

PV



in The Built Environment

December 2000

UK Activities for Task VII of the IEA Photovoltaic Power Systems Programme

This newsletter is the sixth in a series designed to inform those interested in Building Integrated Photovoltaics (BIPV) of recent activities associated with the IEA Task VII – PV in the Built Environment. It summarises the latest developments in building integrated photovoltaic systems including activities undertaken in the UK under the DTI PV programme, actions on-going within Task VII and some major international projects and programmes.

The Solar Office - First Monitoring Results now out

Akeler's 4600m² Solar Office at Doxford Business Park, with its innovative architecture and its combination of low and renewable energy design, was completed in March 1998. It was then and still is a unique project.

The design includes an imposing 640m² PV façade. For two years now, from April 1998 to



March 2000, the building has undergone detailed monitoring of the integrated array, carried out by the project's lead designer, Studio E Architects. The results speak for themselves:

The PV array has generated a total of 113,000kWh during the two-year monitoring period, which compares well with the design prediction of 55,000kWh per year.

An on-site computer recorded the values of irradiation, ambient temperature, input and output power as average values over 10 minutes. The Newcastle Photovoltaics Applications Centre downloaded these data on a weekly basis and analysed them.

Nine different types of module are used, all with multi-crystalline cells but with different cell densities in the modules. The average module efficiency is 11.3%. The overall system efficiency is 8% which is about the expected level considering the usual losses in the cabling and inverter, module mismatch, temperature effects, periods of very low insulation and soiling.

The modules are wired in four sub-systems with two 35 kW three phase inverters and two 1kW single phase inverters. It is usual to derate the inverter in climates where low light levels are prevalent in order to improve overall efficiency.

Early operational problems at the Solar Office, which were due to inverter failures, were causing intermittent output. But since these have been resolved the system has been operating without further problems. The only other reliability problems were data loss caused by failures of the monitoring computer. Apart from that, the system performed with excellent reliability.

Quality standards for the PV modules caused some more concerns. No standards for cell alignment, entrapment of air bubbles and tears in the cells existed so far, so contractor and designer had to devise an ad hoc standard.

Another experience gained during the construction was the importance of harmonising the warranties offered by PV

manufacturers and installers and co-ordinating the delivery of the components.

But overall, the project exceeds its design predictions and demonstrates that integrating photovoltaics into commercial buildings is not only possible, but also an acceptable practice for speculative developers.

A report on the Doxford Solar Offices project is due to be published by ETSU at the end of December 2000. The report, which will be available from the ETSU Enquiries Bureau, provides a commentary on the design, construction and commercial issues encountered during the course of the project and presents the findings of the monitoring work.

The building has now been occupied by the company Domainnames.com.

It is anticipated that some assessment of the building in use will be carried out.

Engineering Recommendation G77

Earlier this year the Electricity Association published guidelines for connecting domestic-sized PV systems (below 5 kW) to the distribution network. These guidelines are known as Engineering Recommendation G77.

G77 has been published with an 18 month 'bedding in' period to allow an opportunity for feedback from the electricity supply and PV industries before it is formalised in the Distribution Code. The DTI are funding a project, led by Halcrow Gilbert, to continue liaison between the electricity supply industry and PV industry and gather feedback during this period.

The next meeting of the G77 Working Group will be held in January 2001. Any comments from installers or other 'users' of the G77 guidelines should be sent to Jim Thornycroft (thornycroftjm@halcrow.com) before the 16th January for consideration at the meeting.

It is important that industry takes this opportunity to play an active role in the development of suitable and workable guidelines for connection.

At the last meeting of the G77 Working Group in October 2000, it was agreed that further work was required on the issue of whether inverters using solid-state switching should be permitted in the UK. This is critical to the acceptance of **AC Modules**. These are currently not approved for connection in the UK. Work to define a suitable test procedure for the automatic protection of an inverter and other issues pertinent to the connection of AC modules, will be funded under a new DTI project anticipated to begin in February.

AC Modules represent a potentially large market in the UK because they reduce the cost of entry for homeowners to a price comparable to that of purchasing a new computer and, since they do not require any DC cabling, are easier to install. However, they must conform to the same standards for safety and power quality as other PV systems.

Metering Arrangements

Although the electricity exported from a PV generator to the network will be used locally it currently incurs the full distribution use of system charge and thus the owner typically receives 2 p/kWh or less.

Earlier this year, TXU Europe introduced the first **net metering** scheme in the UK whereby generators received the full supply value (5.51 p/kWh) for the electricity they exported to the network. While net metering is not justified as a theoretical principle upon which to base network charging it may be that the costs of setting up individual contracts may be greater to DNOs and suppliers than an agreement to net-meter.

A Working Group was set up in March this year by the DTI and OFGEM to examine technical, commercial and regulatory issues relating to the network

connection of embedded generation. This Group has recently published a paper entitled: 'Issues for Domestic and Other Micro-Scale Generation' which outlines a range of possible metering arrangements for generators such as PV. This paper will be presented to Ministers before Christmas and will be included in a Government consultation document due to be issued early next year.

The price that PV generators receive for the electricity they export will also benefit from the **Renewables Obligation** on suppliers. Under the proposed Obligation (www.dti.gov.uk/energy/index.htm) generators will receive up to an extra 3 p/kWh for eligible renewables, which includes PV.

Ventilated PV Panels

Housing an exhibition hall, restaurant and classroom, the Brocks Hill Millennium Park Visitors' Centre near Leicester is situated in a wood and farmland park created for the community by Oadby & Wigston Borough Council.

Using a unique combination of renewable energy sources and low energy design features, the newly opened building is a model of sustainable development.

The building is heated and ventilated by an air-handling unit that supplies tempered air via low-level displacement units.



Distinctive, however, are the heat sources used by the system.

If conditions are right and heating demand cannot be met solely by recovering heat from the extract air, the fresh air is preheated by diverting it through a series of channels that run beneath an array of roof-mounted PV panels that supply part of the Centre's electricity. This is the first time ventilated PV panels have been installed in the UK.

A customised thermal store provides a further source of heat. The stratifying thermal store has three independently controlled sources of supply: the ventilated PV panels (via an air-to-water heat exchanger), a conventional evacuated tube solar water collector and a dual-fuel boiler that will run on wood or oil.

The building and its energy performance are to be monitored by the Institute of Energy and Sustainable Development. The monitored data can be viewed on the IESD website: www.iesd.dmu.ac.uk/mpwww/

Workshop on Urban PV

In the UK most activity has been on building integrated PV, but in other countries attractive designs are being developed for other structures in the urban environment. These applications were the subject of a workshop held under the auspices of Task VII in Stockholm in September this year.

The two broad types of PV systems were discussed. One was grid-connected systems on structures such as car ports and canopies over station platforms. The second was stand-alone systems used where, for example, the cost of the PV system is less than the cost of digging up a street for a grid connection.

Attractive designs were presented in both categories. Several European manufacturers are developing standard products such as illuminated stop signs, timetables and shelters for buses and trams, parking meters, highway signs and advertising displays.

A report on the workshop with information on the many products and designs presented there will be published shortly. See the Task VII website or contact Halcrow Gilbert (halcrowgilbert@halcrow.com).

DTI PV Programme Activities

This section briefly reviews some of the on-going projects managed by ETSU under the Department of Trade and Industry's Photovoltaic Programme. The emphasis of the programme is on gaining an understanding of the opportunities for, and barriers to photovoltaics so as to inform industry and government. Building integrated applications are one of the priority areas identified within the programme.

DTI Call for Proposals

Proposals for research and development projects are now being sought by the DTI's New and Renewable Energy Programme, managed by ETSU. The priority areas for solar projects are as follows:

1. Projects to develop and evaluate innovative approaches that offer the prospect of improvements in the basic cell or module technologies, with the goal of improving performance and/or reducing the cost.
2. Projects that develop and evaluate innovative approaches that offer the prospect of improvements to production processes, with the goal of improved competitiveness.
3. Projects to develop and evaluate innovative approaches that offer the prospect of improvements in the balance of system technologies, such as power conditioning equipment, metering, wiring and installation systems.
4. Research and development to evaluate innovative applications of photovoltaic systems, including stand alone systems.

Outline Proposals must be received at ETSU by 11.00 a.m. on Thursday 25th January 2001.

Electronic versions of the proposal pack, including application forms, are available in Word 97 format; please e-mail Colin.Bough@aeat.co.uk for an electronic copy. Should you require a paper copy, please contact Colin Bough on 01235-432522.

Domestic PV Field Trial

The Call for Proposals for the recruitment of project teams to install and monitor systems within the domestic PV field trial was undertaken in May 2000. By the deadline date of 20th July 2000 a total of 25 proposals had been received for the domestic PV field trial. The total requested DTI contribution to the projects amounted to £4.5m. The proposals were comparatively assessed to select projects to install at least 100 PV systems.

Nine projects were selected which include a variety of geographic locations, PV technology, integration method, newbuild and refurbishment installations, housing and household characteristics. More details on the projects selected will be available when the contracts have been finalised. The recruitment of all nine projects will involve a DTI contribution of £1.4 million for the installation of 221kWp of PV to 166 dwellings.

If you would like to receive information bulletins on the progress of the field trial please contact:

Ian Butterss, BRE Ltd. Garston, Watford, WD2 7JR
ph. ++44 (0)1923 664552
fax ++44 (0)1923 664097
email: butterssi@bre.co.uk

Electra-Slate

The report covering the development of the new Electra Slate by Intersolar, which was co-funded under the DTI New and Renewable Energy Programme, is now available from the ETSU N&RE Enquiries Bureau.



The main objectives of the work were to produce a design specification, develop a prototype, evaluate and start pilot production of a

low-cost roofing slate. Intersolar, working with partners PV Systems Ltd. and support from Alfred McAlpine, have completed this development project over the period June 1999 to July 2000.

The product has been designed to physically resemble a Welsh slate, with each Electra-Slate producing 46V, 1.4Wp. The Electra-Slate is simple to install and can be installed by a roofer with no PV experience, and no special training.

For Further Product Information Please contact:
PV Systems, Tel: +44 (0) 29 2082 0910

Publications

Practical guidance is now available for architects, specifiers and building services engineers who are considering including photovoltaic systems in their buildings. The Chartered Institute of Building Services Engineers (CIBSE) has produced a wide-ranging guide, which will give readers a thorough understanding of the considerations, and enable them to provide high quality systems.

Installation constraints and opportunities together with the dos and don'ts of design and installation practice are combined in this guide that also includes recommendations on the installation process, the skills required and safety aspects. Case studies of existing systems are used to demonstrate some of the lessons learnt so far.



“Understanding building integrated photovoltaics” is priced £20 for CIBSE members and £30 for non-members and is available from Publication Sales, CIBSE, 222 Balham High Road, London SW12 9BS. Tel: 0208 675 5211, Fax: 0208 675 3302, e-mail: pubsales@cibse.org

Future Events

	Date and venue	Description of Programme
E-World of Energy Trade Fair and Congress	13-15 February 2001 Essen, Germany	Includes all kinds of energy producers Info: Sigrid Fey phone: +49 201 7244532, e-mail: fey@messe-essen.de internet: www.e-world-of-energy.com
PV Building Integration Concepts Workshop	March 2001, (postponed from November 2000) Netherlands	This is being organised by Ecofys, under the auspices of Task VII. Contact Tony Schoen (Fax +31 30 280 8301) for further details.
7 th Annual Int. Sustainable Development Research Conference 2001	5-6 April 2001 Manchester, UK	Info: Elaine White phone: +44 1274 530408, e-mail: elaine@erpenv.demon.co.uk internet: www.erpenvironment.org
Forum 2001 Solar Energy: The Power to Choose	21-25 April 2001 Washington D. C., USA	Info: American Solar Energy Society ASES phone: +1 724 7793003, e-mail: info@mrs.org , internet: www.mrs.org
North Sun 2001 The 9th International Conference on Solar Energy in High Latitudes	6 to 8 May 2001 Leiden, The Netherlands	Visit http://www.northsun.org for more details, conference topics, a pre-registration form and on-line submission of abstracts
Exhibition: Sustain 2001	8-10 May 2001 Amsterdam, The Netherlands	Info: Amsterdam RAI International, Mr Herbert Holtrust phone: +31 20 5491212, e-mail: sustain2001@rai.nl internet: www.sustain2001.com
Solar Energy 2001: World Trade Fair for Renewable Energy	7-9 June 2001 Berlin, Germany	Info: Profair GmbH, Rainer Henzel phone: +49 5121 52486, e-mail: info@solarenergy-berlin.de
17 th European Photovoltaic Solar Energy Conference & Exhibition	22-26 October 2001 Munich, Germany	Info: WIP-Renewable Energies, Stephanie Boeglin phone: +49 89 7201235, e-mail: wip@wip-munich.de internet: www.wip-munich.de
2001 Solar World Congress of the International Solar Energy Society	25 November – 2 December 2001 Adelaide, Australia	Info: ISES 2001 c/o Hartley Management Group phone: +61 8 8363 4399, e-mail: sgt@ozemail.com.au internet: www.eastend.com.au/solar

Thank you to all of you who returned the Feedback Questionnaire issued with the July Newsletter. The response was very positive, and the comments and suggestions will help to ensure that this newsletter remains an informative and useful reference resource for BiPV activities in the UK.