown, except in large buildings with BEMS systems, although some domestic condensing boilers are now being fitted with it as standard; it remains to be seen if the programming of the onboard software creates problems for consumers.

Electricity Supply

There are no special tariffs for heat pumps, although there are off-peak tariffs for night rate "storage heaters". The UK generating base is around 20% nuclear, with upto another 5% of nuclear electricity being imported from France. This electricity is around 1/3 of the cost of peak electricity, and is an ideal partner for a heat pump which is operating on a "wet" underfloor system which exhibits significant lag in a well insulated building.

There are proposals for heat pumps tariffs, and for interrupted supply tariffs. None of these are yet in existence although one supplier, Scottish & Southern have a tariff where there are two hours of electricity available during the day at lower cost.

It costs three times as much to run a heat pump on peak-rate electricity using radiators as a heating distribution system, compared to a "concrete" wet underfloor system.

The UK has a particular problem with respect to electricity. Almost all EU homes have a three phase power supply. In the UK, there is generally only a single phase power supply. Almost all heat pumps are of the vapour compression type with an electric motor, which operates more efficiently and has a longer life with a three phase power supply. There is also the problem of high starting currents from single phase compressors creating disruptive loads across the network which could give heat pumps a poor name. There are presently EU-wide proposals to limit starting currents to 60 amps, and if these were adopted in the UK then this could be disadvantageous to scroll compressors as "soft starts" will reduce the inertia during starting.

The UK has a tremendous number of buildings which are still heated with direct electricity, predominantly in areas where there is no mains gas. These areas usually have better quality power supplies, and the overall electricity consumed in these areas would decrease if the direct electric heating were replaced with heat pumps.

The UK has traditionally been self sufficient in energy - indeed, producing more oil than some smaller OPEC nations. However, from 2006, it will be a net importer of energy,

which has implications for both energy and foreign policy. Present government policy is to phase out the remaining nuclear power, and tax the more polluting coal stations such that there is now massive reliance on gas fired power stations. With the closing of Sullum Voe oil terminal in Shetland (the EU's biggest oil terminal) and the decline in the UK's North Sea gas supply, widespread power cuts are being predicted in the near future by energy companies. Electricity demand closely correlates to external ambient temperature in the UK, so it had widely been expected that power cuts would take place primarily in the winter. However, most of London suffered an unexpected power cut at the end of August 2003 which is a "wake-up" call which reinforces the predictions.

Refrigerants

The UK has lax regulations on refrigerant supply, with no qualifications being required to handle them. Official UK Government policy is that HFC refrigerants, as are commonly used in heat pumps, should not be used where there is a viable alternative. However, there is great debate at many levels as to whether this policy needs to be enforced.