EUROPEAN HEAT PUMP NEWS

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GENERAL

European Climate Change Program (ECCP)

Rayner Mayer is a member of two European Commission working groups involved with energy consumption whose final report is about to be issued.

By the time this newsletter appears, the ECCP program will have been published. It will be debated at a stakeholders meeting on 2-3 July 2001 in Brussels, to be followed by a communication from the Commission in the autumn and ratification of the Kyoto Treaty on greenhouse gas reductions. Politically this will be a major step forward because of the present US administration's intention not to sign the treaty.

The ECCP program will show that the required energy savings are possible and are cost effective even at current energy prices. Moreover, there is a set of actions that individual citizens can take that will reduce further the environmental impact of energy usage. The ECCP program will propose that the EU should commit itself to developing a more sustainable lifestyle as recognised in the Maastricht treaty.

The programme will comprise both top down measures like EU directives and regulations and bottom up measures such as public awareness and a campaign for climate change. Using energy more efficiently and increasing the use of renewable energy in the form of heat and electricity are essential elements. Heat pumps are identified as one of the key technologies for reducing the energy consumption for dwellings heated by electricity.

There are also strong technical and economic arguments for incorporating local renewable energy sources directly into buildings - for example solar water heating panels, PV arrays and heat pumps. The more energy that can be used locally, the lower the transmission and distribution losses and the lower the environmental impact.

Rayner Mayer
Chairman EHPA

EHEAT - Heating systems calculation software

EHEAT is software designed to assist in evaluating the **heat/energy demand** of a building and in **sizing** and **selecting** of **heat pumps**. The software conforms with the European standard EN832 and was designed to comply with regulations in different European countries. **EHEAT** evaluates the energy and heat usage of a building and allows the selection of the most efficient heating system (from point of view of the energy consumption and cost). **EHEAT** runs on any PC under Windows 95/98, Windows NT or Windows 2000.

EHEAT is language sensitive and can be used by technicians and engineers from different European countries.

Brief description

EHEAT performs different evaluations on a building. After defining the characteristics of the building and the heating system, the software runs different calculations and outputs data reflecting the energy balance of the building according to external temperature variations, the performance of the heating system and life cycle parameters.

a) Heat/energy demand calculation module
The user defines a number of parameters for each building calculation. In several cases, country-specific default values are provided. The input data is:

- General building information;
- Building elements;
- Main heating system;
- Bivalent heating system;
- Water heating requirements;
- Ventilation system;
- Climatic data.

The output depends on the **calculation method** for heat losses and gains, that can be set to *monthly*, *seasonal* or, for heat pumps, *adjusted to outlet temperature* or *fixed outlet temperature*. The output (table and/or graphics) represents the energy balance of the building. For heat pumps, the result also allows the sizing of the heat pump.

b) Heating system costing module
This module calculates the running and life cycle costs of the heating system, and compares them to other heating systems.

c) Language facilities
EHEAT includes a special module that allows the user to define all elements of the user interface in his local language, by setting up all language-specific elements (menus, labels and other information stored in the database and available to the user, usually in list boxes, message boxes etc.)

Delivery conditions

The National Research and Development Institute in Informatics (ICI) provides the software and the documentation. Technical assistance is also provided. Programs are delivered on diskettes, and documentation in hard-copy or electronic format.

References

The **EHEAT** system was developed under the SAVE II European Project "Transforming the market for electrical heating of domestic dwellings" by the National Research and Development Institute for Informatics (ICI).

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Sustainable industrial park with heat pumps

The Netherlands – A sustainable commercial building area, which boasts a 40 % reduction in CO_2 emissions compared to its conventionally heated and cooled equivalent, is currently being completed in Heemskerk, the Netherlands. The first 25 companies are about to move in.

"De Trompet" is the name of this 56,000 m^2 commercial building area. At an early stage of the planning process, the local community, the project developer and the installer agreed to set a goal of 40 % reduction in CO_2 emissions compared to condensing gas-fired boilers and conventional chillers. Techneco (Netherlands) is the technical consultant, and heat pumps will play an important part in achieving the targets.

To limit the heat demand in the first place the insulation of the buildings in the park is above average and balanced ventilation with heat recovery has been installed. The buildings are heated by individual heat pumps, connected to low temperature heat distribution systems. The heat source is water, which is pumped up from an aquifer at a suction well, distributed to the buildings and fed back into a second well. The groundwater is also used for cooling. Figure 1 shows a schematic drawing of the installation.

The ground water wells and distribution are installed and managed by the utility, REMU. The companies in the park buy their own heat pump, heat exchangers and balanced ventilation installation. The park will not be connected to the gas grid, which will save money. Part of the electricity needed to drive the heat pumps will be generated on-site with photovoltaic panels. The additional electricity will probably be "green power", produced by sustainable sources and bought in a joint contract.

Source: Techneco, the Netherlands
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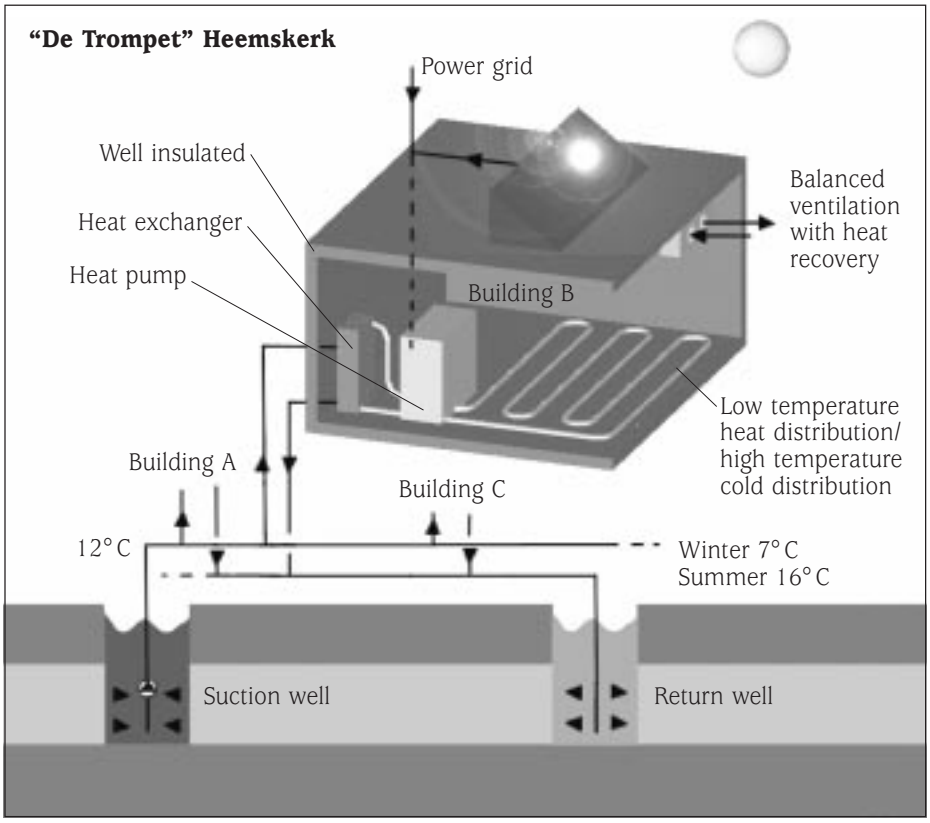

Figure 1: Schematic drawing of the installation at the "Trompet" industrial park.

The Bedrock – an important heat source

Drilling deep holes in the ground can appear to be a complicated way of extracting heat but in Sweden alone 14,000 energy wells were drilled during the year 2000. The prognosis for 2001 is an increase of 30 %. This article discusses the techniques. In the next Newsletter, recommendations for future development will be addressed.

Brine and DX-systems

Most bedrock-coupled heat pumps use an indirect system with brine circulating in a plastic U-tube. A minority, especially smaller capacities up to approx. 3 kW, uses a direct expansion system (DX). In the DX heat pumps the refrigerant is circulating through a U-formed copper tube placed in the borehole.

Most of the energy wells in Sweden are bored into rock, gneiss, granite and limestone being the most common types of stone with the first two having a very good conductivity. The thickness of the overburden is the determining factor in the price of the well. It is much more expensive to drill through overburden than through rock because of the casing required to prevent the hole from collapsing.

One of the problems with bedrock heat is that you have to know the distance to the firm rock and the type of material to predict the cost of the well accurately. Sweden has a relatively thin overburden in most places. However, in many other countries in Europe the overburden is thick or an unknown factor and consists of various materials. This means different drilling methods must be used, which increases cost.

Design of the energy well

Determining factors for the required depth of the borehole are the conductivity and temperature of the bedrock, the cooling capacity of the heat pump and the calculated extraction of energy over the year.

A common design temperature for the incoming brine is 0° C as an average over the year. That gives a possible power outtake of 40-60 W/m per borehole. For a 9 kW heat pump this means a borehole approx.130 m deep is needed. The lowest cost for drilling in rock is obtained if the whole depth can be achieved with a single hole.

To increase the quality of the energy wells and to protect the groundwater SGU (Geolo-

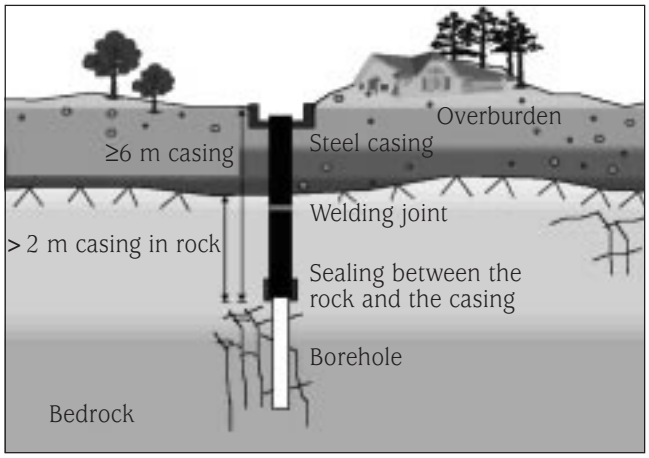

Figure 2: "Normbrunn 97"

gical Survey of Sweden) and the two Swedish drilling organisations Avanti and Geotec have developed a standardised energy well called "Normbrunn 97". This standard includes guidelines for the construction of the well, the machinery required and the training of the driller.

Drilling methods

The Down The Hole (DTH) hammer technique is most often used for energy wells in Sweden. A compressed air driven bore hammer works in the bottom of the hole. It is supported by air through the borehole lining. The technique is suitable for drilling down to a couple of hundred metres. To drill 180 m, the practical limit for energy wells, a 25 Bar compressor is needed to do both the drilling work and to overcome the static water pressure in the hole. The diameter of the hole is usually 115 mm or 140 mm. The drilling rig must be designed for both drilling and installing the casing and for DTH drilling in rock. It has to be easy to handle and transport on different terrains without damaging the vegetation.

The next Newsletter will discuss cost and future perspective.

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REGULATIONS

Proposed European Heat Pump Charter

France – An international consortium under the SAVE programme of EC DG TREN has finished work on a proposed European Heat Pump Charter. This will guarantee that consumers are buying a high-quality energy-saving installation and increase their confidence in heat pumps.

ADPM (France), SINTEF Energy Research (Norway), TWK (Germany), UCF (France) and EUROVENT (Belgium) participated in the consortium. The group decided to work towards functional certification rather than standardisation. Certification is relatively simple and voluntary, and can be used as a marketing tool. In the meantime, CEN-TC182/WGAN65 is working on a standard of competence for installers/designers of refrigerating and heat pump systems. The European Heat Pump Association (EHPA) will manage and improve the Charter.

A signatory to the proposed European Heat Pump Charter declares that he and his company satisfy a number of quality criteria. The most important are summarised below.

A signatory:
- is competent to install heat pumps and his company is trustworthy;
- will supply full information and a full quotation in writing;
- helps the client to benefit from financial incentives for heat pumps;
- will correctly install and hand over the equipment, and complete the paperwork without delay;
- ensures that all components used satisfy current standards and the heat pump itself is certified by Eurovent (if applicable);
- will repair malfunctions and propose a maintenance contract.

The abovementioned consortium has also promoted heat pump training when required. Two international workshops have been organised to discuss heat pump quality assurance systems in Europe. Also, the technical commissions of ADPM and AFF have printed instal lation guides with the aim of improving installation quality for the French market.

The full text of the European Heat Pump Charter can be found on www.ehpa.org.

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CEN/TC 228[1] project programme. New European standards projects for heating systems using heat pumps

International agreements in support of environmental protection and the reduction of the greenhouse effect are a new challenge for European Countries. These countries will have to develop the use of adapted technologies to save energy and minimise production of CO_2 in the future.

European Directives and European Commission programmes also encourage the use of high efficiency heating systems for buildings.

In order to promote the wide-ranging implementation of these technologies designers and installers need European Standards providing a common terminology and basic principles for design and installation. These basics should address not only the heat pump, but also its relationship to the heat distribution system and, when relevant, to the heat source.

During its last plenary meeting in Lucerne (Switzerland) in November 2000, TC 228 added a new work item to its standardisation program dealing with these kinds of systems.
Another initiative related to heating systems using heat pumps has also been taken by TC 228 WG4[2]. Heat pumps will be addressed in the chapter relevant to heat generation in the "calculation method for energy consumption of heating systems" that WG4 is drafting.

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1 European Committee for Standardisation/Technical Committee "Heating systems in dwellings"
2 Consumption calculation of heating systems.

History of the Austrian market

The Austrian heat pump market took off after the second oil price shock, stimulated by tax reduction measures for energy saving investments by the Austrian government and supported mainly by one utility, OKA. After reaching a peak in installations the market collapsed and stabilized at a lower level. It then fell again, but is now on the road to recovery (Fig. 1). Sales figures of heat pumps for space heating in the residential sector are currently rising, although no national heat pump programme is in force.

Teething problems

In the 1980s, market development in Austria was unstable. Heat pumps for residential applications are only one part of a complex system that has to be designed carefully. In the 1980s:

- A few committed companies started with the production of heat pumps, and training programmes for installers.
- Other market players were motivated by governmental subsidies but not sufficiently skilled to design the complete system. Refrigeration people knew nothing about heating and hydronic heating systems, and installers knew nothing about the characteristics of heat pumps and how to scope and integrate a heat pump into a heating system of this type.
- Some utilities started their own heat pump programmes that were not really focused on heat pumps but on improving the balance of their grid.

This combination resulted in a rapid increase in heat pump sales, but led ultimately to a breakdown in the market.

Current situation

Establishing a stable heat pump market was and still is a difficult task. However, the fact that sales are currently rising without a governmental programme in place is encouraging and shows that Austria is on the right track.

The main market is new single-family houses. In this respect Austria is the country of direct-evaporation ground-coupled heat pumps, which have a market share of almost 66 %.

Austria currently has more than 145,000 heat pump units in operation comprising about 112,000 heat pump water heaters, 32,000 heat pumps for heating purposes and 2,000 for heat recovery, all in the building sector. The installed thermal capacity is about 720 MW and the annual heat delivery 1,800 GWh, corresponding to an oil equivalent of 235,000 t/yr. The CO_2 emission reduction amounts to 460,000 t/yr based on the electricity generation mix and oil-fired boilers.

LGW promotes

The current favourable market development is due to the Leistungsgemeinschaft Wärmepumpe (LGW), the heat pump manufacturers and distributors association of Austria, founded in 1990. The organisation promotes heat pumps to show their value within the energy system despite market competition. Measures are also taken to overcome legal constraints.

To increase customer confidence in heat pumps LGW has co-operated within D-A-CH, the heat pump associations of Germany, Austria and Switzerland, which have introduced a quality label for heat pump units.

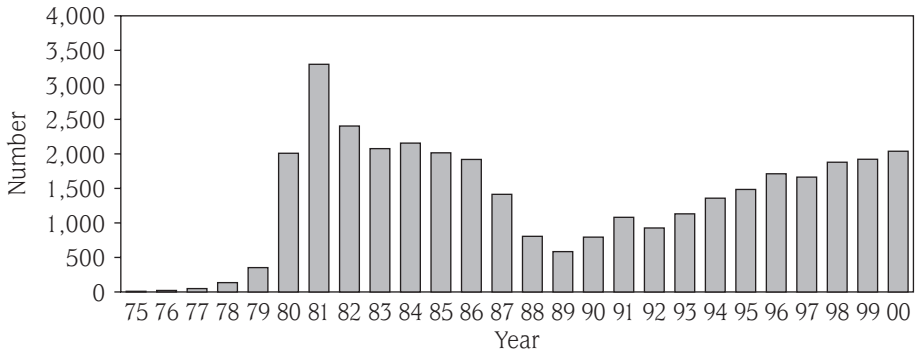

Fig. 1: Development of the Austrian Heat Pump Market

This label, accepted by the utilities in the member countries of D-A-CH, guarantees that customers are getting a reliable product with spare-parts, maintenance and servicing secured for at least 10 years.

Installer certification

LGW has additionally initiated a training program for heat pump installers to avoid another breakdown in the market such as occurred in the early eighties. This training programme should be the precursor for a certification label for D-A-CH installers, or one issued in future by the European Heat Pump Association (EHPA).

The rules for obtaining certification as a heat pump installer are a course in theory consisting of four modules, practical training at the heat pump test rig at Arsenal research, and an examination. The certificate is conferred on the person, who has successfully passed the examination, and his company has the right to use the certified heat pump installer logo. If the person holding the certificate leaves the company the LGW must be informed and the certified person must be replaced within 6 months.

Conclusion

Success in the market is not an accident but is the result of research, excellent products, skilled installers, the support of the utilities, and a common objective.

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