



heat pump programme

Annual Report 2002

Heat Pump Programme

Implementing Agreement
for a Programme of
Research, Development,
Demonstration and
Promotion of Heat Pumping
Technologies

International Energy Agency

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* extended until May 2003		

IEA Heat Pump Programme participating countries: Austria (AT), Canada (CA), France (FR), Germany (DE), Italy (IT), Japan (JP), Mexico (MX), The Netherlands (NL), Norway (NO), Spain (ES), Sweden (SE), Switzerland (CH), United Kingdom (UK), United States (US).

International Energy Agency

The International Energy Agency (IEA) was founded in November 1974 as an autonomous body within the Organization for Economic Co-operation and Development (OECD) to implement an international energy programme. Membership consists of 25 of the 29 OECD member countries.

Activities are directed towards the IEA Member countries' collective energy policy objectives of energy security, economic and social development, and environmental protection.

One important activity undertaken in pursuit of these goals is a programme to facilitate cooperation to develop new and improved energy technologies and introduce them into the market. Activities are set up under Implementing Agreements, which provide the legal mechanism for establishing the commitments of Participants and the management structure to guide the activity.

Implementing Agreements are independent bodies operating within a framework provided by the IEA, and hence take full responsibility for their work programmes and publications.

The IEA currently has 42 active Implementing Agreements encompassing activities relating to fossil fuels, renewable energy, efficient energy end-use, fusion power and information dissemination. This publication concerns the *Implementing Agreement for a Programme of Research, Development, Demonstration and Promotion of Heat Pumping Technologies*, more commonly known as the IEA Heat Pump Programme.

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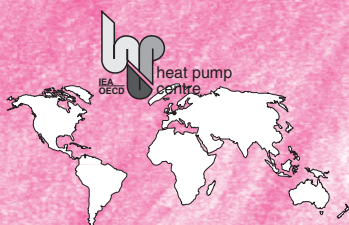
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The IEA Heat Pump Programme

The Heat Pump Centre

The Heat Pump Centre is the central information activity of the Programme



The Centre links people and organisations worldwide in support of heat pump technology and communicates through National Teams in its member countries.

Close links have been forged with other international organisations concerned with heat pumps, including:

- International Institute of Refrigeration (IIR)
- American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
- United Nations Environment Programme (UNEP)
- European Heat Pump Association (EHPA)

Organised under the umbrella of the International Energy Agency in 1978, the IEA Heat Pump Programme is a non-profit organisation funded by its member countries. The scope of the Programme covers heat pumps, air conditioning and refrigeration. The participating countries are:

Austria • Canada • France • Germany • Italy • Japan • Mexico • the Netherlands • Norway • Spain • Sweden • Switzerland • UK • USA.

Vision

The Programme is the foremost worldwide source of independent information and expertise on heat pump, refrigeration and air-conditioning systems for buildings, commerce and industry. Its international collaborative activities, to improve energy efficiency and minimise adverse environmental impact, are highly valued by stakeholders.

Mission

The Programme serves the needs of policy makers, national and international energy and environmental agencies, utilities, manufacturers, designers and researchers. It also works through national agencies to influence installers and end-users.

The Programme develops and disseminates factual, balanced information to achieve environmental and energy efficiency benefits through deployment of appropriate high-quality heat pump, refrigeration and air-conditioning technologies.

Strategic Objectives

Environmental

To quantify and publicise the environmental and energy efficiency benefits of heat pumps.

Market and Deployment

To develop and deliver information to support appropriate deployment.

Technology

To maintain and develop international technical RD&D collaboration that furthers the environmental and market objectives.

Information Management

To provide effective collaboration and flow of information to, from and between stakeholders and other relevant bodies.

Activities

Activities of the Programme include an information service, the Heat Pump Centre, collaborative international projects, so-called Annexes, workshops, analysis studies and a triennial international conference.

The Executive Committee held two meetings in 2002:

- 23-24 May in Beijing, China
- 24-25 October in Madrid, Spain.

Chairman's Statement 2002

IEA Implementing Agreements (IAs) usually run for five years, after which a critical review is conducted by the IEA. Based on past performance and success, the reviewers decide whether or not the IA should be extended for another five-year period. At the end of 2002, the Executive Committee (ExCo) was informed by the IEA that the Heat Pump Programme has been extended until 2007.

One of the highlights of 2002 was the 7th IEA Heat Pump Conference staged in Beijing, China. With 330 participants from 19 countries, a strong technical programme, excellent organisation, and spiced up with an impressive social programme, the conference was a great success. At the spring ExCo meeting, also held in Beijing, Chinese authorities announced their intention to join the Heat Pump Programme (HPP). This is only the second IA that China has joined. Needless to say, the HPP is eager to get down to business with China, a vast market with an impressive industrial growth. The potential for cooperation on heat pumping technologies is substantial.

The HPP continues to reach out and coordinate activities with relevant bodies and organisations. An interesting initiative launched in 2002 was the so-called Building Coordination Group (BCG). This is a gathering of representatives from the building-related IAs, who meet twice a year to coordinate efforts. One of the BCG goals is to establish joint and specific activities between the IAs. A strategy for the work was formulated in 2002 and implementation will start in 2003.

The past year also saw the completion of the HPP restructuring process. The new organisation is now fixed, which means that, as IA members, all countries now shoulder responsibility for the Heat Pump Centre (HPC). It also means that National Teams will be set up in each of the member countries to establish a strong link between the HPP and the national markets.

One new Annex was established in 2002. This is not an impressive figure, but ideas for new activities are flourishing. Implementing these ideas and transforming them into activities is perhaps our greatest challenge. In many cases the problem is that it takes too long for the financing to be secured. In this situation, both industry and governments are urged to take an active part in supporting potential projects. Without specific projects, the IA will be terminated. Having said that, many encouraging initiatives are now underway.

Special thanks for their commitment during 2002 go to the chairman of the International Organising Committee for the Beijing Heat Pump Conference, Mr John D. Ryan (USA), and to the entire Chinese National Organising Committee, headed by chairman Wu Yuan Wei. Through dedication, enthusiasm and lots of hard work, they were responsible for the success in Beijing. The ExCo would also like to thank Mr Keith Snelson (Canada) and Mr Martin Zogg (Switzerland) for their eternal participation and service to the ExCo.



*Rune Aarli,
Chairman Executive Committee
IEA Heat Pump Programme*

Highlights of 2002

7th IEA Heat Pump Conference

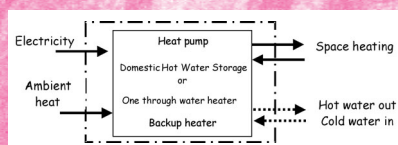


The China Daily newspaper dated 27 May 2002 reported on the 7th IEA Heat Pump Conference in Beijing, using the expression: "Energy experts promote heat pump applications". The conference was a challenge, an excellent experience, and a great success.

In a country with a rapidly developing economy and mind-boggling activity level in the building sector, these are the perfect ingredients for an emerging heat pump and air conditioning market. For the first time in the history of the IEA Heat Pump Programme the conference was held in a country outside the IEA group of nations.

In this content, China has announced that it plans to join the Programme in the near future, probably in 2003. A half-day seminar focusing on the Programme was organised after the conference to discuss subjects of interest to China.

Heat pump system energy flows



Switzerland can be proud. It managed to establish a new Annex, in a new area for the Programme, i.e. guidelines and standards. The title of the Annex is: *Test procedures and seasonal performance calculations for residential heat pumps with combined space and water heating.*

Existing test procedures are restricted to the separate testing of space heating (or cooling) and the heating of tap water. This Annex will study the testing of the most common integrated heat pump system designs with tap water heating. The Annex will produce a set of comprehensive test procedures as a recommendation for national and international standards organisations. Easy-to-use calculation methods will also be developed for designing systems.

Nine countries participate in the Annex (Austria, Canada, France, Germany, Japan, Norway, Switzerland [Operating Agent], UK and USA), which has been given the number 28. Work begins in January 2003 and is scheduled for completion in May 2005.

International workshop in Madrid

On 23 October 2002, in conjunction with the autumn ExCo meeting, the Spanish National Team (ENEBC) organised an international workshop entitled: *The Heat Pump – Present and Future*. Participants included policy makers, industry representatives and researchers.

The main conclusions were that the Spanish heat pump market is developing well and that more active involvement in international R&D programmes should be considered. Spanish market parties and researchers were encouraged to formulate new international research activities.

Collaboration with IIR takes shape

Representatives of the Programme and the IIR met twice during the year, in Paderborn and Nuremberg (Germany). The IIR has supported the Programme with reviews and information for the newsletter. The HPP is involved in updating the IIR Dictionary.

Plans to organise a HPP short course at the IIR Congress in Washington in August 2003 are evolving positively. The title of the course is: *Advances in supermarket refrigeration - improved refrigeration/heat recovery systems, analytic methods, refrigerant management, and secondary fluids in international context*. Results of HPP activities will be presented.

Annex Achievements 2002

The Heat Pump Centre

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Participating countries: Austria, Canada, France, Germany, Italy, Japan, the Netherlands (Operating Agent), Norway, Mexico, Spain, Sweden, Switzerland, UK and USA.

Activities

The past year was memorable in two ways, as:

- it marked the 20th year of HPC operation;
- it was the first year of working under the new, restructured HPC.

That these two events took place in the same year is a coincidence, although a remarkable one. By supplying information and services the HPC has contributed in several ways to the success of heat pumps, not only in mature markets, but also in weaker markets such as Europe. Not only the energy efficiency benefits of heat pumps, but the environmental benefits in particular, have been the main driver for the HPC activities over the past decade.

Retaining membership has been a major challenge and problem for the HPC. To overcome this problem, the ExCo introduced Programme-wide membership of the HPC from 1 January 2002. Fourteen countries are now members of the HPC. The most important improvement is stability and a potentially broad information exchange base. The change has also solved the problem of 'information free-riders'. The international information and contact network has now become considerably wider and stronger.

Another important change implemented in 2002 has been the introduction of a fully electronic newsletter. Making the newsletter available to a wide audience via the Internet, where it can be downloaded free of charge, provides a strong impulse to marketing the Programme, as well as promoting heat pump technology.

International collaboration

The past year also saw the first steps towards formalising collaboration with the European Heat Pump Association (EHPA), an industry association that has joined forces to promote the proper use of heat pump technology.

The HPC participated with contributions to the 2003 Montreal Protocol reassessment report process for the UNEP Technical Options Committee Refrigeration, Air Conditioning and Heat Pumps.

Input on heat pumps was also provided for the UNEP report 'Industry as a partner for sustainable development'. Production of the underlying report on the 'Refrigeration sector achievements and challenges', was coordinated by the IIR. The report was presented at the World Summit on Sustainable Development, August-September 2002 in Johannesburg.

The IIR has embarked on a long-term project of updating and expanding its Multi-Language Dictionary. The HPC is leading the task group for the chapter on Heat Pumps.

Publications

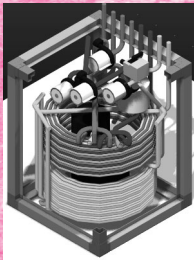
New publications launched in 2002:

- Refrigerant management programmes – refrigerant recovery, recycling and reclamation;
- Single-room heat pumps for cold climates;
- Ground-source heat pump systems – case studies;
- Reducing carbon emissions with heat pumps – the UK potential;
- Proceedings (book and CD-ROM) of the 7th IEA Heat Pump Conference.

These publications can be ordered via e-mail: hpc@heatpumpcentre.org or via the website www.heatpumpcentre.org

Annex 25: Year-Round Residential Space Conditioning Systems Using Heat Pumps

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Participating countries: France (Operating Agent), the Netherlands, Sweden and USA.

Conclusions of Annex 25

After three years of operation, Annex 25 has been finalised. The results from the various countries participating reveal little similarity, as national situations and needs are very different, depending on the culture, climate and the energy politics.

Nevertheless, a number of conclusions were drawn from the various contributions, i.e.:

- the feasibility of such new or improved heat pump systems in a residential environment has been proven – measurements have confirmed the economic competitiveness of such heat pump solutions compared to conventional heating systems;
- heat pumps can achieve high performance for both space heating and domestic hot water, which represents a considerable amount of energy savings and a significant reduction in global warming;
- finally, indoor comfort has clearly improved through using such systems compared to other conventional heating solutions, particularly during the summer, with only limited extra energy required.

Annex 26:

Advanced Supermarket Refrigeration/Heat Recovery Systems

Participating countries: Canada, Denmark, Sweden, UK and USA (Operating Agent).

This is the first Annex within the Programme to combine refrigeration and space conditioning. The objective of Annex 26 is to demonstrate and document the benefits of advanced system designs for food refrigeration and space heating and cooling for retail supermarkets. Analyses carried out under Annex 26 have shown that both energy savings (over 10%) and TEWI reductions (up to 60%) are possible with low-charge refrigeration systems as compared to conventional multiplex DX systems. Use of evaporative heat rejection approaches (condensers or cooling towers) to reduce condensing temperatures is a key to obtaining maximum energy savings. Integrating heat pumps with the refrigeration system to recover heat (rejected by the refrigeration system) for space heating can yield overall cost savings of 10% compared to conventional approaches. In general further efforts to reduce TEWI for advanced low-charge systems would benefit more from reduced energy usage (through efficiency increases or load reductions) than from further reduction in refrigerant charge and losses. The total value of the Annex research work is approximately USD 5 million. This represents a leveraging of each participant's funds of up to 10:1.

The final working meeting of the Annex was held on 19-20 November 2002 in London, UK. The Operating Agent and the participants are now finalising the Annex report and expect to have it completed by March 2003.

Annex 27:

Selected Issues on CO₂ as Working Fluid in Compression Systems

The participating countries are: Japan, Norway (Operating Agent), Sweden, Switzerland, (United Kingdom, partly for 2001) and the United States.

Annex 27's main objective is to bring CO₂ technology closer to commercialisation, by adding critical issues of both a basic and applied character. It is important to involve industry, especially manufacturers, as well as research organisations.

The remaining work basically consists of writing the final report. This Annex will be finalised at the HPP ExCo meeting on 15-16 May 2003.

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Summary of the Annexes

Annex	Operating Agent	Participants	Completed
1. <i>Common Study of Advanced Heat Pumps</i>	Germany	Austria, Belgium, Canada, Denmark, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, UK, USA	1980
2. <i>Vertical Earth Heat Pump Systems</i>	Sweden	Austria, Canada, Denmark, Sweden, USA	1983
3. <i>Heat Pump Systems Applied in Industry</i>	Belgium	Austria, Belgium, Canada, Denmark, Finland, Germany, Italy, Japan, the Netherlands, Sweden	1984
4. <i>IEA Heat Pump Centre</i>	Germany	Austria, Belgium, Canada, Finland, Germany, Italy, Japan, the Netherlands, Norway, Sweden, USA	1990
5. <i>Integration of Large Heat Pumps into District Heating and Large Housing Blocks</i>	Sweden	Denmark, Germany, Italy, Sweden	1986
6. <i>Study of Working Fluid Mixtures and High Temperature Working Fluids for Compressor Driven Systems</i>	Sweden	Austria, Denmark, Finland, Germany, Japan, USA	1986
7. <i>New Development of the Evaporator Part of Heat Pump Systems</i>	Sweden	Canada, Denmark, Finland, Norway, Sweden	1989
8. <i>Advanced in-ground Heat Exchange Technology for Heat Pump Systems</i>	Canada	Canada, Germany, Switzerland, USA	1992
9. <i>High Temperature Industrial Heat Pumps</i>	Belgium	Belgium, Germany, Finland, Japan, the Netherlands, Sweden, Switzerland, USA	1990
10. <i>Technical and Market Analysis of Advanced Heat Pumps</i>	USA	Sweden, USA	1991
11. <i>Stirling Engine Technology for Application in Buildings</i>	USA	Japan, Sweden, USA	1989
12. <i>Modelling Techniques for Simulation and Design of Compression Heat Pumps</i>	USA, Italy	Austria, Belgium, Germany, Italy, Japan, Switzerland, USA	1992
13. <i>State and Transport Properties of High Temperature Working Fluids and Non-Azeotropic Mixtures</i>	Sweden	Canada, Germany, Japan, Norway, Sweden, USA	1992

Annex	Operating Agent	Participants	Completed
<i>14. Working Fluids and Transport Phenomena in Advanced Absorption Heat Pumps</i>	Japan	Belgium, Denmark, Germany, Japan, Sweden, USA	1991
<i>15. Heat Pump Systems with Direct Expansion Ground Coils</i>	Canada	Austria, Canada, Japan, USA	1993
<i>16. IEA Heat Pump Centre</i>	The Netherlands	Austria, Japan, the Netherlands, Norway, UK, USA	Ongoing
<i>17. Experiences with New Refrigerants in Evaporators</i>	Sweden	Canada, the Netherlands, Norway, Sweden, Switzerland	1993
<i>18. Thermophysical Properties of Environmentally Acceptable Refrigerants</i>	USA	Austria, Canada, Germany, Japan, Sweden, UK, USA	1999
<i>19. Cancelled</i>			
<i>20. Working Fluid Safety</i>	Belgium	Belgium, Japan, the Netherlands, Norway, Switzerland	1993
<i>21. Global Environmental Benefits of Industrial Heat Pumps</i>	USA	Canada, France, Japan, the Netherlands, Norway, Sweden, UK, USA	1996
<i>22. Compression Systems with Natural Working Fluids</i>	Norway	Canada, Denmark, Japan, the Netherlands, Norway, Switzerland, UK, USA	1999
<i>23. Heat Pump Systems for Single-Room Applications</i>	Canada	Canada, France, Switzerland, Sweden, US	1999
<i>24. Ab-Sorption Machines for Heating and Cooling in Future Energy Systems</i>	Sweden	Canada, Italy, the Netherlands, Norway, Japan, Sweden, UK, USA	2000
<i>25. Year-Round Residential Space Conditioning Systems using Heat Pumps</i>	France	France, the Netherlands, Sweden, USA	Ongoing
<i>26. Advanced Supermarket Refrigeration/Heat Recovery Systems</i>	USA	Canada, Denmark, Sweden, UK, USA	Ongoing
<i>27. Selected Issues on CO₂ as Working Fluid in Compression Systems</i>	Norway	Japan, Norway, Sweden, Switzerland, UK, USA	Ongoing

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