Sunny Partnership

Cooperation in the field of renewable energies: scientists from the Fraunhofer Institute for Solar Energy Systems and MIT are to research the environmentally friendly energies of the future

By Bernward Janzing


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The concentration of expertise in the field of solar energy is greater in the south-west of Germany than anywhere else in Europe. The Fraunhofer Institute for Solar Energy Systems (ISE) in Freiburg, on the Black Forest foothills, is the largest solar research institute on the continent. More than 600 scientists, including some 140 doctoral and diploma students, work here on an area covering more than 18,000 square meters. Now the Freiburg-based solar experts have launched a transatlantic collaboration project on an unprecedented scale. Together with the Massachusetts Institute of Technology (MIT), the ISE researchers have founded the Fraunhofer Center for Sustainable Energy Systems. It will be located adjacent to MIT. Professor Hans-Jörg Bullinger, President of the Fraunhofer Society, regards the German-American science partnership as proof of the quality of German research: "This new collaboration shows that our know-how is highly regarded – even at the elite universities in the United States."

According to Eicke Weber, Director of the ISE, the market for solar energy is still somewhat underdeveloped in the US, and this is why they want to "make a contribution that could generate dynamic growth" together with the researchers at MIT. The new center is also designed to open up new prospects for the German solar industry. As Roland Schindler, one of the heads of the new institute, explains: "It will also help German enterprises enter the US market." Nolan Browne, Director of Business Development for Energy Sectors at the new Fraunhofer facility, is convinced that MIT will benefit from this cooperation: "We aim to build a bridge between research at MIT and successful commercialization."

This is an aim that the ISE has already achieved. The Freiburg scientists have been extremely successful in linking highly professional basic research with industrial contracts. Only a fifth of the annual budget of over 30 million euros is still covered by institutional funding. The rest comes from project funds provided by either public investors or industry; the latter now generates a third of turnover.

The whole spectrum of solar energy

For ISE head Eicke Weber the close cooperation with the USA is a logical continuation of his previous German-American career. He lived in the US for 23 years before taking over as head of the ISE in July 2006. From 1983 Eicke Weber, who is now 58, taught materials science at Berkeley University in California. Former colleagues are now the institute director's cooperation partners at MIT.

The Fraunhofer ISE covers the whole spectrum of solar energy – from photovoltaics to solar heat, from energy storage to building-services engineering, from optics to materials research and the optimization of manufacturing processes in the solar industry. The first joint research projects with the US partners will involve

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Transatlantic Excellence

Two of the world's largest research institutions, the Research Center Jülich and the Oak Ridge National Laboratory, have agreed to work together in the field of fuel-cell technology

Their research findings regularly make headlines around the world, their names stand for scientific excellence – and now they want to work together on the propulsion systems of the future: Both research institutions intend to jointly develop materials and methods that will make possible cheap and powerful fuel-cell systems for use in vehicles and electricity generation. In concrete terms, the two partners want to help each other in the analysis of materials. The Oak Ridge National Laboratory offers outstanding capabilities in imaging processes for materials research and in chemical analyses of solid bodies and surfaces, while the Research Center Jülich is a leading authority in direct methanol fuel-cell technology – in other words, in the development of materials, the production of cells and cell stacks as well as the construction of complete systems. Jülich has the largest group of scientists worldwide working in public fuel-cell research. In 2007 the Research Center presented a prototype of its fuel-cell system for palletlifting carts. A fuel cell directly converts the chemical energy of liquid methanol into electrical current for the motor. Long charging periods are no longer required and the cart can be refueled in a few minutes.

intelligent switches and software programs that optimize the output of solar modules. The two partners also want to simplify the production and installation of solar energy plants to make solar energy generation more economical. Moreover, the scientists at the future Fraunhofer Center for Sustainable Energy Systems intend to devote their attention to alternative energy technologies such as fuel cells.

One focus of research at the new institute near Boston, however, will be energy-efficient construction techniques. Experts believe that US demand for advanced building technologies will grow in the coming decades because of rising energy prices. The ISE has the expertise to take on such a task, says Roland Schindler. "We have years of experience with new buildings and refurbishing old ones – especially in the fields of heat insulation and reducing electricity and heating costs." Up to now the ISE's research and work has been limited to Europe. In the USA "we will have an opportunity to get to know and learn to deal with very different and very varied climatic conditions," Schindler explains.

The institute's building, completed in autumn 2001, is an excellent example of this. The design looks simple from the outside, but in fact it's a highly ingenious scientific project. Energy consumption per square meter has been considerably reduced compared to conventional new buildings. The energy required for heating is only about 50 kWh per square meter per year, and the construction costs were similar to those of conventional buildings. A geothermal heat pump provides warm air in winter and cool air in summer. Outside air is fed into the rooms through plastic ducts buried six meters underground – a depth that is pleasantly cool in summer and still relatively warm in winter.

Sunlight could be used for heating

Of course, solar energy is also used in a wide variety of ways. The hot water in the canteen comes from solar panels, 200 square meters of photovoltaic modules are enough to provide all the power needed for electric lighting. Thanks to the architectural design, the solar cells were creatively integrated into the building: framed in glass on the south-facing façade, they prevent the rooms from becoming overheated in the summer, while still letting in daylight. The rooms were also designed to optimize the use of daylight and minimize the need for artificial light. For one thing, the favorable proportions of the rooms mean that none of the offices are wider than five meters. For another, the special glass skylights in the ceilings redirect incident sunlight to lighten up the workplaces. The ideal positioning of windows was very precisely simulated during the planning phase so that sunlight could also be used for heating.

All in all, the building features some smart ideas that save the Freiburg institute enormous costs – and are bound to cause a major stir in the USA, too. ■