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Photovoltaic innovations from site analysis to system optimisation: Intersolar Award for young enterprises and new solutions

2009/06/22

Approximately 60 000 visitors from over 150 countries seized the opportunity at the end of May to access information on products and services of the international solar industry at the Intersolar 2009 in Munich. 1 417 exhibitors made an important statement for the sector and its international development at the world's largest specialised fair for solar technology. In nine exhibition halls and the open-air area of the new fair premises in Munich more companies than ever before displayed innovations and proven technology on 104 000 square metres of exhibition area. "Even ahead of the fair we've seen many highly innovative products and systems – in the submissions for the Intersolar Award as well as in the presentations delivered at the Innovation Exchange. As leading international fair Intersolar is used by the exhibitors to publicly present their innovations for the first time," says Markus Elsässer, Managing Director of Solar Promotion GmbH, one of the two organisers of Intersolar 2009.

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In order to ensure international visibility for innovations and successes of the fair, the Intersolar Award was this year granted for the second time to honour particularly innovative products and services. Six pioneering technologies were awarded the Intersolar AWARD in the categories "Photovoltaics" and "Solar thermics".



Photo: Solar Promotion GmbH

The Intersolar Award honours technological innovations in photovoltaics and



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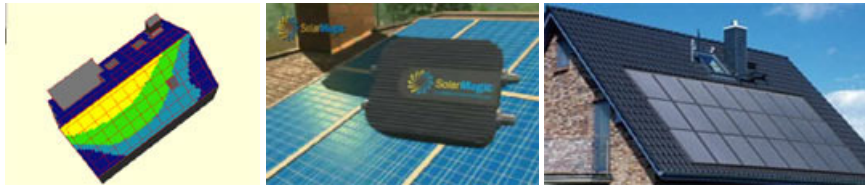
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solar thermics.

In the category Solar System of the Month, Solarserver is proud to present the excellent photovoltaic innovations of Aerowest GmbH (AeroSolar software), National Semiconductor Corp. (SolarMagic energy management) and SOLON SE (SOLON Black 160/05 photovoltaic in-roof system) after a first review. The recipients of prizes in the category of solar thermics, NEP Solar Pty Ltd, RESOL Elektronische Regelungen GmbH and Ritter Energie- und Umwelttechnik GmbH und Co. KG, will be introduced in a separate feature.



Analysis of AeroSolar potential; "SolarMagic"; SOLON Black 160/05.

AeroSolar calculates solar power potential and outputs without local time

From a total of 45 applications, of which 11 were received from abroad, the photovoltaic adjudicators honoured three companies with the Intersolar AWARD. Aerowest GmbH from Dortmund, that compiles high-resolution aerial images, received the prize for its AeroSolar software which is currently the only system with which calculations can be done, without a specific local time, whether a photovoltaic system on a certain roof will be financially viable. For this purpose AeroSolar compiles a 3D image of the roof surfaces and then calculates how much solar power can be produced with a certain roof system. Local specifics such as hours of sunshine or shading through trees or other parts of buildings are taken into consideration in such calculations.



On the basis of high-resolution aerial images AeroSolar calculates output and economic viability of solar power roof systems. Photo: Aerowest GmbH.

With an aircraft Aerowest GmbH captures high-resolution geo-data with an accuracy of two to five centimetres, which is then transformed into three-dimensional building models. On this basis AeroSolar compiles detailed 3D presentations of roof surfaces with a specially developed radiation model. With consideration of the shading, a radiation balance is then compiled which contains radiation development throughout a day as well as throughout the entire year with reference to the hours of sunshine. The results provide not only comments on the possible output of a solar power roof system, but also on its economic feasibility.

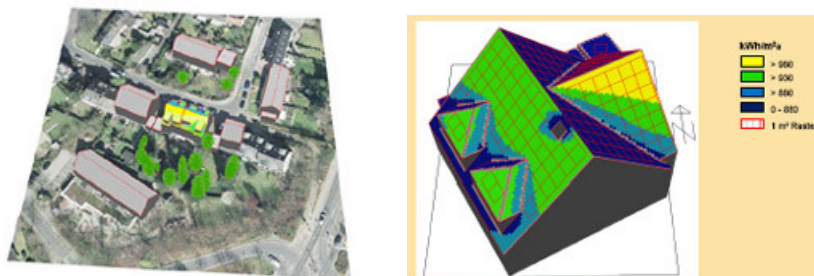
Modelling on the basis of 3D city models

The AeroSolar procedure is based on a holistic approach that links the exact 3D models with the differentiated radiation model simuSolar that provides high accuracy in terms of time data and spatial data. All relevant roof surfaces in the area of investigation are captured, taking into consideration the specific location and geometrical data. In order to accurately determine varying shading effects at different times, every individual surface is divided into partial surfaces with a side length of 0.5m for which, in turn, the annual radiation potential can be calculated to the minute.

Parameter sets for any roof surface; detailed analysis

for individual properties

For every roof surface the spatial surface area as well as the direction and pitch are determined. The radiation values are stated in Kilowatt hours per year. Potential radiation corresponds with the value that can be theoretically achieved. Average radiation describes the average total radiation of all partial surfaces with due consideration of shading. Minimum and maximum radiation indicate the lowest and highest radiation value of any partial surface in relation to the respective roof surface under investigation.

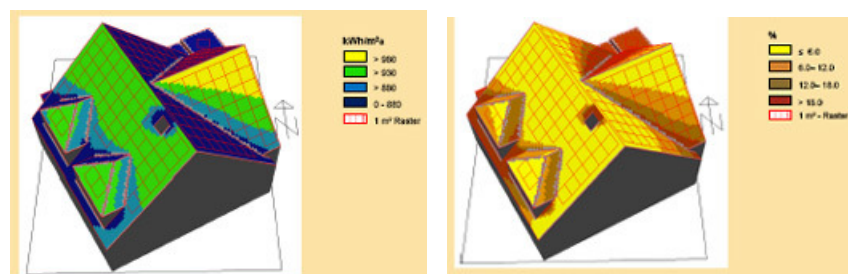


Left: 3D aerial photograph. Right: Solar radiation on an individual building. Graphics: Aerowest GmbH.

With the patented AeroDach dimensioning procedure every individual object can be measured very accurately and can be modelled three-dimensionally with all detailed structures. For example, the calculation of potential takes into consideration all superstructures and dormer windows in their geometrical shapes and can allow for more concrete planning of systems. The calculation of output and economic feasibility for systems of various sizes and degrees of efficiency with due consideration of solar power feed-in tariffs in terms of the German law on renewable energies is done on the basis of the so-called performance ratio of the PV system, i.e. the actual electricity produced with the solar generator. Thus this procedure does not only provide assistance in deciding for or against the construction of a solar power system, but also provides a well-founded basis for planning the ideal location of the modules and the economic operation of a photovoltaic system.

New opportunities for city planning and distribution

Besides the calculation of potential and economic feasibility, AeroSolar provides new opportunities for city planning and distribution: thus, for example, owners of suitable buildings can be directly approached, or city-wide solar land registers can be compiled. Furthermore, AeroSolar calculates the potential available in residential areas of a certain larger district. Currently city databases with about 6 million buildings in Germany are available; an extension and geographical expansion to the neighbouring country (The Netherland) has already been planned.



Analysis of solar potential: total annual radiation (left) and percentage decrease of direct radiation through shading (right). Graphics: Aerowest GmbH.

SolarMagic increases solar power output under difficult circumstances

The American company National Semiconductor Corp. received the Intersolar AWARD for the SolarMagic Power Optimizer that minimises energy losses of photovoltaic systems caused by environmental conditions. The device increases solar power output of PV roof systems that are partially located in the shade of trees or chimneys or that are negatively affected by pollution (e.g. fallen leaves). SolarMagic offers house owners immense potential to utilise roof surfaces that were categorised as unfeasible so far, the adjudicators emphasised. In addition, SolarMagic technology can also be retrofitted to systems that have been in operation for many years in order to improve their energy yields.



More flexibility in planning systems

In order to maximise energy yields National Semiconductor developed the SolarMagic Power Optimizer with which every individual photovoltaic module can produce maximum solar energy, even while other modules do not achieve their full performance. SolarMagic, however, does not only compensate energy losses, but also allows more flexibility for fitters when they design the fitting of new PV systems, for example, by configuring modular strings of different lengths or by combining modules of different manufacturers.

Additional locations of PV systems

By compensating energy losses in challenging application sites, SolarMagic technology ensures that PV systems become of interest at more locations. So far many locations were discarded because of their problematic conditions. SolarMagic technology now allows the problems to be alleviated and thus the photovoltaic market to be expanded by making available practical solutions to more users.



SolarMagic demonstration at the Intersolar 2009; Brian Halla, CEO of National Semiconductor, is happy to receive the Intersolar Award. Photos: National Semiconductor Corp.

More reliable, stronger systems

SolarMagic technology increases energy yields with the help of electronic circuits and advanced algorithms in conjunction with mixed-signal technology. In this way, the supplier claims, up to 57% of the energy losses caused through mismatching can be compensated. The outputs delivered by the various modules to the inverter are processed which counters many reliability problems, e.g. transient voltage. PV systems equipped with SolarMagic technology thus achieve higher long-term reliability.

Field experiment proves that over 54% of energy losses are compensated

National Semiconductor reports that field experiments conducted at the company HaWi Energietechnik AG in the Bavarian town of Eggenfelden showed that SolarMagic can compensate for 54.4% of the energy lost through partial shading. The test was carried out from April to May 2009. In the investigations done at HaWi a conventionally cabled PV system was partially shaded by a construction that simulated visual obstructions. For the analyses a test and a control system were configured, each consisting of two strings with four Schott Solar ASE-300-DGF modules each. The strings fed into a Mastervolt QS6400 inverter. Output data was collected with a Meteo Control System with a measuring accuracy of $\pm 5\%$. Although the shade affected only 16 to 20% of the modules, the average energy loss amounted to almost 28%. An identical system that was, however, fitted with SolarMagic Power Optimizers on average delivered 7 to 21% more solar power under identical conditions, which compensated for 54.4% of the losses, National calculates.

"SolarMagic Power Optimizers offer an innovative solution to the problem of mismatching between panels, which the PV industry has been battling with since its inception," Hans Wimmer, Chairperson of the Board of HaWi Energietechnik AG explains. "Their simple integration is particularly impressive. Since this technology is not bound to specific modules, we can easily fit it in new and existing systems, regardless of who the manufacturer of the specific panels is."

Solon Black: attractive modules for new and older roofs

The Berlin-based company SOLON SE developed the photovoltaic in-roof system SOLON Black 160/05 that can replace conventional roof tiles completely and that was awarded the Intersolar Award. This easy-to-install complete system is also suitable for older roof trusses because of its low weight. Special features of SOLON Black 160/05 are the completely black modules, the black side panels as well as the black polyurethane frame that combine to form an attractive aesthetical feature.



Photovoltaic in-roof system SOLON Black; Modules with black frame and black side panels. Photos: SOLON SE

SOLON Black 160/05 is manufactured from black, monocrystalline solar cells on a black backside Tedlar film. The black frames and sides round off the attractive, homogeneous design of this system. The adjudicators justified their decision in favour of SOLON Black 160/05 as one of three equally ranked winners by the wide scope of application of this module. Its simple assembly, its attractive optical appearance and its light weight contributed to new roof surfaces becoming available for photovoltaic systems – even on roof beams that were thus far not considered strong enough for conventional roof-mounted systems. The equal load distribution without any lumped loads and the low overall weight allow for installation even on older buildings.



The polyurethane frames of the individual modules overlap similar to roof tiles. Photos. SOLON SE

Solar modules replacing roof tiles

Furthermore, the adjudicators were convinced by the innovative polyurethane frame. Together with Bayer MaterialScience AG, SOLON SE developed a special process to manufacture this solar module with this particular frame. The boring holes in the frame allow direct, rapid assembly by screwing these modules onto the roof battens. No additional substructure rails, aluminium rails and module clamps are required. In addition, the polyurethane frames of the individual modules overlap similar to roof tiles and thus make this system part of the water-carrying layer; water can run off easily. The side panels that are a standard feature ensure connection with all common tiles or roof tiles. SOLON Black 160/05 can achieve a maximum output of 180 Watt peak, which corresponds to a degree of effectiveness of 14.06%. SOLON provides a performance guarantee for 25 years on its modules.

Author: Rolf Hug, Editor: Solarserver. Material and illustrations: Intersolar 2009; Aerowest GmbH, National Semiconductor Inc. SOLON SE

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