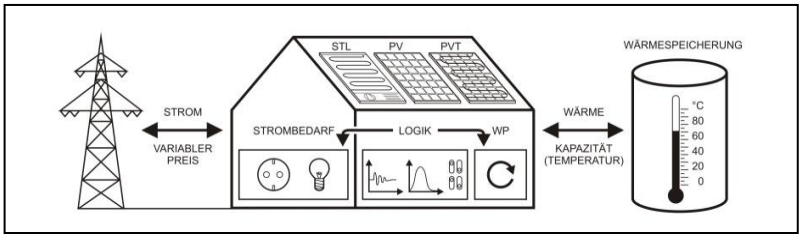
Heating and Electricity Supply Based on Renewable Sources

”Sol2Heat” Combines a Heat Pump with Thermal Storage Systems, Photovoltaics, Time-depending Electricity Costs, and Smart Control



Concept visualization: Time-depending electricity costs, local electricity production, heat pumps, and thermal storage systems are combined via a smart control. (Graphics: fbta KIT) ((Legend: Strom = Electricity, Variabler Preis = Variable costs, Strombedarf = Electricity consumption, Logik = Logics, WP = Heat pump, Wärme = Heat, Kapazität = Capacity, Temperatur = Temperature, Wärmespeicherung = Heat storage, STL = Solar thermal/air collectors, PV = Photovoltaics, PVT = Photovoltaic/ thermal collectors))

KIT Energy Center: Having future in mind

Monika Landgraf
Chief Press Officer

Kaiserstraße 12
76131 Karlsruhe, Germany
Phone: +49 721 608-47414
Fax: +49 721 608-43658
E-mail: presse@kit.edu

The “Sol2Heat” project of Karlsruhe Institute of Technology (KIT) is aimed at coupling heat and power supply, both of which are to be based on renewable energy sources to a maximum extent. The system combines a heat pump with thermal solar collectors as the heat source, modular thermal storage systems, and photovoltaic modules. For this purpose, the scientists develop an integrated energy management scheme, by means of which local consumption is largely adapted to fluctuating power production and power costs that vary with time. “Sol2Heat” allows for the direct use of the electricity produced by photovoltaics and for reducing the grid load.

The increasing share of renewable energies in Germany is associated with big challenges in power supply. As power production from the regenerative sun and wind fluctuates with time, differences between supply and demand have to be balanced. Electricity can be stored in thermal storage systems charged by heat pumps.

The “Sol2Heat – Intelligent Production and Storage of Solar Heat and Power to Increase Solar Power Fractions in the Grid and Enhance Load Management” combines a heat pump-based heating system with photovoltaics and a smart control. “In this way, heating

and power supply can be coupled, primary energy use can be minimized, and CO_2 emissions can be reduced," Project Head Tillman Faßnacht of the Building Science Division of KIT explains. The scientists connect the heat pump-based heating system with photovoltaic modules that convert solar energy directly into electric energy. Alternatively, they use PV/T modules combining photovoltaic cells with solar thermal collectors for the production of electricity and heat from solar energy. An innovative modular thermal storage system takes up excessive heat and keeps it available for use.

Moreover, the researchers develop an integrated energy management scheme. It covers all thermal storage systems, including the mass of the building, as well as the heat pump, the photovoltaic or PV/T system, and household appliances. Furthermore, it considers incentives of the utilities, such as power costs that vary with time. The work is aimed at maximizing the share of solar power in the energy supply of the building, minimizing operation costs, and reducing grid load. Both energy supply of the individual building and integration into the entire energy system based on renewable sources benefit from the smart combination of technologies.

Within the framework of the project, the simulation study made focused on the use of PV or PV/T modules in the system envisaged. According to the study, use of PV/T modules instead of solar thermal/air collectors applied so far causes the power consumption of the system to increase. But thanks to electricity production by PV/T, the resulting annual power consumption from the grid is far smaller. The basic control strategy designed for coupling the system with PV/T collectors ensures optimum storage of locally produced power in the form of heat.

The "Sol2Heat" project is coordinated by the Building Science Division of KIT. Project partners are Consolar (www.consolar.de), a manufacturer of heating systems, the engineering office Bickele & Bühler (http://ibb-stuttgart.de/), and the Research Center for Information Technology (FZI; www.fzi.de). The project is funded by the Federal Ministry for Economic Affairs and Energy (BMWi).

The Karlsruhe Institute of Technology (KIT) is one of Europe's leading energy research establishments. Research, education, and innovation at KIT foster the energy turnaround and reorganization of the energy system in Germany. For this, KIT links excellent competences in engineering and science with know-how in economics, the humanities, and social science as well

as law. The activities of the KIT Energy Center are organized in seven topics: Energy conversion, renewable energies, energy storage and distribution, efficient energy use, fusion technology, nuclear power and safety, and energy systems analysis. Clear priorities lie in the areas of energy efficiency and renewable energies, energy storage technologies and grids, electric mobility, and enhanced international cooperation in research.

The Karlsruhe Institute of Technology (KIT) is a public corporation according to the legislation of the state of Baden-Württemberg. It fulfills the mission of a university and the mission of a national research center of the Helmholtz Association. Research activities focus on energy, the natural and built environment as well as on society and technology and cover the whole range extending from fundamental aspects to application. With about 9400 employees, including more than 6000 staff members in the science and education sector, and 24500 students, KIT is one of the biggest research and education institutions in Europe. Work of KIT is based on the knowledge triangle of research, teaching, and innovation.

This press release is available on the internet at www.kit.edu.

The photo of printing quality may be downloaded under www.kit.edu or requested by mail to presse@kit.edu or phone +49 721 608-4 7414. The photo may be used in the context given above exclusively.