EUROPEAN HEAT PUMP NEWS

The Newsletter of the European Heat Pump Concerted Action

Issue 1, May 1999

EDITORIAL

This Newsletter forms the first of four issues during the following year, as part of a wider project, 'Concerted Actions for the Promotion of Heat Pumps in Europe', partially funded by the European Commission as a THERMIE B activity and co-ordinated by FIZ Karlsruhe, Germany. Other participants in the project include SINTEF (Norway), NOVEM (The Netherlands), ADPM (France), Leitungsgemeinschaft Warmepumpe (Austria) and David Reay & Associates , assisted by BR Technology, (UK).

There are four main objectives of the Concerted Action:

- To implement the promotion of heat pumping technologies on a Europe-wide basis
- To improve the awareness concerning heat pumps of a number of specific groups who are crucial to increased heat pump market penetration
- To make recommendations for a European training programme, for example for installers
- To support the application of environmentally sound working fluids.

It should be noted that in the context of this activity, 'heat pumping technologies' covers heating, cooling and dehumidification in domestic, commercial and industrial applications.

Promoting technologies can be done in a number of ways. Traditionally one method has been the distribution of literature, such as Newsletters, and the holding of regional seminars on specific subjects. The advent of the internet has broadened the scope for direct access to large quantities of information electronically, and this project, building on the activities at FIZ in previous EU projects, will include expansion of the European Heat Pump Network (HPN) and updating of the database (see http://www.fiz-karlsruhe.de/hpn) as well as publishing this Newsletter on the internet.

The imminent establishment of a new UK Network on Heat Pumps (see News Item) will, we hope, as an example of European co-operation, lead to direct links with the European Heat Pump Concerted Action .

Natural refrigerants (or working fluids) are becoming increasingly important as we continue to search for effective replacements for CFCs. A number of the replacements widely used so far, in particular the HFCs, have the potential to contribute to global warming, and there is growing awareness that working fluids such as hydrocarbons, air, water, CO_2 and NH_3 will need to be used, where appropriate, in greater volumes. It is therefore an important task within this project to study the current status of such fluids in heat pumping cycles, and to disseminate such data *via* a Workshop. Thus SINTEF and NOVEM (with the help of TNO in the Netherlands) will carry out the study and organise the Workshop. The emphasis at this time will be on uses in heat pumps in buildings.

The wider application of heat pumps can only be supported if those responsible for installation and maintenance are adequately trained. The third task within this project involves an analysis of past and current training courses and the production of an inventory of suitable courses. This will be carried out by FIZ Karlsruhe. In addition, ADPM will organise a workshop: 'Heat Pump Training Programmes for Targeted Groups', to be held later in 1999.

Werner Bahm,
FIZ, May 1999.

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IN THIS ISSUE

INNOVATION IN HOME HEATING

Readers of the recent issue of the IEA Heat Pump Newsletter will be aware of the strong interest world-wide in ground source heat pumps. Even in Europe the number of installations is many hundreds of thousands, with Scandinavia leading the way.

The use of heat pumps in the home in the UK has yet to become 'big business' on the scale seen in a number of Continental countries, but the lead taken by a major UK utility company, Scottish Hydro-Electric plc (now known as…..), has certainly helped to encourage constructive discussion of domestic heat pumps here. It is part of the overall aim of this company to actively seek innovative energy efficient products and services.

The unit selected for trials in Scotland was the award-winning Swedish unit, manufactured by Markus Energi. This system uses a horizontal ground coil of 13 mm diameter copper pipe, buried between 0.8 and 1.0 m deep. The working fluid is circulated through the coil, evaporating as it extracts heat from the ground. The heat is delivered to the home as warm filtered air (from the 1.4 kW output Markus 1500 model), or as warm air and hot water (from the Markus 2500 Kombi model - output 2.7 kW). The COP averages about 3.0. The heat pumps are in Lerwick, far North in the Shetland Isles, in Perthshire and near Dundee.

The heat pumps are sized to meet all space heating needs for most of the year. Auxiliary electric panel heaters are provided for top-up heat during the coldest times of the Winter. The cost of the Markus Kombi model is EURO 3330, but a grant towards the initial full cost of EURO 1530 is available to customers of this utility. (Note that these costs do not include installation or supplementary heating).

A useful feature of the installations is the user-friendly control system incorporating a diagnostic socket for the service engineer to investigate operating difficulties and a 'Smartcard' facility for recording the operating history and sending it to the utility and Markus Energi for analysis. The control system incorporates a number of fault and problem codes to identify any problems arising.

Photo of the Markus 2500 Kombi Unit Installed in the Kitchen of a Home

Information supplied by Maurice Millar. Scottish Hydro-Electric's energy efficiency web address is: www.hydro.co.uk/serve/energy/index.htm
Markus Energi has a web site: www.markusenergi.com

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UK NETWORK ON HEAT PUMPS TO BE SET UP

An information and collaboration network on heat pumps will be officially launched on Wednesday 7 July at a seminar in London (seminar details being finalised).

Through support and funding from DETR, DTI, the Heat Pump Association and the wider industry, the Network will help & encourage the UK heat pump market to develop according to 'best practice' on environmental and economic grounds.

All those active and interested in heat pumping technologies, including industrial and buildings-related applications are invited to participate. The Network will help participants to share information and best practice, co-ordinate collaborative projects and get the most out of the recently announced UK membership of the IEA

Heat Pump Centre in the Netherlands. A Network secretariat will organise six-monthly workshops & newsletters, and co-ordinate the activities.

Contact Roger Hitchin for an information pack at BRECSU (fax 01923 664 097, email hitchinr@bre.co.uk), or Tony Bendall at the Heat Pump Association (fax 01491 575 024, email tonyb@feta.co.uk).

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THE OBJECTIVES OF THE NETWORK

- To inform Government in preparation of energy, environmental & trade policies affecting heat pumps
- To develop by consensus, and promote, balanced information and guidance about heat pump technology & its usage in the context of energy efficiency within the UK
- To transfer innovation & best practice from abroad into the UK on heat pump technology
- To improve understanding of UK and export markets for heat pump technology
- To encourage & facilitate greater UK participation in international R&D and market development project work on heat pump technology, including ideas generated by the UK

SCOPE OF THE NETWORK

The Network will have benefits wherever heat pump technology can be used for heating and cooling of buildings, and for heat recovery for industrial & buildings applications.

There will also be significant spin-off benefits in the general area of refrigeration. There are many technical and market problems common to both heat pumps and refrigeration (for example, choice of refrigerants, design of heat exchangers, training of installers etc.).

TARGET PARTICIPANTS/AUDIENCE FOR THE NETWORK
Two primary audiences:

- Within the UK: The supply side of the UK industry - manufacturers, utilities, suppliers, importers, component manufacturers, researchers, architects, consultants/specifiers, Government (DETR & DTI).
- Internationally: The Heat Pump Centre, international trade associations and other Heat Pump Centre National Teams.

Secondary audience, not directly targeted but borne in mind when preparing products:

- Potential users, enquirers from any sources.

FOR MORE INFORMATION

Find out more on heat pumps at the Heat Pump Centre web site http://www.heatpumpcentre.org

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Dutch Strategic Agreement on Heat Pumps

The latest issue of *Novem Journal*, the journal published twice a year by the Netherlands agency for energy and environment, notes the Strategic Agreement recently initiated in the Netherlands. Relevant extracts from the article are given here: "Heat pump activities in the Netherlands focus on various sectors including commercial/institutional buildings, houses, agriculture and industry. Although the implementation of heat pumps is a major strategy in the Dutch sustainable energy policy, results take time to materialise. The residential sector particularly suffers from several market barriers (low gas price, high investment cost for heat pump systems, and limited design/installation experience). Despite this, there is a growing interest in heat pumps in all sectors. R&D projects managed by Novem and activities from the market itself are contributing to widespread increased knowledge and know-how.

"To overcome these barriers the Dutch Ministry of Economic Affairs has initiated a Strategic Agreement with heat pump manufacturers, utilities and installers covering heat pumps in the residential sector. This Agreement will focus on product and installation cost reductions, knowledge development and transfer to installers, products and system quality and certification, incentives and policy instruments, and heat pump projects. The overall goal is to create a breakthrough in the residential heat pump market over the next eight years. The Agreement should be implemented by the end of 1999.

"The main driving force supporting the Agreement will be the Dutch Heat Pump Programme, which also promotes heat pumps through R&D and disseminates information to sectors other than residential."

For more information: Internet http://www.novem.org

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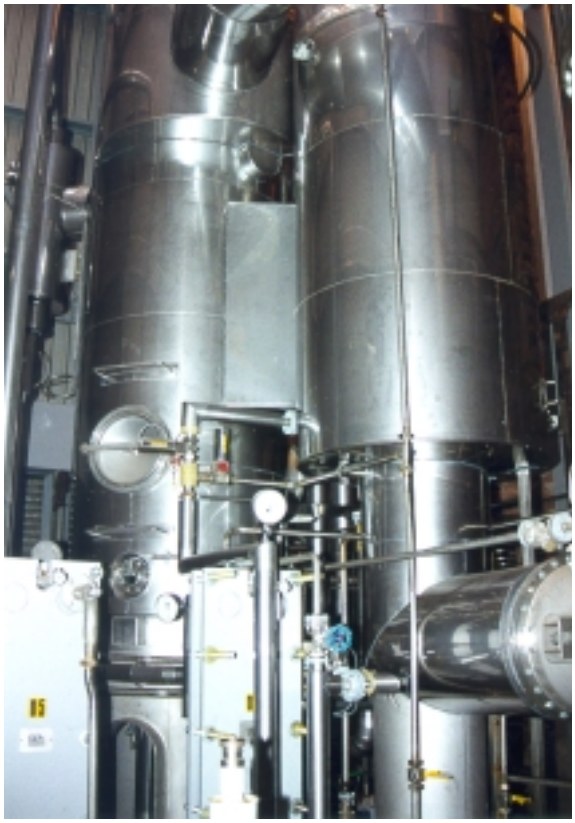
An Energy-efficient Evaporator at Pure Malt Products

Pure Malt Products Limited produce a wide range of malt extracts at their Haddington factory near Edinburgh. These find many applications in the food and beverage industries which demand the highest standards of production.



Evaporation is a key operation in the manufacturing process, and Pure Malt Products use single and multiple effect evaporators designed to provide the optimum processing conditions for each product. Until recently, all the evaporators were heated by steam, and this represented the major use of steam on site.

Continuing expansion created a need to increase evaporation capacity, but the existing boiler was already operating at full load on occasions. After considering several alternatives, Pure Malt Products decided to install a new falling film evaporator which operates on the mechanical vapour recompression (mvr) principle. In a steam heated evaporator, all or part of the evaporated vapour is discharged to a condenser, and its large heat content is lost to the system. If the vapour is compressed to a suitable pressure, it can be condensed in the evaporator acting as the heating medium. The steam supply is largely replaced by the mechanical energy input to the compressor, and the overall energy consumption is greatly reduced.

The new evaporator at Pure Malt Products is a single effect, three stage system, installed by BEEDES Ltd. Operation is under vacuum. The photo shows the calandria and separator (right-hand unit) from the side. Plate heat exchangers are for preheating and condensate vent. The large duct (lower right) is the bottom vapour outlet from the separator to the suction side of the compressor.

The evaporator was commissioned in January 1999, and careful monitoring of utilities consumption has confirmed the anticipated savings. At an evaporation rate of 4000 kg/h, the new evaporator uses a total of 85 kW for the compressor (250 to 325 mbar abs. pressure rise) and all pumps, about 40 kg/h of low pressure steam, and a small quantity of cooling water for the vent condenser. Comparing this with the operating costs for the steam heated evaporator previously used indicates that the running costs are reduced by at least £2 per tonne of water evaporated. It is estimated that the payback time of a comparable installation, compared with a steam-heated evaporator and additional boiler plant, would be 3-4 years.

Contact: Fred Brotherton, BEEDES Ltd., South Holmewood, Malthouse Lane, Burgess Hill, West Sussex RH15 9XA, UK. Tel./fax: +44 1444 250708.

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HEAT PUMP WORKING FLUIDS STILL INFLUENCED BY OZONE LAYER CONCERN

On 23 October 1998 there was a European Council decision to consult the EU Economic & Social Committee (ESC) on 'Proposals for a Council Regulation (EEC) on substances that deplete the ozone layer'. (Note that these substances are not used solely for refrigeration/heat pumps - Editor). Subsequent to this, the ESC responded that the European Community "must strengthen its hand in negotiations within the framework of the Montreal Protocol and introduce European measures that demonstrate the feasibility of reducing substances which deplete the ozone later."

Additionally, the ESC was supportive of the R&D into alternative substances (to CFCs etc.), allowing Europe to bring forward the phase-out date stipulated in the Protocol. Of particular interest to those in the heat pumping sector were four points raised by the ESC.

- It called upon the EC to 'ponder more carefully an approach in which a distinction is drawn between various types of HCFCs in terms of environmental impact, in order to speed up the phase-out of those with the greatest ozone-depletion potential

- The Commission should also look more closely at the safety aspects of alternatives, such as the flammability of HCs and the toxicity of NH_3
- The Commission should also emphasise the links scientists are uncovering between the Greenhouse Gas Effect and the hole in the ozone layer
- Finally, recovery of fluids and leak prevention were regarded as important.

(For further information: OJ No. C 40 of 15.02.1999, p. 34; or CORDIS FOCUS, No. 127, 22 Feb. 1999).

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Ground-source Heat Pump Systems in Austria

The heat pump market in Austria is presently dominated by ground-coupled systems, both direct-evaporation systems - which dominate the market - as well as secondary fluid systems, combined with low-temperature heat distribution systems. Direct evaporation systems, where the evaporator of the heat pump is buried in the ground or put into a bore hole, have some advantages compared with secondary circulating fluid systems. The main advantage of direct-evaporation systems is the elimination of the secondary fluid heat exchange and the circulating pump, which has, especially at low heat source temperatures, a significant power requirement. Both effects lower the COP and the SPF, respectively. A disadvantage is soldering at the site to connect the ground collector and the heat pump unit.

However, one Austrian heat pump manufacturer has developed a packaged prefabricated direct-evaporation ground-source heat pump for outdoor installation. The complete unit is transported to the site on a pallet, the heat pump part is mounted on a small foundation, the evaporator coil, folded on the pallet, is being laid out into the excavated ground, covered with sand and filled up with the excavated ground material. The connection to the building consists of the supply and the return pipe and cables for power supply and control.

For the utilization of the ground as a heat source, various system designs have been developed. Horizontally arranged ground coils are most commonly installed 0.3 m below frosting depth, i.e. at in a depth of about 0.8 - 1.2 m. This type of systems is most commonly used in newly constructed single-family homes, which are well insulated (the specific heat load is 60 W/m^2 heated area and below), the distribution system is a floor heating system with maximum supply temperature of 35°C. The systems used in Austria are most commonly direct-evaporation systems, the refrigerant was originally R-22, now R-290 (propane), R-1270 (propylene) and R-407C are used. The SPFs are in the range of 4 to 4.5. An improvement has been achieved recently by recharging the ground, using solar-heated air from the loft; the SPF of such a system is higher than 5.

The depth of vertical coils depends on the ground conditions and on the drilling equipment available, presently systems with 50 m, 100 m and recently 240 m are being realized. The heat exchangers used are either of U-tube, double U-tube type or coaxial type. Vertical systems, which due to the drilling costs are more expensive, are used in existing single-family homes with a cultivated garden, which would be destroyed by installing horizontal coils, and in multi-family houses and other large buildings, where insufficient space for horizontally installed systems is available. The majority of systems are secondary loop systems; down to a depth of 50 m also direct-evaporation systems are used.

A third system are in-ground air collectors for preheating the outside air, which can be used either as a heat source for outside air heat pumps or as a source for controlled ventilation systems, which are most commonly again equipped with an air/air heat pump for heating the fresh air by heat recovery from the exhaust air. In the case of low-heating-energy buildings such fresh air systems can be used as the only heating device of the building.

The ground is an excellent heat source for heat pumps. Carefully designed systems offer SPFs of 4 and more, and this is an excellent way for reducing CO_2 emissions.

References

Halozan, H. (1996) Effective Use of Ground-Source Heat Pumps, Workshop: Proc. Systems and Controls for Energy Efficiency, Tokyo, May 7-8, 1996, 149-160.

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Rieberer, H., Halozan, H. (1998) CO_2 Heat Pumps in Controlled Ventilation Systems, IIR Conference: Natural Working Fluids 98 Oslo, 2.-5. June 1998, 212-222.

(Communicated by Hermann Halozan, Institute of Thermal Engineering, Graz University of Technology, Inffeldgasse 25, A-8010 Graz).

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CO_2 as Refrigerant

The final meeting of the EU project COHEPS (EU JOULE Contract JOE3-CT95-0006) "Energy efficient and environmental friendly heat pumping systems using CO_2 as working fluid" took place in Mainz, Germany, on March 18, 1999. It was combined with the workshop "CO_2 Technology in Refrigeration, Heat Pump and Air Conditioning Systems". In the morning session the partners of this project (Austria, W. Ritter, Coordinator, H. Halozan; Belgium, J. Berghmans; Germay, H. Kruse, F. Steimle; and Norway, P. Neksa) presented their findings

on CO_2 as refrigerant for heat pump water heaters, heating and drying systems, and on safety aspects of this high-pressure fluid. The afternoon session was used for presentations of companies working in this field. More than 60 attendees joined this workshop.
The findings of this project are promising, and therefore the partners decided to tender for a follow-up project, in which the scientific results of COHEPS should be transferred to industry with the aim of production and market introduction of this technology. Additional organisations and companies have been invited to join this new task.

For further information contact: Prof. H. Halozan, Graz University of Technology, Graz, Austria. Fax: +43 316 873 7305).

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NEW UK INDUSTRIAL HEAT PUMP BROCHURE

In order to increase the awareness of industry, in particular the chemicals sector, ETSU, on behalf of the Department of the Environment, is preparing to issue a brochure dealing with industrial heat pumps. The aim is to give potential users data on the types of heat pump and the application areas which have been successful, both in the UK and overseas, and to direct those interested to further sources of assistance, equipment etc. Up to four of the six pages will be devoted to case studies, some of which will have been 'translated' from the extensive NOVEM portfolio of case studies so that they can be used to illustrate the situation with UK energy prices.

UK JOINS THE IEA HEAT PUMP CENTRE

As of 1999, the United Kingdom is a member of the IEA Heat Pump Centre (HPC).

This is excellent news for those manufacturing, specifying and using heat pumps - also for all those wishing to find out more about the technology.

Membership has been made possible through support from the UK Department of Trade & Industry, the Department of the Environment and the Heat Pump Association

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HiGee Applied to Heat Pumps

An innovative absorption cycle machine featured at the 1st meeting of PIN - the Process Intensification Network established at the beginning of 1999. Hosted by Newcastle University, in the North East of England, 65 members of PIN from the UK, Italy, Germany and the Netherlands heard dr. Bob Lorton of Interotex, the Cheltenham, UK-based company managing the chiller/heat pump project, describe the concept, and how process intensification had helped it on the road to success.

*Rotex is a rotating double effect absorption chiller/heat pump, the 'intensification' arising principally by using high gravity - hence HiGee - forces generated on rotating components. This allows it to be compact, (*Rotex will be quoted as a good example of active heat transfer enhancement in a paper at the Berlin IEA Heat Pump Conference*). The intensification of heat and mass transfer allows the unit to be constructed with a diameter of only 600 mm, many of the principal 'active' components rotating at 800 rpm. Additionally, smaller 'compact' plate heat exchangers are used as solution heat exchangers.*

Dr. Lorton pointed out that rotation allowed the generation of thin films, of about 60 μm thickness. Coupled with the very small boundary layers and the highly energetic fluids resulting (75 g forces at the edges of the rotating components), enhanced heat and mass transfer was achieved. At the condenser, for example, an overall heat transfer coefficient of 65 kW/m^{2}K was achieved. The whole unit is hermetically sealed to prevent air entering, and novel 'pitot' pumps are used to circulate liquids between components. The mass throughput in the absorption cycle is about 75 g/s.

Currently, within a THERMIE project, a number of field trial Rotex units are being established, in particular in Northern Spain. The unit is housed in a 1.5 m high box for the trials.

With regard to performance, the provision of 10 kW cooling duty, with the coolant at 40^{o}C, was achieved with a Coefficient of Performance of 0.95.

(For further information: Contact Bob Lorton at Interotex Ltd., Cheltenham, UK on: Tel: +44 1242 254886; fax: +44 1242 250793).

CADDET WEB SITE

Visit the CADDET Web Site for lots of case studies of heat pumps, including industrial examples world-wide:
http://www.caddet-ee.org

CADDET has also published a report in its Energy Efficiency Analysis Series (No. 23)- 'Learning from Experiences with Industrial Heat Pumps'. Information on this report, and others in the series, can be obtained via the Web Site. Brief data on 17 industrial installations are given, with references to the full case studies. Heat pump technologies included are closed compression cycle, MVR, thermal vapour recompression, absorption heat pumps and absorption hat transformers. The Report also devotes a section to process integration applied to heat pump placement within a process.

CADDET has commissioned an Analysis Report with a Canadian organisation to cover the subject of 'heat pumps in cold climates'. This should be published this year, and will be of interest to domestic/commercial specifiers/potential users. For those interested in applying compact heat exchangers to heat pumps, the Analysis Report (No. 25): 'Learning from Operating Experience with Compact Heat Exchangers', should be highly relevant and up-to-date. Case studies of units such as the plate and shell heat exchanger are included, and the new Chart Marston 'Marbond' unit is covered. Again, publication is imminent.

Heat Pump Quality Label of D-A-CH

The name D-A-CH has a long tradition as the umbrella for the cooperation between Germany (D), Austria (A), and Switzerland (CH); the present D-A-CH organization is concentrated on heat pumps, i.e. heat pump marketing. The representatives in this organization are IWP (Information Wärmepumpe, Germany), LGW (Leitungsgemeinschaft Wärmepumpe, Austria) and FWP (Fördergemeinschaft Wärmepumpe, Switzerland), organizations, where heat pump manufacturers, distributors and installers as well as electric utilities try to promote heat pumps to increase the market share of this technology with respect of energy conservation and of reducing greenhouse gas emissions, especially CO_2 from burning fossil fuels.

Heat pumps are an old technology, and principally the same equipment is used for refrigeration and air conditioning. The difference is that in the case of producing cold for refrigeration, air conditioning and industrial processes it has no competitor. For producing heat as heat pumps it has to compete with conventional heat production by burning fuels, most commonly fossil fuels.

The introduction of heat pumps for space heating in Europe started at the beginning of the Eighties as a reaction on the two oil price shocks; the goal was energy conservation and oil substitution. But due to mistakes made by all parties involved into this process - partly not finally developed units without maintenance and servicing, wrong integration into hydronic systems etc. - a promising market collapsed. Now the situation has changed, the driving forces are environmental issues like climate change and therefore reducing greenhouse gas emissions, mainly CO_2 from burning fossil fuels. This is a second chance for heat pumps.

To avoid the mistakes from the first market introduction, D-A-CH has started to increase the quality standards for heat pump systems. The first step is the "Wärmepumpen Gütesiegel", a quality label for heat pump units, presently water/water, brine/water and air/water heat pumps. To be awarded with this quality label, units have to be tested in a test center selected by the national organization, with respect to minimum COP, quality of the components, noise levels and keeping the EU regulations for manufacturing and operating the units. Additionally, guarantee for 3 years, spare parts for 10 years and maintenance within 24 hours for the region where the heat pump is sold, have to be provided by the manufacturing company. It has been decided that tests as well as quality labels have to be accepted in all three countries, independent of where a company has passed the tests and applied for the quality label.

The rules for this quality label went into force in November 1998, and the first companies will show their heat pumps with the D-A-CH quality label at the IEA Heat Pump Conference in Berlin end of May this year. But this is only the beginning: Test methods for other systems like direct-evaporation ground source heat pumps will be agreed, and the main problem, the integration of the heat pump into the system, has to be covered. Projects on the quality of heat pump systems as well as training programmes for heat pump installers have

already been started to find the best solution for the certification of installers. Again, efficiency, reliability and maintenance will play an important role. But it fits into the role that D-A-CH wants to play to increase the knowledge of and to broaden the market share of this technology for reducing CO_2 emissions and thereby leading to a better environment in the future.

(Communicated by: Hermann Halozan, Institute of Thermal Engineering, Graz University of Technology, Inffeldgasse 25, A-8010 Graz).

FORTHCOMING EVENTS

Heat Pumps - A Benefit for the Environment. 6th IEA Heat Pump Conference, 1999.

The first announcement for this Conference, the sixth in a series of triennial conferences on heat pumps under the auspices of the IEA Heat Pump Programme, has recently been published. The Conference will be held in Berlin from 31 May to 2 June, 1999.

The Conference consists of oral papers in plenary sessions on the state-of-the-art in various fields, poster presentation, an exhibition of equipment, technical visits, and of course a social programme.

Workshop on HCFC Alternatives, Geneva, 13 June 1999.

The Swiss Agency for Environment, Forests & Landscape (SAEFL) and DG XI is organising this event, the aims of which are to clarify that: Technically and economically feasible alternatives to HCFCs are now available in most applications within the two major HCFC-using sectors (refrigeration and foams); and there is scope to tighten current HCFC controls under the Montreal Protocol.

Fax INFRAS on +44 1 205 95 99 for information.

20th International Congress of Refrigeration of the IIR, 1999.
To be held in September 1999 in Sydney, Australia. Theme: Refrigeration into the 21st Century, (but there are always many heat pump papers/posters). Contact: Congress Secretariate, GPO Box 128, Sydney, NSW 2001, Australia. Fax: +61 2 2622323. Email: tourhosts@tourhosts.com.au

6th National UKConference on Heat Transfer, 1999.
To be held at Heriot-Watt University, Edinburgh on 15-16 September 1999, organised by the IMechE. There are a number of industrial sessions, and several papers are relevant to heat pump technologists. There will be a parallel exhibition. Contact: IMechE Conference & Events Dept., on tel. +44 171 973 1291.

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The next issue of EUROPEAN HEAT PUMP NEWS will include reports on the 6th IEA Heat Pump Conference, including one discussing the relevance of activities world-wide to the position of heat pumping technologies in the EU.

THE NEXT ISSUE OF *EUROPEAN HEAT PUMP NEWS* WILL BE ISSUED AT THE END OF JULY, 1999. PLEASE SUBMIT ALL COPY TO DAVID REAY BY 15 JULY 1999.