HEAT PUMP NEWS
Saving Energy

HPA HEAT PUMP ASSOCIATION

Volume: 1 No. 5

IT'S ALL HAPPENING FOR HEAT PUMPS!

People are clearly listening to our message — heat pumps continue to rise up the Energy Agenda. Consider what has happened:

- Heat Pumps listed on The Carbon Trust Energy Technology List.
- 5% VAT on domestic ground and air source heat pumps.
- Grants for heat pumps from Clearskies / Low Carbon Buildings Programme.
- Strong representation of heat pumps in the new Building Regulations ADL1, ADL2.
- Positive references to heat pumps in every energy review document issued by a host of different agencies.

The technology is very good and improving all the time, so we will continue to put the message across to government — where the HPA is the trusted technical partner and to the private sector.

Reading this issue of our News suggests yet more applications for the use of heat pump technology, this being one of our prime objectives. You will also see the tasks ahead — Eco Labelling, Refrigerant Handling, and ever more communication about what heat pumps have to offer.

I hope you find this issue interesting and informative.

Tony Bowen, President, HPA

'Free heating for pensioners with heat pumps'

By using ground source heat pumps, households that are not connected to the gas grid can have heating costs that are lower than the Winter Fuel Payment — so pensioners can effectively get free heating (if local authorities bear the cost of the installation). *See back page — 'A further boost for heat pumps'.*

Heat Pump for the People's Park

Inside Saltwell Park, Gateshead

Hadrian Air Conditioning and Refrigeration Ltd. of Washington, Tyne and Wear has installed a Daikin Air to Air VRV heat pump heat recovery system, supplied by HPA member Space Airconditioning plc, at Saltwell Park for Gateshead Council as part of a £10 million restoration project.

Known to the local community as the 'People's Park', Saltwell Park was first opened to the public in 1876 and was designed to provide a haven for the working people of Gateshead to visit. Standing in 55 acres of landscape, woodland and ornamental gardens, the Gothic mansion Saltwell Towers lay in ruins for many years.

The project started in 1999 with the complete restoration of the mansion. Gateshead Council wanted to provide an Interactive IT Activity Centre that was bright and modern within Saltwell Towers, but this had to be achieved within the strict regulations of a Grade II listed building.

The comfort of visitors was very important, Hadrian Air Conditioning & Refrigeration were asked by Gateshead council to design a system that would offer the ultimate in climate control in the most cost effective way but that would blend in with the internal fabric of the building.

"The Daikin VRV heat pump heat recovery system was chosen due to its excellent efficiency characteristics and compatibility with the restrictions of a Grade II listed building. Daikin ducted fan coils offered excellent performance as well as being able to integrate with the Architect's vision of the aesthetics required internally. In addition, the high performance heat recovery system enables extremely efficient heating during the winter months," said Alan Unsworth, Hadrian Air Conditioning and Refrigeration Ltd.

A Renewable Resolution

The European parliament which shares co-decision powers with the Council of Ministers has passed a comprehensive resolution on renewable heating and cooling. They request the European Commission to draft a new directive, which will set a target of 20% contribution by renewable energy sources by 2020. This is a very significant step forward in terms of delivering the remaining goals set out in the 1997 White Paper on Renewables and which was also agreed as part of the EU's Climate Change Program. DG TREN have agreed to include the draft of this directive in its 2006 work program.

In addition the resolution also requests the eco-labelling of all renewable heating and cooling systems. This work is already under way for heat pumps but will now have to be broadened to encompass all such sources.

Swimming pools — a perfect role for heat pumps

Heat pumps have transformed the environmental control management of modern swimming pools....

First developed three decades ago, heat pump technology is the super hero of environmental control that has simply transformed the management of modern swimming pools.

Such is the level of sophistication that now, 30 years on, for each kW of electrical energy used to operate the latest dehumidification units from industry pioneers, Calorex, up to 3.5 kW of energy are recovered — the only humidity control system which recovers more energy than it uses.

On a typical municipal leisure centre with a 25m learner pool, a heat pump based system can save over 250 tonnes of CO_2 emissions per annum compared to a recuperator based air handling unit.

In this energy-conscious, budget-dominated age, it would take a brave pool operator, or a rather aged ostrich, to bury their heads in the sand, when it comes to a quick fix solution that will not only save energy, but will also reduce running costs and all for a minimal capital outlay that will see pay-back within a matter of years.

Carbon Footprint

Local authorities and leisure operators are under more pressure than ever to demonstrate efficient and effective energy efficiency with a backdrop of reports that suggest current atmospheric levels of the greenhouse gases, carbon dioxide and methane, are higher now than at any time in the past 650,000 years. Another recent study reports that for the last 150 years, sea levels have been rising twice as fast as in previous centuries.*

Recreation and leisure is one of the top three in the highest carbon emissions league table according to the Carbon Trust, the body that provides free, practical advice to business and public sector organisations to help reduce energy use.

The Carbon Trust says business has the opportunity to take a new approach to delivering products and services to consumers in order to substantially increase carbon emissions reduction.

Taking a pro-active lead, British manufacturer, Calorex, is a privately owned company that is constantly striving to improve the carbon footprint for businesses both within the recreation sector but also to a broad scope of business sectors from manufacturing to information technology. Employing around 120 staff at its Essex base Calorex has traded and grown successfully for more than 25 years. The company provides the very latest heating and ventilation heat pump systems for indoor and outdoor pools and has a world-wide customer base to prove it.

Using heat pump technology to maximise energy efficiency is core to Calorex's product range and close to the company's heart with company figurehead, Tony Bowen, the current president of the UK Heat Pump Association.

Calorex systems have been successfully installed up and down the UK and all over the world where pool managers tackle the perpetual challenge of balancing the need for high water temperatures and the excess of humidity and condensation caused by evaporation from the pool surface.

Condensation Cocktails

Unchecked, not only does this cocktail create an unpleasant environment for swimmers and poolside staff, if moisture levels remain uncontrolled, the building fabric and its content will suffer untold damage.

Much more than just a question of poor housekeeping, the consequences of not controlling humidity in swimming pools is potentially catastrophic. Testimonies to this include such recent tragedies as the Moscow pool disaster that claimed more than 27 lives with over 100 injured.

A typical leisure centre pool can contain up to a million litres of water heated to around 30°C. Water evaporates from the surface at a rate of hundreds of litres every hour. Evaporated water needs to be removed or it will turn to condensation that will immediately start to cause problems.

Pre-heat pumps, that valuable energy would have just been expelled to the outside atmosphere. Heat pumps cleverly provide the means of recovering that energy. Air is passed through the evaporator, a finned coil, where it is continuously cooled. The water vapour is condensed to give up its latent heat and runs away as water.

At normal pool temperatures, 2 kWh of latent heat is recovered for every three litres of water vapour condensed. The air temperature has been lowered by the removal of sensible heat to enable the dehumidification process to proceed and both the sensible and latent energy come together in the refrigerant gas. This is now raised to a higher temperature by the compressor and used to heat the pool water as well as the pool air.

When the humidity rises above the target level, a compressor is switched on, together with the integral heat pump circuit and the heat recovery dehumidification process starts. Latent and sensible energy available in the moist air is recovered and returned to the pool water and air, via the built-in heat exchangers.

If the recovered energy is insufficient to meet the water and/or air heating load, the unit's integral low pressure hot water heat exchangers redress the balance.

As an added bonus, the system cleverly takes care of the pool environment by incorporating automatic fresh air control. Introduction of fresh air that also passes through the heat recovery process at up to 70% of recirculated air is kept to a minimum to satisfy occupancy and dilution demands, reducing to virtually zero during unoccupied periods. Should natural solar gain increase the air temperature of the pool hall, the units can even provide air conditioning by dissipating unwanted heat into the exhaust air.

Off The Shelf

A thermodynamic heat-recovery dehumidifier comes complete with a control panel, air temperature and humidity and water temperature sensors, pool air and pool-water heat exchangers — in fact everything necessary to control the pool environment, and it will fit into a plant room space substantially smaller than that needed for a conventional system.

Because the complete unit is in one insulated case and has been factory tested and set-up, it is very simple to fit. All controls and sensors are inside, and it only requires a three-phase power supply, connection to the LPHW headers, connection to the pool water circuit, condensate drain and duct connections. A commissioning engineer is provided at start-up to ensure all is well.

When the overall costs of using a heat-pump, heat-recovery dehumidifier are considered, it is important to remember that heat-pump dehumidifiers will recover sensible and latent heat that will be returned back into the pool water giving an efficiency of 300% to 350%. Passive units cannot do this, offering only 50% to 60% when external air temperatures are favourable.

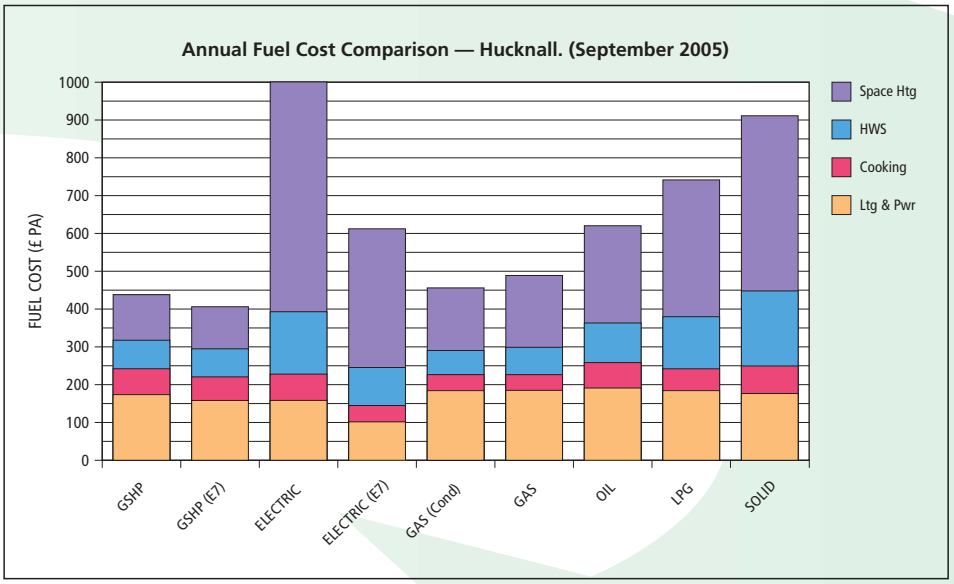
Modified office AHU units are far less efficient than dedicated heat pump units in swimming pool heat recovery. They are also not designed for a swimming-pool atmosphere, which is reflected in their operating life. In fact, dedicated swimming-pool equipment will always give better service than something simply 'cobbled together' for individual jobs.

Systems for wet leisure environments are specialist because they need to be designed to tolerate the harsh environment of a pool hall and its associated water treatment chemicals, such as chlorine. All components have to be specially selected resulting in extensive use of coatings, treatments and plastics.

Five star energy-efficiency, even for ostriches.

**Source — Science publication, 2006.*

Ground source heat pumps — 600,000 hours monitoring proves their efficiency



Ground Source heat pumps can halve carbon dioxide emissions in residential premises, according to a recent study undertaken by Powergen.

The Powergen HeatPlant is a ground source heat pump specifically designed to provide all the space and water heating for the typical, small, well insulated houses being built by Housing Associations and other social landlords in areas of the country not served by mains gas.

Available in two sizes with thermal power outputs of 3.5kW and 5.0kW respectively, the units are suitable for houses with floor areas up to around 100m² built to present day Building Regulation standards.

The units are unusual in having a dual control mode which delivers either a high temperature output (up to 65°C) when heating domestic hot water, or low temperature (selectable within the range 35°C to 55°C) when providing space heating to under floor or radiator based systems.

This wide range of output temperatures means that the total requirements for both space and water heating can be provided without recourse to the use of direct acting electric flow boilers or immersion heaters as 'top-up' devices. Experience has shown that these 'top up' devices can so significantly lower the overall annual operating efficiency (the Seasonal Performance Factor) of heat pumps as heating only devices in domestic premises.

To prove this point Powergen monitored electricity use in a number of houses on two of the first sites in the country to adopt this technology.

One site, of 10 houses, has been continuously measured for three years, the second site, of 15 houses, for two years.

An accumulated total of 600,000 hours of service provision has therefore been recorded and forms the basis of this report.

All the houses were retirement bungalows of similar size, shape, heat loss, occupancy, and usage with under floor heating and conventional gravity fed hot water cylinders.

Considerable theoretical analysis of the house energy profiles and predicted heat pump performance was carried out in support of this exercise. More importantly, the promoting Housing Association also provided the electricity and gas meter readings from three sites of directly equivalent properties using gas for their heating and hot water.

The results from the 43 houses in this study formed an invaluable control group against which the performance of the heat pump systems could be judged.

Some of the heat pump houses were measured more thoroughly than others, with dual rate meters being connected. This meant that both general electricity and heat pump electricity use could be separately measured during both the 'Day' and 'Economy 7' periods to determine the value or otherwise of the use of off-peak tariffs for this form of heating.

Sufficient readings were taken to ensure that winter and summer energy use could be calculated.

As can be imagined, the amount of data arising from this exercise was considerable and a great deal of useful information has been derived.

Some of this is shown in the graph shown here but there are a handful of key indicators, which are worth highlighting.

The useful space heating requirement averaged 5750 kWh_{th} pa (= c. 100 kWh_{th}/m^2) across all the sites, both those heated by heat pump and those heated by gas, although the range across individual houses was quite wide, varying between 3500 and 8000 kWh_{th}.

Average domestic hot water usage varied between 2000 and 2500 kWh_{th} per annum per house (= c. 6.5 kWh_{th} / house / day).

Average annual electricity consumption by the heat pump for space heating was just over 1400 kWh_e, and for domestic hot water provision around 1000 kWh_e.

The average Seasonal Performance Factors for the heat pumps were therefore calculated as 4.1 when delivering low temperature water to the underfloor heating, and 2.25 when delivering high temperature water to the primary coil of the hot water cylinder.

These results are consistent with the data from the gas condensing boiler heated houses if space heating was delivered at an efficiency of 85% and hot water at an efficiency of 75%.

Carbon dioxide emissions related to heating and hot water averaged just over 1 tonne per annum per house (17.7 kg/m²), compared with 2 tonnes for the gas heated houses.

Average annual running costs worked out at just over £200 per annum.

Carbon savings with heat pumps

BRE has published two Information Papers relating to carbon savings options in housing: 'The scope for reducing carbon emissions from housing' — IP15/05, and 'Domestic energy use and carbon emissions: scenarios to 2050' — IP16/05. Two of the four scenarios are based on current trends: 'Policy' (current and known policy measures); 'Efficiency' (increased take-up rates of insulation) and two on step-changes in markets. The latter two assume a growing role for heat pumps. These lead to substantial extra carbon savings but only the more aggressive of these (step-change 2) achieves a 60% saving by 2050. In IP15/05 the technical potential and cost-effectiveness of different measures and technologies are considered. As the costs (and efficiencies) of large-scale application in 2050 are uncertain, figures are presented for high and low cost estimates.

Under either scenario, heat pumps have the potential to save significant amounts of carbon in 2050. Under the low-cost assumptions, photo-voltaics become cost-effective by 2050, but heat pumps and biomass boilers are substantially more cost-effective than other renewables or additional insulation (most houses are assumed to have achieved high insulation levels by 2050) — but none of these is actually cost-effective.

Using the high-cost assumptions, heat pumps rank well ahead of photo-voltaics but behind biomass boilers. In both cases, heat pumps are more attractive economically and in terms of carbon savings than solar water heating.

www.brebookshop.com

A further boost for heat pumps

A further boost to heat pump technology has been given by the UK Micro-generation Strategy. This was announced in March and includes ground-source heat pumps within its scope. As this year's budget statement announced, £80m is to be spent over the next three years to support microgeneration technologies under the Low Carbon Buildings Programme. The strategy paper points out that, by using ground source heat pumps, households that are not connected to the gas grid can have heating costs that are lower than the Winter Fuel Payment — so pensioners can effectively get free heating (if local authorities bear the cost of the installation). The new programme takes a more holistic approach than the previous 'Clear Skies' and 'Photovoltaics' programmes. For ground-source heat pumps a maximum grant of £1,200 (exclusive of VAT) subject to a 30% limit will be available regardless of size. Grants will only be awarded (for any of the technologies covered) if the dwelling already has a number of energy-efficiency measures in place. There will be a shift in emphasis to large-scale developments in order to engage the construction sector more widely. More information from: www.lowcarbonbuildings.org

The Climate Change Programme 2006 report has also been published. It covers a lot of ground, including information on the Micro-generation Strategy. It also reports that the Design and Demonstration Unit (DDU) within DTI will shortly begin a combined gas network and community renewables programme in partnership with Regional Development Agencies in the North East of England, Yorkshire and Humberside. The renewables projects will draw on a range of technologies that can deliver heat at a price comparable to that of mains gas to homes that cannot economically be connected to the gas grid.

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How to Join:

The Heat Pump Association is dedicated to the implementation of applying the available technology of heat pumps and will achieve this goal with the aid of new members joining the already committed companies.

Therefore any company that would like to receive information on how to join the HPA and share in the continuing benefits of all our members, please contact the HPA secretary Terry Seward:

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or by fax back form below.

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