



HEAT STORAGE

Platforms, Initiatives, Infoportals, Associations,

BINE Informationsdienst

www.bine.info (in German)

BINE information service promotes the information and knowledge transfer from the energy research to practice in the fields renewable energies and efficient energy technologies. BINE is funded by the Federal Ministry for economics and technology (BMWi) and works with numerous companies, research centres and politics. BINE distributes a large number of publications (mostly in German) (Projektinfo, Themeninfo, BasisEnergie). BINE Experts hotline offers project-related and practice-relevant additional information. Furthermore is the book series of BINE to mention, published by Solarpraxis.

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ECOSTOCK

<http://inraweb.stockton.edu/eyos/page.cfm?siteID=82&pageID=29>

The Tenth International Conference on Thermal Energy Storage Ecostock 2006 took place from May 31 – June 2, 2006 with the title: *“Thermal Storage Here and Now”*. The Conference was sponsored by the International Energy Agency, Energy Conservation through Energy Storage and U.S. Department of Energy, Energy Storage Program and The Richard Stockton College of New Jersey. On the above website all papers of the conference can be downloaded.

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EUROSOLAR

http://www.eurosolar.de/en/index.php?option=com_content&task=view&id=267&Itemid=8

EUROSOLAR was founded in 1988 as the non-profit European Association for Renewable Energies that conducts its work independently of political parties, institutions, commercial enterprises and interest groups. Together with the World Council for Renewable Energy (WCRE) organised EUROSOLAR in October 2006 the first international conference a new international conference series on *“The case of energy autonomy: Storing Renewable Energies”* to take place every two years in the future. The conference topics were the state of the art in energy storage technologies and their various applications, possibilities of integrating Renewable Energies and a hundred per cent RE energy mix, possibilities of cutting the Renewable Energies costs by energy storage, need for further research and

development activities in energy storage technologies. The proceedings can be obtained from this web site.

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LWSNet

http://www.lwsnet.info/start_e.htm

LWSNet is a Network to Overcome the Fundamental Problems Involved in Developing Highly-Efficient Latent Heat Stores on the Basis of Inorganic Storage Materials. Partners of the Network are: ZAE Bayern, BAM Federal Institute for Material Research, DLR, SGL Carbon Group, TU Bergakademie Freiberg, University of Wuerzburg and University of Freiburg. The Project is funded by the Federal Ministry of Education and Research (BMBF) under the funding codes 03SF0307A-F within the BMBF initiative "Fundamental Research Networks for Renewable Energy Sources and Rational Energy Usage".

The LWSNet research network is dealing with fundamental considerations concerning the application of inorganic latent heat storage materials (phase change materials = PCMs).

The objective is to develop solutions to overcome the main problems involved in PCM technology. The main difficulties here are that:

- the charging and discharging efficiency of PCM stores is too low since the surface is too small in relation to the volume and the thermal conductivity is insufficient
- supercooling effects occur due to poor crystallization which cause the storage systems to discharge at inspecific temperatures.

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Chairman of the Board: Prof. Dr. Ulrich Stimming

PREHEAT

www.preheat.org

The PREHEAT project supported by Intelligent Energy provides an overview of

- national and EU support programs relevant for heat storages
- national and EU policies relevant for heat storages
- national and EU regulations relevant for heat storages
- other decision making processes relevant for beneficial use of heat storage or barriers for beneficial use of heat storages
- benefits from improved conditions for heat storages in programs, policies and regulations and other decision making processes

The objective of PREHEAT is to provide the industry and decision makers in the EU with a reference framework to maximise the benefits of heat storage technologies and to increase the attention and funding possibilities for heat storage technologies implementation.

On the long term, PREHEAT aims at a coherent European promotion program with a collective approach by the industry, R&D institutions and other market actors. From the diverse and large number of companies working on heat storage technologies (mostly SME's), PREHEAT will initiate a

heat storage community, and will raise the awareness of the need for efficient heat storage, boosting the implementation of RES and RUE.

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International Energy Agency: Energy Conservation through Energy Storage Implementing Agreement (ECES IA)

<http://www.iea-eces.org/>

Active participants in ECES IA include Belgium, Canada, Denmark, Finland, Germany, Japan, Norway, Sweden, UK, USA and Turkey. The strategic objectives of ECES-IA are:

- to maintain and develop international technical RD&D collaborations that further the environmental and market objectives
- to quantify and publicise the environmental and energy efficiency benefits of integrated energy storage systems
- to develop and deliver information to support appropriate market deployment and provide effective collaboration and information to stakeholders.

Some active annexes are:

Annex 20 Sustainable Cooling with Thermal Energy Storage

Annex 16 Deployment of Energy Storage Technologies

Annex 15 Applying Energy Storage in Ultra-low Energy Buildings (planned)

Annex 21 Thermal Response Test for Underground Thermal Energy Storages (planned)

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INDUSTRY

BINE

On following link you can find a list of companies involved in PCM Technologies:

http://www.bine.info/pdf/infoplus/Adressen_26.pdf

Cristopia Energy Systems

<http://www.cristopia.com/>

Cristopia Energy Systems develops a unique technology of Thermal Energy Storage Systems which has stemmed from research at the Energy Centre of " Ecole des Mines de Paris ". This technology has been specially created in 1982 for A/C Building and Industrial Refrigeration to shift electric consumption from peak hours to off-peak period and to reduce the electrical supply. The STL Thermal Energy Storage System is composed of a tank(s) filled with nodules (balls) and heat transfer fluid. Approximately 60% of the volume of the tank is occupied by the nodules and the remaining 40% is fluid. The heat transfer fluid is usually mono-ethylene glycol. Other brines such as mono-propylene glycol or calcium chloride may also be used. The number of nodules in a system determines both the heat exchange rate between the nodules and the heat transfer fluid and also the total energy stored in the STL. The spherical nodules (balls) are blow moulded from a proprietary blend of polyolefins and filled with PCM (Phase Change Material). A range of PCMs allow thermal energy to be stored at temperatures between -33°C and +27°C (see table). The system is regarding Air Conditioning for example suitable for Office buildings, museums, cinemas, district cooling systems, hospitals, banks, supermarkets, hotels, residential complexes etc.

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Geothermie Neubrandenburg GmbH

<http://www.gtn-online.de/index1.htm>

Geothermie Neubrandenburg Ingenieure & Geologen (GTN) is involved in following working fields: Geothermal Energy Use / Balneology, Geology, Drilling Engineering, Geo-modeling, Energy- and Hydro-engineering, Licensing Procedures

In the area Underground cold and heat storage two following projects can be mentioned:

Generation of electric power, heat and cold for the Reichstag building (seat of the German Parliament) in Berlin A rape oil-driven 1,600 kWel cogeneration unit forms the centre of the system. Excess heat arising from the power-driven machinery is fed into an underground aquifer heat store (300 m deep) in summer which is recovered at times of peak demand in winter. A second ground-water-bearing bed situated at a depth of approx. 50 m is used as a cold store. Here, groundwater cooled down to 5 °C by means of ambient cold is stored in winter feeding the cooling systems of the building in summer without any additional drive power. Boiler units, compression- and absorption-type chillers and heat pumps are installed to cover the medium and peak load as well as for redundancy reasons.

Residential Complex HELIOS at Rostock-Brinckmanshöhe (Along with the 1,000 m² of effective collector surface, an aquifer thermal energy store was installed in order to maximise the volume of solar thermal energy use in summer for the all-season sanitary hot water preparation and heating of the residential area which includes 108 flats covering a total floor area of 7,000 m²).

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RUBITHERM TECHNOLOGIES GMBH

<http://www.rubitherm.com/english/index.htm>

RUBITHERM has been specialised in phase change heat storage. Besides their products in phase change materials RUBITHERM has its own research centre for storage technology. RUBITHERM's performance profile: Manufacture and delivery of PCM-Material based on paraffin and salt hydrate. Manufacture and delivery of different products with integrate PCM-Material Development and adaptation of PCM-Material on demand profile.

The fields of applications of the RUBITHERM PCM concerning latent heat storage are:

- climatisation storage for indoor climate control
- storage of cooling energy for reduction of peak loads
- buffer storage for solar-, fossil fuel- and warmth systems
- buffer storage for heating systems

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ALFRED SCHNEIDER GmbH

<http://www.alfredschneider.de/index.htm> (in German)

ALFERD SCHNEIDER produces the Latent heat storage in modular type LWS 750. This storage system uses the melting enthalpy of a salt for storage of heat. It can be utilised for heat storage from solar collectors, wood boiler plants and other sources of energy. The most important advantages are: Small space requirement, high heat load and unload, and complete unloading of the heat reservoir.

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SOLARPRAXIS AG

http://www.solarpraxis.de/index.php?793&backPID=793&tt_products=366

Publication „Neue Marktübersicht Solarspeicher: Der passende Tank für die Sonne“, 2007, „New Market overview solar storage systems: the appropriate tank fort he sun“ is published in 2006, DVD-ROM, Data base with more than 1000 storages, ISBN 978-3-934595-69-9

TransHeat GmbH

<http://www.transheat.de/> (in German)

TransHeat is a modern power supply for the heating and cooling of buildings using waste heat through PCM storage system. TransHeat represents a line-free long-distance heat supply. The energy source can be spatially up to 35 km distant from the consumer. TransHeat uses physics of materials with the phase transition, i.e. with solidifying and when melting. The energy is stored latently during the change of the state of aggregation. As transport containers freight containers are used.

Energy is through a heat exchanger supplied from the outside and transferred to the heat exchange medium oil. This is mixed with the storage medium and delivers to it its energy. Salt hydrate melts and stores this energy. The loaded container is then transferred to an energy consumer. There the process runs in the same way, but the energy is transferred now through the heat exchanger to a heating cycle. After unloading the latent heat storage is returned to the energy source and the cycle begins again.

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RESEARCH AND DEVELOPMENT

Bayerisches Zentrum für Angewandte Energieforschung e.V. (ZAE Bayern)

<http://www.zae-bayern.de/>

ZAE is regarding energy storage involved in the development of short and long term energy storage systems (sorption systems, latent heat storage systems) as well as electrical energy storage (super caps, batteries). Working fields are:

- Design and Calculation of sorption storage systems
- Development of latent heat and cold storage systems (Development and characterization of storage materials, design, construction and test of components and storage systems, quality assurance, Development of innovative PCM-(Phase Change Material)- Technologies for Air Conditioning

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Energy research Centre of the Netherlands

<http://www.ecn.nl/en/egon/r-d-programme/energy-storage/>

The group Energy Storage develops new technologies and systems for the storage of electricity and heat, mainly for application in the built environment.

For storage of electricity the focus is on redox-flow batteries, supercaps and lithium-ion batteries. For heat storage the research focus is on high-temperature storage in fluids and phase change materials and on compact storage in thermo-chemical materials.

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Research areas in Energy Storage

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Fraunhofer ISE - Institut für solare Energiesysteme

<http://www.ise.fraunhofer.de/>

Fraunhofer ISE developed together with industrial partners (BASF, DAW, STO) PCM (Phase Change Materials) and based on that building materials with encapsulated PCM. At the core of each microscopically small plastic sphere is a wax storage medium. When the temperature rises, the wax melts and the phase-change material absorbs heat. When the temperature drops, the wax solidifies,

and heat is emitted. During the phase change, the temperature remains constant. Phase change materials (PCMs) therefore take their name from their mechanism of action. Owing to their micro encapsulation technology PCMs can be integrated invisibly into the most diverse of construction materials (more details s. www.micronal.de).

Based on the building materials with micro-encapsulated PCM Fraunhofer ISE is now investigating activated cooling ceiling incorporating PCM, which require significantly less cooling energy than conventional cooling ceilings, can be controlled and can use alternative heat sinks.

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Fraunhofer-Institut für Umwelt-, Sicherheits- und Energietechnik

<http://www.umsicht.fraunhofer.de/>

Together with industrial and public customers Fraunhofer UMSICHT develops and researches the newest knowledge in its business segments and transfers it to industrial appliances and marketable products: Renewable Resources, Renewable Resources, Process Technology, Biofuels, Advanced Materials, Information Technology in Process Engineering, Energy Technology, Energy Systems, Resources Management

Concerning the competence field Energy Systems Fraunhofer UMSICHT is involved among others in:

- Energy system analysis, benchmarking and optimization of heat, cold and power supply system operations
- Application of combined power, heating and cooling, thermal chillers
- Hybrid cold/heat accumulators (PCM/PCS)
- Storage of electric power
- ORC-processes (organic rankine cycle)
- CO₂-emissions management (monitoring/trading)

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IGS – Institut fuer Gebäude- und Solartechnik an der TU Braunschweig

http://www.igs.bau.tu-bs.de/_institut/frameset_e.htm

The IGS - Institute for Building Services and Energy Design at the Technical University of Braunschweig handles the entire spectrum of energy and climatic design in buildings. The main areas of activity are building technology, edificial physics as well as passive and active usage of solar energy for residential and office buildings.

In the field of Energy storage following project can be mentioned: Storage of Heat and Cooling Energy in the Foundation Area of Energy Efficient Office Buildings (Investigation of office buildings with energy piles, borehole- and foundation heat exchangers for heat and cold supply, Forecast-supported controlling of thermally activated and building components.)

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ITW - Institut für Thermodynamik und Wärmetechnik, Stuttgart

<http://www.itw.uni-stuttgart.de>

Since 1984, the development of storage types for seasonally heat storage is being undertaken at ITW, nowadays in cooperation with several other institutions and offices. On the basis of earlier research projects, the following storage types have been developed: Hot water heat storage, gravel-water heat storage, duct heat storage, aquifer heat storage. The decision to use a certain type of storage system mainly depends on the local conditions and, above all, on the geological and hydrogeological situation in the ground below the respective construction site.

For all types of storage, but mainly for aquifer and duct heat storage systems, a preliminary geological examination of the storage site is essential. Approval of the water authorities must be obtained at an early stage. If different storage types are possible, an economic optimization should be carried out with the building costs for the different types of storage taken into account. This is because the storage types will be of different sizes according to the heat capacity of the storage material.

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SOLITES

http://www.solites.de/default_en.htm

Solites stands for research, development, consultancy and promotion for solar and sustainable thermal energy systems in particular large scale solar heating systems with seasonal storage. Solites is a research institute of the Steinbeis Foundation and was founded in May 2005 by former employees of the University of Stuttgart.

Fields of activity of SOLITES are:

Scientific-technical accompaniment of the RTD programme Solarthermie2000plus in behalf of the Federal Ministry for the Environment BMU (The RTD activities of SOLITES focus on solar district heating with seasonal storage)

Expert group on long-term heat storage: SOLITES leads the expert group on long-term heat storage in behalf of Projektträger Jülich (PTJ) in order to coordinate experience exchange and RTD activities related to this technology.)

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TU Chemnitz, Fakultät Maschinenbau, Technische Thermodynamik

<http://www.tu-chemnitz.de/mb/TechnThDyn/Forschung/fenergiespeicher.php> (only in German)

One main topic in the research of the Institute Technical Thermodynamics is the “Thermal Energy storage” (for heat and cold). There are following projects running at the moment:

- Further Development and optimization of load and unload systems for tank and ground basin (experimental and computational investigations will help to understand the procedures inside the storage system in order to minimize the internal losses)
- .Feasibility investigation for the support of Combined Heat Power and Cold Plants by the usage of Cold storage in large supply systems. Absorption chillers are not enough to use significantly the waste heat, cold storage systems are for economical reasons necessary.
- Pilot project for the optimization of large supply systems on basis of the CHPC Plants through Cold Storage. Substantial points of this pilot project are the establishment of the first large short-timing cold storage in Germany, the operation of the CHPC Plant with storage, the comparison between planning and operating measures and the introduction of this technology in Germany
- Computation of gravel-water reservoirs

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STANDARDS AND GUIDELINES

www.beuth.de

ENV 12977-1:2001-10

Thermal solar systems and components - Custom built systems - Part 1: General requirements

DIN V ENV 12977-3:2001-10

Thermal solar systems and components - Custom built systems - Part 3: Performance characterisation of stores for solar heating systems

VDI 4640 Part 3: 2001-06

Utilization of the subsurface for thermal purposes - Underground thermal energy storage