HEAT PUMP NEWS
Saving Energy

HPA HEAT PUMP ASSOCIATION

Volume: 1 No. 2

WELCOME…

to the 2nd edition of *Heat Pump News*. We seek to show you useful applications of heat pump technology in service today, as well as sketching in the background to energy matters, government policies and developing technology.

This issue highlights several commonly found applications which use products available today 'off the shelf' in the UK from reliable manufacturers:

- Replacement of older 'cooling only' air conditioning units by high efficiency heat pump units which not only provide the same cooling at much lower energy inputs but also provide heating to substitute for existing on site systems at lower energy input — all leading to lower CO_2 emissions.
- Swimming pool dehumidification and heat recovery. There are hundreds of pools in the UK using heat and vent systems, which are crude and exceptionally inefficient. The heat pump dehumidifier not only solves problems of excessive humidity and improves bathing conditions but at the same time recovers latent and sensible energy for use in pool air and water heating — major energy savings and quick payback times.
- Heat pump chillers offering significantly greater efficiency.

If you are interested in a similar project, call the number appearing at the end of each article for more information.

Today's heat pumps are growing ever more efficient, can operate all the year round over a wide range of temperatures, and can heat air or water — CO_2 reduction is standard! Many types also now qualify for Enhanced Capital Allowances.

We hope you find both the applications and the other news and data interesting. If you want to be on our regular mailing list, please contact the Heat Pump Association.

Tony Bowen, President, HPA

Outdoor units are discreetly installed.

This Issue

Slough offices get heating and cooling — lettable space is increased too

Even with a ceiling void of only 250mm, offices at 10 The Grove in Slough were still able to take advantage of Fujitsu's VRF (variable refrigerant flow) system by utilising compact ducted indoor units to provide heating in winter and cooling in summer.

Heating too

Renovation of the 367m² three-storey office building was already underway when RS Refrigeration won the air conditioning contract. Originally a cooling only project, architect Dunthorne Parker realised that by removing the wet heating system not only was the lettable space increased but this approach also provided a more economical and controlled working environment by providing heating as and when it was needed in addition to cooling. Ocean Air Distribution Ltd recommended the VRF because it offered two solutions to the narrow ceiling void: a choice of either cassettes or ducted units.

The ducted units fit neatly into the ceiling void supplying conditioned warm or cool air to the space via discreet diffuser grilles. Two three-pipe heat recovery VRF networks have been installed connected to a total of 14 indoor units. In addition the condensers provide an equally discreet installation outside.

The Grove has undergone extensive refurbishment by specialist contractor, Orion Interiors Group, that has resulted in an open plan space that can be either left open or divided into cellular offices, depending on occupier requirements. Fujitsu's VRF can accommodate both as each indoor unit can be independently controlled for cellular use or group controlled by one master controller in an open plan area. The two types of central controllers enable the user to configure time, temperature and airflow settings, winter and summer, for all individual or groups of indoor units as required.

Fujitsu General (UK) Co Ltd
Tel. 020 8731 3451

One stop environmental control

With more than 300,000 visitors flocking to a popular swimming pool every year, the managers of a busy Hertfordshire leisure complex were working overtime to maintain acceptable poolside conditions.

A total loss ventilation system was ejecting air from the Lee Valley Leisure Centre in Broxbourne, at the rate of eight air changes per hour.

Faced with escalating energy bills, the centre operators called in Calorex Heat Pumps, who recommended a heat recovery and dehumidification system to provide a one-stop environmental control solution.

The pool complex was refurbished four years ago when a Calorex HRD unit was installed. The machine, located in a basement plant room, continues to maintain optimum pool air conditions while providing the majority of the pool water and air heating by virtue of heat recovery from the dehumidification process.

An energy-efficient HRD heat pump system will remove moisture from the atmosphere, collect its latent energy

and re-use it to assist water and air heating, creating a self-perpetuating heat cycle that ensures energy costs are kept to a minimum.

Furthermore, a heat pump heat recovery unit will introduce sufficient fresh air input to maintain the optimum condition for bathers and spectators alike while ensuring that humidity levels are kept low enough to safeguard the building and fabric from moisture and damage.

During this process, outgoing exhaust air will be stripped of both latent and sensible energy that is recovered to the fresh air stream via the heat recovery process.

During warm weather, this process will reverse by rejecting unwanted energy to outside and cooling incoming fresh air to maintain comfortable air temperatures within the pool hall.

Only a heat recovery circuit that contains a refrigeration circuit can recover such large quantities of latent energy and provide a true air conditioning effect during warm weather.

Heat pump technology drastically cuts down the cost of running a pool as it permits a high 'coefficient of performance' (COP) to be attained. An overall figure of 3.5:1 is realistic. This means effectively, for each one kW of electrical energy used, we can expect to recover 3.5kW of heat energy, thus generating major savings in CO_2 emmisions.

Tel. 01621 856611

Ground source heat pumps for residential heating

by J. C. W. Parker, B.Eng., C.Eng., MCIBSE, FRSA.

The ground source heat pump is a simple device. It is designed to collect the solar energy stored naturally at low temperature in the ground around a building, raise the temperature of this low grade heat, and transfer (or 'pump') it into the building's heating system. It is such an efficient process that it can provide full electric space and water heating at lower running costs than a condensing gas boiler. This capture of renewable solar energy from the ground also leads to very large reductions in CO_2 emissions compared with any conventional fossil fuel. The system is extremely simple and consists of a length of polyethylene pipe buried in the ground (called the ground heat exchanger or ground loop). This is connected through a water circulating pump (the ground loop or 'source' pump) to the evaporator of a vapour compression refrigeration unit (the heat pump). The building's heat distribution system is connected to the condenser (output or 'load') side of the heat pump in a similar manner to connecting a conventional boiler.

The highest operating efficiencies arise when low temperature systems such as underfloor heating are used although radiators are perfectly acceptable providing they are sized appropriately. Domestic hot water at 50°C to 60°C can also be provided although some makes of gshp require a small amount of additional 'top-up' (usually from an electric immersion heater) to achieve the higher temperature. The ground loop heat exchanger is buried in the ground in a configuration and size designed to suit both the site layout and the energy needs of the building.

The general physical principles of the system rely on the fact that below a depth of 5 metres or so the huge thermal mass of the earth means that ground temperatures are stable, and on average in the UK operate within the range 8°C to 14°C.

A water and antifreeze mixture, which the heat pump attempts to cool to a temperature of around 2°C, is circulated within the loop by the ground loop pump whenever the building demands heat from the heat pump.

This 10 degree difference between the surrounding earth and the loop causes energy to flow from the ground into the loop, warming the source water for the heat pump's evaporator, typically by about 3K. The heat pump's condenser is fitted into the heating system's primary pipework and is sized to deliver heating system water temperatures in the range 30°C to 70°C, at flow and return water temperature differences, normally between 5 and 10K, depending on the application. The heat pump compressor is usually driven by an electric motor and provides the system with an overall efficiency (known as the Coefficient of Performance) often greater than 4.0. (i.e. The use of 1 kWh of electricity to drive the heat pump results in a total of 4.0 kWh of useful heat being delivered

SYSTEM EMISSIONS

Annual fuel cost (Oct 2003)	Annual CO_2 (SAP 2001)
Ground source heat pump (E7)	
£215	1.6 tonnes
Natural gas boiler (condensing)	
£300	2.9 tonnes
Natural gas (non-condensing)	
£345	3.3 tonnes
LPG (bulk) (non-c.)	
£500	4.3 tonnes
LPG (bottle) (non-c.)	
£670	4.3 tonnes
Oil (35 sec) (non-c.)	
£300	4.4 tonnes
Electricity (store + panels) (E7)	
£510	6.5 tonnes
House coal (open fire + back b.)	
£380	6.6 tonnes
Smokeless solid (closed stove + back b.)	
£515	7.5 tonnes

Space Air gets top marks at Ashridge College

The management of the Ashridge Management College in Berkhamsted looked to their own mission statement when considering the heating requirements of a Grade 1 Listed 12th Century barn that they were converting into a cyber café and office space. 'Applying Leading Edge Thinking' resulted in the application of leading edge technology in the form of Daikin VRV heat pump air conditioning supplied by Space Air.

Tax savings

"Although in this case study", said Space Air, "eligibility for the Government's Enhanced Capital Allowance scheme was not a major factor in the purchasing decision. The exceptional energy efficiency of the Daikin VRV inverter controlled heat pump system in both heating and cooling modes, acknowledged by its inclusion in the Carbon Trust's Energy Technologies list, more than justifies the client's choice and satisfies the environmental requirements. Commenting on the successful project, facilities manager, Mike Blackborough said, "The barn has been restored and adapted to provide a building of historic interest while meeting the modern day demands of a high profile management college. Being Grade 1 Listed, the conversion was subject to stringent local planning laws and came under the close scrutiny of the English Heritage. The ability to combine both the heating and cooling requirements in one, energy efficient system was considered to be a major advantage in the design process. One of the oldest buildings on the site, it was critical that the system chosen would be aesthetically sympathetic and cause minimal disruption to the fabric of the building, while meeting our environmental and operational requirements. "With the wealth of exposed original timbers, Wall and ceiling mounted fan coil units would not have been in keeping and so we opted for an under floor system, fortunately heat pump systems offer considerable flexibility in application."

Briggs and Forrester of Northampton carried out the installation and project manager Conty O'Sullivan explained that with the many exposed original timbers and restricted space for external plant it was decided that the Daikin VRV heat pump system was the easiest to install and could be incorporated very successfully.

Design support

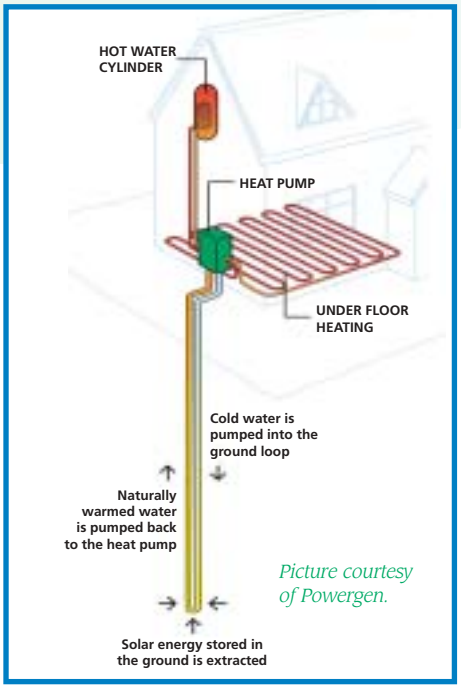
Mr O'Sullivan said, "The Daikin distributor, Space Air, provides, through its local branches, design support, quality sales and technical service backed up by good stocking levels and product information. Additionally we were confident in the proven reliability and efficiency of the R407C VRV heat pump system and therefore had no hesitation in recommending it for installation in this valued client's premises. The long pipe runs possible with the VRV system meant that the condensing units could be positioned totally out of sight on a remote roof. The system is also suitable for extension at a later date for the Phase 2 refurbishment as well as giving individual control for cellular offices". Mr Blackborough, for Ashridge Management, concluded, "The end result has been outstanding and the building is now considered as the flagship of the college. The project has also won 3 awards; two for architectural merit and the other was a commendation for trademanship, by the Hertfordshire Association of Architects."

Space Airconditioning plc
Tel. 01483 504883

systems

into the house). As an example of how effective a ground source heat pump can be in delivering both the lowest annual running cost and CO_2 emissions, this table shows the results of an analysis (using factors published in SAP2001) for a small (100m²) well insulated house, with an annual useful space and water thermal energy requirement of 12500 kWh.

Tel. 01865 784903



Picture courtesy of Powergen.

Inverter driven heat pump for retro-fit R22 market

Mitsubishi Electric has launched an inverter driven heat pump air conditioning range that offers a large reduction in power consumption and high COP ratings. It also offers the ability to replace old R22 systems using the existing uncleaned pipe work.

The Mr Slim R410A Power Inverter air conditioning units use DC inverter technology and a new frame compliance scroll compressor to offer cooling COPs of up to 3.6 and heating COPs of up to 3.4. The range allows for increased pipe runs of up to 75 metres, alongside a reduced pipe diameter and offers 'a 40 per cent saving on annual running costs'.

No new piping

Mitsubishi Electric's built-in 'cleaning-free' Replace technology removes contamination from the refrigerant circuit negating the need for new pipe work installation, while realising 'significant' cost savings in installation time and cost.

The range includes four outdoor models, all running on single phase power supply.

"The very low starting currents of the inverter driven compressor allow us to offer these high capacity, single phase units without the traditional issue of very high starting currents. The possibility of a complete air conditioning solution is now available for commercial premises without three phase power supplies," said Donald Daw, product marketing manager of the company.

Tel. 01707 282880

Heat pumps play a part in the International Energy Agency

The IEA has had a heat pump programme for over 20 years with over 25 active or completed projects.

Its strategic objectives are:

- To quantify and publicise the environmental and energy efficiency benefits of heat pumps
- To develop and deliver information to support appropriate deployment
- To maintain and develop international R,D&D collaboration that furthers the (previous two) environmental and market objectives
- To provide effective collaboration and flow of information to, from and between stakeholders and other relevant bodies

Currently there are 12 participant countries, including the UK, the USA and Japan, as well as a number of European countries.

Joint projects

The programme provides participants with the opportunity to carry out joint projects where they can learn from overseas activities and experiences in exchange for providing some of their own knowledge. The programme covers all heat pumping technologies — not just heating applications. Projects can range from the almost complete "Advanced Supermarket Refrigeration/Heat Recovery Systems" to "Global Environmental Benefits of Industrial Heat Pumps". Details of the programme can be found on www.heatpumpcentre.org. Although it is countries that are formally members, it is organisations that participate in the projects, and the door is open to UK companies, Universities and other bodies. There is an opportunity to get early knowledge of new developments (typically, the results of technical projects are initially available only to participants, coming into the public domain after some delay. Informational projects usually become available immediately) and to share pre-competitive development or basic research.

The downside is that the IEA provides no funding — participants have to fund their own contributions. This sometimes means that contributions are activities that the participants intended to carry out anyway — the extra information gained from other participants justifies the relatively low additional costs of collaboration. For R&D projects, participation in IEA projects can improve the case for obtaining funding from third parties.

A number of new projects are currently being considered — and new suggestions are always welcome.

Current proposals include projects on:

- Ground source heat pumps
- Long-term performance of heat pumps
- Retrofit heat pumps for buildings
- Heat pump water heaters
- Tools for the Performance Analysis of HVAC&R systems in supermarkets
- The role of heat pumping energy systems for a sustainable society

If any of these are of interest, please let me know — I am the UK representative and, currently the chairman.

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Clearskies ahead

Clearskies has been established over the last few months to encourage the take-up of new technologies by private individuals and communities. Funded by DTI, Clearskies has set out to develop ground source heat pumps (heating only), solar, photo-voltaic and biomass systems. As several technologies have little technical or installer infrastructure in the UK, it has been necessary to create lists of appropriate products of suitable efficiency, commence installer trials and accreditation programmes, and embark upon an awareness campaign. Homeowners taking up new technologies can benefit from direct cash grants. An interesting project doing some good development work. For more information see www.dti.gov.uk

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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:

E-mail: terrys@feta.co.uk.
Telephone: 01491 578674
or by fax back form below.

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