



IEA- Implementing Agreement Energy Conservation through Energy Storage

Strategy Plan

2006 - 2010

Preface

The strategy plan of the Executive Committee of the Implementing Agreement Energy Conservation through Energy Storage (ECES) outlines the scope and goals of the IEA-Energy Storage Programme for the next term 2006 through 2010. It is an update of the previous strategy plan that was approved by the Energy End-Use Working Party in 2000 for the extension of the Energy Storage Implementing Agreement until December, 2005.

The strategy plan will serve as the basic working document to guide the future work of the Executive Committee and will also provide a comprehensive summary for other Committees of the IEA and for the IEA-secretariat. More detailed information on the IEA Storage Programme, especially for a public audience is published in Conference Proceedings, Annual Reports of the Executive Committee, Annex Status Reports, and various Brochures and on the Internet-Website (<http://www.iea-ec.es.org/>) of the IEA-Energy Storage Programme.

International Energy Agency

Energy Conservation through Energy Storage

Short Strategy

Mission: To facilitate research, development, implementation and integration of energy storage technologies that optimize energy utilization by improving overall energy efficiency and economic growth, while benefiting the local and global environments.

Vision: Energy storage technologies can overcome the temporal mismatch between energy supply and demand, especially regarding renewable energy technologies, the use of waste energy and energy from ambient sources such as cold from the natural environment.

Energy storage is an enabling technology for use in a variety of energy systems, from residential to commercial and from industrial to agricultural. By contributing to large-scale energy efficiencies, energy storage significantly reduces environmental impacts from energy activities, increases the potential uptake of some renewable energy technologies, increases the potential for sustainable energy development and subsequently leads to better energy security.

Strategic Objectives

Technology: Maintain and develop international technical RD&D collaborations that further the environmental and market objectives.

Environment: Quantify and publicise the environmental and energy efficiency benefits of integrated energy storage systems.

Market and Deployment: Develop and deliver information to support appropriate market deployment and provide effective collaboration and information to stakeholders.

New Annexes in Preparation:

Annex 15: Electrical Energy Storage and Distributed Generation

Annex 16: Market Deployment of Energy Storage Systems.

Annex 18: Transportation of Thermal Energy by Thermal Energy Storage with Phase Change Materials and Chemical Storage.

Annex 19: High Temperature Thermal Energy Storage for Industrial and Power Applications.

Annex 20: Sustainable Cooling with Thermal Energy Storage (approved)

Annex 21: Implementation of Thermal Energy Storage in District Heating and Cooling systems.

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Introduction

Energy storage technologies are a strategic and necessary component for the efficient utilization of renewable energy sources and energy conservation. There is a great technical potential to substitute the burning of fossil fuels by using stored heat or cold that would otherwise be wasted or not used and by using renewable energy resources. These energy sources can be used more effectively through the addition of short and long term energy storage. Thermal and electrical energy storage systems enable greater and more efficient use of these fluctuating energy sources by matching the energy supply with demand. Thermal energy storage can also be used for cooling to reduce or eliminate the demand for electricity, including the most expensive electrical energy which is generated during periods of peak power demand.

The Implementing Agreement on Energy Conservation through Energy Storage was established in 1978 with the objective to facilitate international cooperation on research, development and demonstration (RD&D) of new, innovative energy storage technologies. Energy storage technologies are relevant in many IEA-Implementing Agreements, especially in the building and industrial sectors related to the Working Parties on Renewable Energies and End Use Energy. Cooperation with these IEA-Executive Committees is becoming more and more important in order to achieve the system integration and implementation of storage technologies.

Motivation

In 1973, after the first oil crisis, highest priority was given to improving the energy security of highly industrialized countries. At that time, many countries were completely dependent on imported oil. Today, the situation has changed; fossil fuels are readily available. However, although dependence on imported oil is still very high, the rate of growth of petroleum products is slowing. However, the use of fossil fuels is causing a steady increase of energy-related CO₂ emissions into the earth's atmosphere. This may lead to changes in the world climate in the medium and long term. The use of conventional mechanical cooling, utilizing ozone depleting substances (ODS), such as CFC and HCFC refrigerants, is also a major concern.

In December 1997, the Parties to the UN Framework Convention on Climate Change agreed to the terms of the Kyoto Protocol. This historical agreement sets legally-binding greenhouse gas emission objectives over the period 2008-2012 for industrialized countries. The energy sector, from supply to end uses, is responsible for the majority of greenhouse gas emissions in the developed world, through the combustion of fossil fuels and the emissions of CO₂, N₂O and CH₄, three of the six gases covered by the Protocol.

Many governments have committed themselves to reducing CO₂ emissions into the atmosphere. They have decided to strengthen their national efforts to increase the deployment of energy conservation technologies and utilization of renewable energy sources. So far, in most industrialized countries, renewable energy sources contribute only marginally in satisfying energy demand. This is due to several reasons, in particular because new energy systems are not yet economically competitive with the combustion of fossil fuels, long term reliability is not yet proven, and there are still some regulatory and market barriers which

have to be overcome. Therefore, further attempts must be made to resolve these issues. This is especially true for many new energy storage technologies and concepts that have not yet been implemented on a large scale in the market.

The Executive Committee on Energy Storage has the following mission and vision for the Programme:

Mission: To facilitate research, development, implementation and integration of energy storage technologies that optimize energy utilization by improving overall energy efficiency and economic growth, while benefiting the local and global environments.

By developing and disseminating factual, balanced information, the programme on energy storage augments the work of policy makers, national and international energy and environmental agencies, utilities, manufacturers, designers and researchers. It also works through national agencies to reduce market barriers and to influence the implementation and integration of energy storage technologies in an appropriate manner.

Vision: Adverse environmental impacts, including possible climate change effects, are caused by energy usage in all sectors of the economy. Energy storage technologies, however, can overcome the temporal mismatch between energy supply and demand, especially regarding renewable energy technologies, the use of waste energy and energy from ambient sources such as cold from the natural environment.

Energy storage is therefore an enabling technology for use in a variety of energy systems, from residential to commercial and from industrial to agricultural. By contributing to large-scale energy efficiencies, energy storage significantly reduces environmental impacts from energy activities, increases the potential uptake of some renewable energy technologies, increases the potential for sustainable energy development and subsequently leads to better energy security.

However, since customers of the energy storage programme are not the end-users, it is necessary to build even stronger links with the energy design community and system manufacturers, as well as the energy supply and service industries that serve the end-users.

Over the next term the Programme on Energy Storage will continue undertaking research and technology development, technology transfer activities and the prototyping and deployment of near-market ready and market ready energy storage technologies. The scope of activities will broaden to include more system integration, emphasizing more effective matching of energy supply with energy demand. The expansion of collaborative actions with other Implementing Agreements and countries, and the private sector is, considered highly necessary and desirable.

Strategic Objectives

Technology: *To maintain and develop international technical RD&D collaborations that furthers the environmental and market objectives.*

We will advance the development of thermal energy storage technologies utilizing waste, renewable or ambient energy sources to supply space heating, space cooling and process cooling to achieve significantly improved energy efficiency and cost-effectiveness. Research and develop electrical energy storage technologies and systems that integrate batteries, flywheels, and other storage media with power electronics and controls to enhance energy security and facilitate increased use of renewable energy sources. We will provide a forum to facilitate the international exchange of information and experience on energy storage research, development, project applications, field trials and products. We will advocate that adequate design information on innovative energy storage technologies is made available to interested groups in industry, government, and academia.

Environment: *To quantify and publicise the environmental and energy efficiency benefits of integrated energy storage systems.*

We will evaluate and document the many environmental benefits of energy storage and ensure that potential environmental problems are directly addressed and avoided by sound technical analysis and design techniques. We will involve national and regional environmental agencies in our work to ensure that energy storage meets the present and future requirements of these agencies. We will raise the level of awareness and understanding of energy storage technologies, especially their environmental benefits, and advocate that impartial technical information is made available to all stakeholders.

Market and Deployment: *To develop and deliver information to support appropriate market deployment and to provide effective collaboration and flow of information to, from and between stakeholders and other relevant bodies.*

The required steps to achieve the proper application of energy storage technologies will be encouraged world-wide in the residential, commercial, industrial and agricultural sectors. We will focus our communications efforts on the world market players including design engineers, architects, building owners, developers, governments, regulatory agencies, electric utilities, and community leaders. We will encourage the use of renewable energy sources to cool buildings and other structures in a post-CFC world; develop methods to integrate energy storage technologies into community-based systems; and develop effective residential cold storage techniques that avoid the use of conventional refrigerators in moderate climates.

Economic and technical limitations indicate that cooling is the first priority, followed by combined cooling and heating, and lastly heating. We will develop and encourage deployment of electrical storage with renewable generation technologies where market conditions favour off-grid implementation (many developing countries and remote locations world-wide). Short-term electrical storage will be investigated to improve power quality and reliability. Longer duration electrical storage will be considered for peak shaving, system stability, and improved asset utilization in utility networks. In order to accomplish these objectives the Energy Storage Programme participates in a broad range of activities. Information is provided through many mechanisms, including:

- Various IEA Information Centres such as, The Centre for Analysis and Dissemination of Demonstrated Energy Technologies (CADDET)
- The European Commission
- The United Nations
- Collaborations with other Implementing Agreements, including the seven Building Related Implementing Agreements
- Collaborative international projects (Annexes),
- Workshops and analysis studies (e.g. Future Building Forum)
- The ECES Web-Site (<http://www.iea-eces.org/>).
- Triennial international conferences on energy storage systems. Past energy storage conferences which were attended by more than 200 -500 participants from 20 countries and more have been organized:

1. International Conference on Seasonal Thermal Energy Storage and Compressed Air Energy Storage, Seattle (1981)
 2. International Conference on Subsurface Heat Storage, Stockholm (1983)
 3. Enerstock Toronto (1985), (the first "STOCK" conference, but the 3rd international storage conference)
 4. Jigastock, Versailles (1988)
 5. Thermastock, Scheveningen (1991)
 6. Calorstock, Helsinki (1994)
 7. Megastock, Sapporo (1997)
 8. Terrastock, Stuttgart (2000)
 9. Futurestock, Warsaw, (2003)
- The 10th Int. Conference on Thermal Energy Storage ECOSTOCK will be held 31 May - 02 June 2006 (Richard Stockton College of New Jersey, USA).

Bi-annual Conferences on Electrical Energy Storage Applications and Technologies are organized by the US Department of Energy in the US (www.sandia.gov/eesat). The next one takes place October 16-19, 2005.

Market Opportunities and Barriers to Deployment

As with many other renewable energy and energy saving technologies, energy storage technologies offer great market potential, however there are also significant barriers that impede the implementation of energy storage. The most important factors have been identified by the Executive Committee:

Market Opportunities

- Significant energy saving and fossil fuel substitution potential.
- Significant opportunity to assist in meeting CO₂ emissions targets.
- In creating new jobs in a variety of commercial ventures, especially the drilling and construction industries and the engineering and hydrogeological professions and technical fields for specialized geotechnical and hydrogeological testing, design, monitoring and controls.
- As an enabling technology for renewable energy deployment, such as solar heat storage and electricity storage from wind energy and other sources of electricity, heat and cold.
- Enhanced performance of water source heat pumps, leading to optimized market deployment and energy savings.
- Enhance performance distributed generation heat and power projects.
- Enhanced energy security through the use of storage technologies.
- As a mechanism for cost effective waste heat recovery from existing waste heat emitters such as power plants and oil refineries.

Market Barriers

- Energy storage technologies are not always cost-effective based only on energy savings.
- High initial costs in many cases, but not all, as there are some first cost options.
- Availability of cheap fossil fuels, although spikes in energy costs fuel energy efficiency awareness.
- Groundwater protection regulations often impede the implementation of aquifer storage and sometimes, bore hole thermal energy storage.
- Perceived high technical and financial risks for the owner.
- Lack of knowledge about energy storage and the need for education.

Strengths and Limitations of the Energy Storage Implementing Agreement

Strengths

- Direct and immediate technology transfer among the participating countries.
- Increased research capacity by combining research efforts.
- International network of experts in a focussed technical area.

Limitations

- Lack of sufficient funding for RD&D of thermal and electrical energy storage systems has been a problem; however, acceptance of the Kyoto Accord by most industrialized countries is giving a higher profile to RD&D activities globally.
- Although early demonstration plants had overly optimistic expectations and were not highly reliable, this situation has changed.
- Historically, cooperation has been mainly research-oriented and industry has been underrepresented, this situation is also changing due to a globally increasing interest in energy efficiency stemming from the ratification of the Kyoto Accord

Collaboration with other Executive Committees

To be effective, a close cooperation is necessary not only between the participants of the IA-ECES and experts engaged in the Annexes, but also with the ExCo's and experts of other IA's. Continuing closer cooperation between the relevant Executive Committees is essential, especially for the Storage Programme due to its cross-cutting technological nature.

Storage technologies have to be integrated with the total system and have to meet the specific technical and economic requirements of the application. Integrated system concepts that include storage technologies have to be developed to achieve an optimal cost-effectiveness and energy savings potential. Therefore the Executive Committee has intensified cooperation with other Executive Committees, particularly between the other Building Related Implementing Agreements (BRIA'S):

- Solar Heating and Cooling
- District Heating and Cooling
- Energy Conservation in Buildings and Community Systems
- Heat Pumps
- Photovoltaic Power Systems
- Demand Side Management (DSM)

Joint workshops are employed to share information, to transfer knowledge for implementation of new concepts and technologies and to identify new cooperative activities.

Work and Achievements during the term 2000-2005

Significant progress has been made in the term from 2000 to 2005 by the ECES Executive Committee to achieve its objectives.

- A reliable data and information base on various energy storage technologies and concepts has been established by international reviews of the state of the

art, assessment and market studies, and construction and monitoring of pilot and demonstration plants.

- The technical and economic aspects to implementing new energy storage technologies have been significantly improved.
- National and international guidelines have been developed for the implementation of ground and aquifer storage systems to avoid environmental risks and to facilitate installation by local water authorities.
- Design tools and computer models have been developed and are being used now by engineers for the planning and design of new energy systems that include energy storage technologies.
- Technology transfer and information dissemination has continued with the sponsorship of seminars to end users and decision makers in conjunction with Annex meetings, workshops and international conferences, including a series of international energy storage conferences beginning in 1981. During this reporting period "TERRASTOCK 2000" (Germany) and "FUTURESTOCK 2003" (Poland) were organized by the ECES-IA.
- Several bi-annual conferences on Electrical Energy Storage Applications and Technologies were held in 2000, 2002, 2003. In 2003 the Fourth Conference on Electrical Energy Storage Applications and Technologies, sponsored by the US Department of Energy, Sandia National Laboratories, and the Electricity Storage Association was held in San Francisco October 27-29. ECES dovetailed their electrical storage activities to benefit from this conference .
- Deployment of low temperature Underground Thermal Energy Storage for heating and cooling on a large scale in various countries, e. g., Canada, The Netherlands, Sweden, Norway, the United States of America, Switzerland and Germany.
- First deployment in North America of a Community Based High Temperature Seasonal Solar Heat Store in a Borehole System.
- Arrangement of a NATO sponsored International Summer School on Energy Storage and Renewable Energy in June 2005 in Turkey.
- Preparation of an Energy Storage Text Book for use by graduate students and consultants based on the information from the NATO Advanced Energy Storage Summer School in Turkey in June, 2005.
- Arrangement of joint workshops with several Executive Committees of other Implementing Agreements:
 - ECBCS: November 2000
 - Solar Heating and Cooling: November 2002
 - District Heating and Cooling: May 2003
 - Heat Pumps: May 2004
 - DHC: June 2005
- Internet homepages of the IEA-Energy Storage Programme (<http://www.iea-ec.es.org/>) and various Tasks have been set-up and are very actively updated.
- One new member country (Norway) has joined as a Contracting Party (Research Council of Norway) and one member (the Netherlands) withdrew.

- Two new Sponsors, IF Technologies (the Netherlands) and Warsaw University of Technology Institute of Heat Engineering (Poland), joined in 2004 and 2005 respectively.
- Interest has also been expressed by Australia, Bulgaria, China, France, India, Israel, Malaysia, New Zealand, Slovenia, and Switzerland.
- Cooperation with other international organizations such as the NATO Advanced Summer Institute in Turkey June 2005.
- Annex 17, Advanced Thermal Energy Storage Techniques, Feasibility Studies and Demonstration Projects, was financed by three countries with active participation by experts from nine other countries.

Annexes Slated for Completion in the term 2000-2005

Annex 10, Phase Change Materials and Chemical Reactions for Thermal Energy Storage (1997-2001).

O.A. Prof. Fredrik Setterwall, KTH Sweden

The general objectives of Annex 10 are to solve technical and market problems for a better market opportunity for thermal energy storage systems utilizing PCM or chemical reactions in the building system, the agricultural and industrial sector and to broaden the knowledge base and disseminate information. Participating countries were: Canada, Finland, Germany, Japan, Sweden (OpA) and Turkey.

Annex 12. High Temperature UTES (Phase I: 1997-2000), Phase II: 2001-2003).

O.A.: Dr. Burkhard Sanner, University of Gießen, Germany

In Phase 1 of Annex 12, a State-of-the-Art review of HT UTES applications was completed. Phase II evaluated the most promising applications and system concepts for HT-UTES and assessed the expected benefits of HT-UTES. Participating countries were Canada, Germany (OpA), Belgium, Sweden and the Netherlands.

Annex 13. Design, Construction and Maintenance of UTES Wells and Boreholes (1997-2004)

O.A. Prof. Olof Andersson, Sweden

Annex 13 resulted from the Energy Storage Strategy Workshop held in Montreal in January 1995.. The objectives were to describe UTES drilling and exchange experiences of different technologies; identify related problems in order to establish areas for further R&D; Develop guidelines connected to test drilling and well design and construction; to investigate the occurrences and sources of operational failures related to the well or borehole system and to develop preventive guidelines for monitoring, maintenance and rehabilitation measures. The following countries have participated in the Annex: Belgium, Canada, Germany, the Netherlands, Sweden, and Switzerland (observer), Turkey, and the U.S. The final results will be presented at Executive Committee meeting in November 2005.

Annex 14. Cooling in All Climates with TES (2000-2004)

O.A. Prof. Halime Paksoy, Cukurova University Adana, Turkey

The general objective of Annex 14 was to employ research, development and feasibility studies and to advance integration of many different TES technologies for applications within a variety of energy systems and climate conditions. TES technologies included within the scope of the Annex were UTES (aquifers, boreholes and cavities), phase change materials (ice, snow, inorganic and organic materials), chemical reactions, chilled water tanks and building structures. The countries participating in Annex 14 were Canada, Japan, Sweden, USA and Turkey. The Operating agent was from Cukurova University, Turkey. The Annex was closed at the Executive Committee meeting in Montreal, Canada, May 2004.

Annex 17. Advanced Thermal Energy Storage Through Phase Change Materials and Chemical Reactions-Feasibility Studies and Demonstration Projects (2002-2005)

Prof. emeritus Fredrik Setterwall, Sweden

In continuation of Annex 10 that dealt with R&D on new materials Annex 17 was focused on pilot and demonstration projects to solve technical and market problems for a better market opportunity for thermal energy storage systems utilizing PCM or chemical reactions in building systems and for temperature sensitive materials and waste and natural energy utilization and to broaden the knowledge base and disseminate information.

Research into system analysis was encouraged in order to recognise market barriers for implementing the technology in the residential, commercial, industrial and agricultural sectors. The action was executed in close co-operation with manufacturers, utilities, users, governmental representatives and organizations involved in the dissemination of energy technologies. An important task was to execute case studies and commence demonstration projects so that various promising practical applications of PCM and thermochemical technology could be highlighted. The Annex 17 initiated demonstration projects related to potential fields of application. The Annex resulted in recommendations for the energy industry and more application oriented R&D activities with increased participation of industry and manufacturers. This Annex was closed in May, 2005.

Planned new activities in the next term (2006-2010)

The proposed future activities are partly new topics and partly extensions of the previous and present Implementing Agreement programme work. Various topics and activities will be continued in order to achieve successful implementation of storage technologies. The following list includes the activities being examined by the Executive Committee.

General Issues and Activities:

- The role of thermal energy storage in increasing the energy efficiency of building HVAC systems such as combined with closed-loop building heat pump systems and desiccant-based cooling systems. Cooperation with the IEA Building and Community Systems, Heat Pumping Technologies and Solar Heating and Cooling IA's will be useful.
- Evaluation of the benefits of hot and cold storage with heat pumps, especially the advanced generation of heat pumps, in collaboration with the Heat Pump IA.
- Publication of Programme and Task brochures and reports on the Internet.
- Continuous evaluation and preparation of state-of-the-art reviews.
- Joint efforts will be initiated to implement new energy storage technologies in all countries with an interest in storage or with a significant energy storage market potential.
- Study the potential for water remediation efforts using energy storage through community or aquifer-based planning of large-scale energy supply systems with the objective of assisting the implementation of energy storage in a systematic manner.
- Better (more efficient) Borehole Heat Exchanger Designs, especially to facilitate direct cooling.

***Proposed New Annexes:**

- Annex 15: Electrical Energy Storage and Distributed Generation
- Annex 16: Market Deployment of Energy Storage Systems.
- Annex 18: Transportation of Thermal Energy by Thermal Energy Storage with Phase Change Materials and Chemical Storage.
- Annex 19: High Temperature Thermal Energy Storage for Industrial and Power Applications.
- Annex 20: Sustainable Cooling with Thermal Energy Storage
- Annex 21: Implementation of Thermal Energy Storage in District Heating and Cooling systems.

Electrical Energy Storage and Distributed Generation (Annex 15): The electricity industry worldwide is undergoing a process of fundamental change and

re-structuring, from an era of largely monopolistic utilities and central generation plants, to a competitive market with far greater emphasis on smaller scale distributed generation systems. Such distributed generation systems embrace various smaller scale, renewable resources (e.g. wind, hydro, biomass and solar), micro-turbines, fuel cell power plant and smaller scale cogeneration systems. The operability and economics of such smaller scale distributed generation is often considerably enhanced via the application of storage and as a network stabilisation and control medium. The Annex 15 work programme is proposed to build upon the work already performed in the previous Annex 9 storage programme. Specifically, it will address the application of storage in the context of distributed generation, as a key element in realising the latter's full potential in reducing atmospheric emissions and enhancing energy security.

Deployment of Energy Storage Technologies (Annex 16): The Implementing Agreement on Energy Conservation through Energy Storage has contributed significantly to the development of energy storage technologies in the participating countries. These energy storage technologies are considered a strategic and necessary component for the efficient utilization of renewable energy sources and energy conservation. The energy storage technologies developed and demonstrated involve underground thermal energy storage, thermal energy storage in phase changed materials, and technologies for electrical energy storage. To promote the implementation of thermal energy storage in building energy supply systems, the most energy and cost effective applications have been identified in the framework of Annex 8 to the Implementing Agreement. However, for the deployment of new, energy efficient technologies in the energy market a greater effort is required from all stakeholders.

Transportation of Thermal Energy Utilizing Thermal Energy Storage Technology (Annex 18) A key component in a sustainable energy system is to be able to use thermal energy from various sources at a consumer located at a distance from these sources. For this purpose, the thermal energy has to be transported from one place to another. This could be achieved by using thermal energy storage technology. Depending on the distance, the storage medium could either be pumped through pipelines or for longer distances the TES itself could be transported on a truck or a train. The crucial properties of the TES for the technical and economical feasibility are the storage capacity per volume and weight and the possible charging and discharging power, which affects the possible number of storage cycles per time. A kick-off workshop for the new Annex took place on June 10th 2004 in Arvika, Sweden.

Optimised Industrial Process Heat and Power Generation with Thermal Energy Storage (Annex 19): Previous activities in the Implementing Agreement on Energy Conservation through Energy Storage has achieved significant progress in thermal energy storage technologies for energy savings and for

reduction of peak demand of energy in buildings and in advancing the prospects of cooling with Thermal Energy Storage technologies. However, the potential for thermal energy storage and regenerative heat transfer for the industrial process heat sector for efficient energy utilisation, heat recovery and storage of high temperature waste heat, as well as the need for energy storage for power generation based on new conversion techniques and renewable energy resources (RES) is of interest to several national and international research strategies. Both areas are directed to applications and processes at high temperature. In this context "High Temperature" is defined to be higher than 120 C as required for comfort heating and where water cannot be applied as heat transfer fluid.

Sustainable Cooling with Thermal Energy Storage (Annex 20): Renewable and natural energy sources, main components of sustainable energy systems, can only be made continuously available to users through thermal energy storage (TES). In addition to heating TES provides several flexible alternatives for cooling systems. Recent discussions on topics like global warming and heat waves have brought attention once again to energy efficient cooling systems utilizing renewable energy sources. Cooling demand has already been increasing due to the evolving comfort expectations and technological development around the world. Climate change has brought additional challenges for cooling systems designers. New cooling systems must use less and less electricity generated by fossil fuel based systems and still be able to meet the ever increasing and varying demand. Annex 20 was approved by the Executive Committee at the meeting in May, the kick-off meeting will be held in Nagoya, Japan Sept. 14-16 2005.

Implementation of TES in District Heating and Cooling systems (Annex 21): ECES and the District Heating and Cooling Programme of the IEA held a joint workshop in June in Berlin, Germany. The topic of *Cool Storage in District Cooling Systems* was discussed. The basic elements of a new annex on energy storage in district heating and cooling systems are:

- to advance the prospects of cooling with TES systems by R&D
- to develop design methods
- to undertake feasibility studies and demonstration projects
- information dissemination and technology transfer

UTES Design Tools, Guidelines and Best Practises (No annex designation assigned) As experience from several projects, discussion with colleagues from

other countries, results from conferences (the last one was the 5th Symposium on GSHP, Landau, Nov. 2004), and other communication show, that there is still much to do to make UTES design a standard procedure to be done in a routine way by HVAC engineers. We can define the following areas as:

- Easy-to-use design tools for both ATES and BTES
- General design guidelines and adapted guidelines in individual countries
- Examples of best practices and successful realisations

**(Note that the design, installation and maintenance of the underground part of this work have been dealt with already in Annex 13 and are recognized by this Annex).*

*NOTE: NEW ANNEX “NUMBERS” ARE TENTATIVE UNTIL FORMAL APPROVAL BY THE ECES EXECUTIVE COMMITTEE. THE TEXTS OF PROPOSED NEW ANNEXES ARE AVAILABLE ON THE IEA ECES HOMEPAGE.

Other Activities: The 10th International Conference on Thermal Energy Storage will take place from May 31-June 2, 2006 at Richard Stockton College, Pomona, New Jersey.

Energy Storage Activities in other IEA Programmes:

Special R&D activities on energy storage systems have been carried out in the context of other IEA programmes, examples include.

- Solar Heating and Cooling: Task 32
- Heat Pump Technologies (Annex 29)
- District Heating and Cooling.

Participants

The following countries and corresponding organizations have signed the IEA-Energy Storage Implementing Agreement and are financial contributors to the commonly funded ECES-secretariat:

Contracting Parties (Government Organizations):

Ministry of Economic Affairs, Belgium

Public Works and Government Services Canada, Canada

The Ministry of Energy, Denmark

Technology Development Centre TEKES of Finland, Finland

Forschungszentrum Jülich GmbH, Germany

Italian Agency for New Technologies, Energy and the Environment (ENEA), Italy

The Heat Pump and Thermal Storage Centre of Japan, Japan,

IBERDROLA, Spain

FORMAS, Sweden,

The Research Council of Norway, Norway

Cukurova University Adana, Turkey,

Department of Trade and Industry (DTI), United Kingdom

Department of Energy (DOE), United States of America

Commission of the European Communities (CEC)

Sponsors

IF Technology, The Netherlands
Warsaw University of Technology, Poland

Interested Countries:

The Executive Committee is working intensively to attract more countries to join the activities and to sign the Implementing Agreement. Experts from several countries already participate in the Annex work as observers. Spain signed the IEA-ECES IA in February, 1999. Other countries expressing an interest in the activities of the Energy Storage Implementing Agreement include: Australia, Bulgaria, China, France, India, Israel, Korea, Malaysia, New Zealand, Slovenia, South Africa and Switzerland. Tsinghua University, Beijing has been invited to join the ECES as a sponsor.

References

IEA-ECES Annual Reports, Annex Reports and other information is available on the internet homepage at:

www.iea-eces.org

Other Relevant Internet Website Addresses include:

Reports: <http://www.sb.luth.se/vatten/projects/iea/>

Annex 8: <http://www.sb.luth.se/~bon/bon/IEA/ax8report.html>

Annex 9: <http://www.eatl.co.uk/annexIX/home.htm>

Annex 9: <http://www.eus.de/energy-storage/>

Annex10: <http://www.chemeng.kth.se/avdelningar/ts/annex10/index.htm>

Annex 14: <http://cevre.cu.edu.tr/annex14/>

Annex 17: <http://www.fskab.com/annex17/>