PV in The Built Environment

July 2000

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

This newsletter is the fifth 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.

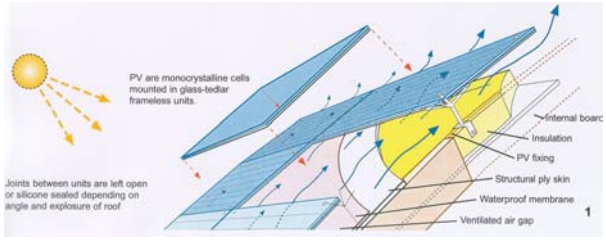
European PV Conference comes to the UK

The **16th European Photovoltaic Solar Energy Conference and Exhibition** took place in Glasgow in May. Early indications are that the Conference was a great success with 1300 delegates and an additional 500 exhibitor's staff, representing a total of 65 countries. The Exhibition was the largest of its kind in the world, signifying the growing commercial interest in PV. In the Conference itself a significant proportion of the papers presented were devoted to the architectural and electrical design of BIPV systems and national strategies for promoting and financing BIPV projects. A copy of the programme and a list of all the exhibitors can be found on the website: www.wip.tnet.de/pv00.htm. The Proceedings will be published by James & James.

Innovation in BIPV Design

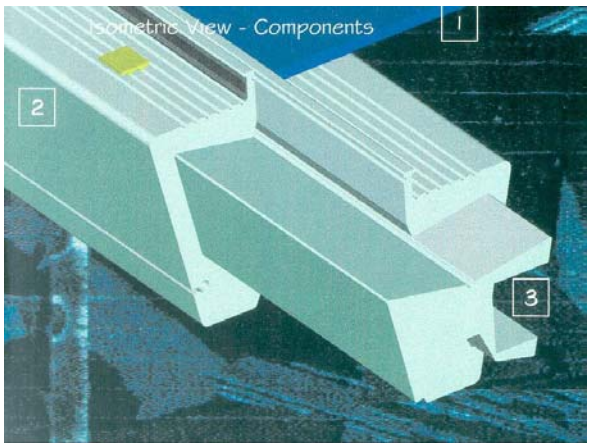
The results of the **Task VII Design Competition** were announced at the Glasgow Conference. The Competition was launched to generate new ideas and concepts for integrating PV into the built environment and attracted entries from architects, engineers, designers and students from 10 countries. Short-listed entries were exhibited at the Conference and the final winners were selected by an international, invited panel of experts.

The overall winner was Robert Webb of Robert Webb Associates (UK) for his design for PV panels as a ventilated rainscreen system over a lightweight, stressed-skin timber construction.



The judges admired the overall concept for the building and its consideration for environmental and passive solar issues in addition to electrical generation.

The overall student winner was Andrew Weight of Reading University for his PhotoFIT design.



This used an innovative profile system as the module frame. It aimed to minimise costs by simplifying installation requirements in terms of components, complexity and time.

Visitors to the Exhibition were also invited to vote for their favourite entry. The Exhibition prize went to Peter Schurch, Jorn Jurgens, Hubert Bittner, Taroni Gianpietro, Stephen Kormann and Pizzoferrato Adelmo of Halle 58 Architekton (Switzerland) for their design of a Solarsail. This was closely followed by the triangular module design submitted by Rogelio Leal Cueva and Tomas Markvart of Southampton University.

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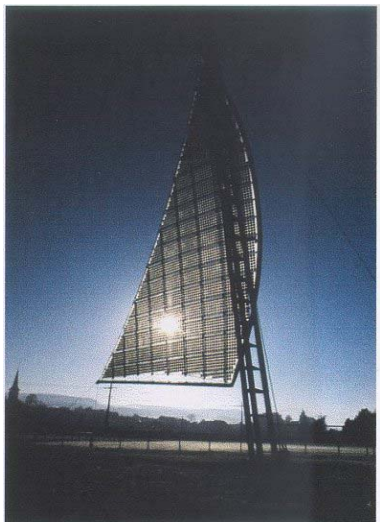
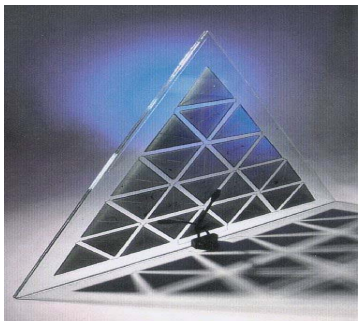




Prizes were also awarded to the winners of the different categories and the full results are published on the Task VII website (www.task7.org/). The prizes were presented by Roberto Vigotti, former chairman of the IEA PVPS programme, during the Conference. Contact is now being made with the British student entries to explore opportunities for supporting the development of their ideas.

Growing Range of PV Products

The Proceedings of the Task VII Workshop on PV Building Integration Concepts, which was held in Lausanne (Switzerland) were published in March and can be downloaded from the Task VII website. The Proceedings include a **review of commercially-available PV products and systems** for installing PV on sloped and flat roofs and in building facades. 51 different products are reviewed, based on information provided by Task VII experts who have direct experience of using these products and on manufacturers' data. The range and quality of the products available for integrating PV into buildings is increasing steadily and a second workshop is planned for November. This will take place in the Netherlands.

A comprehensive database of 250 BIPV projects is also available from the Task VII website and EPFL (Ecole Polytechnique Federale de Lausanne) have a web-based version of the Lausanne demonstration site (www.demosite.ch). The Demosite provides an opportunity for suppliers to showcase their products.

PV at the Olympic Village

A joint **Task VII / Task V Experts meeting** took place in Sydney in March. Task V is the working group on Grid Connection of BIPV systems. Holding a joint meeting enabled discussion on a number of issues of mutual concern such as certification of systems, reliability and new electric design concepts. The meeting included a visit to the **Newington ('Olympic') village**, which has been prepared as an inspired example of best practice, ready for the Olympic athletes in August. 629 PV systems, each of 1 kWp, have been installed. Collectively the PV modules will have the capacity to generate one million kWh's of electricity per year. As well as providing a very high profile site for demonstration of BIPV, the project will be used to investigate network issues involved with a high density of small PV generators. In addition to PV, the houses incorporate energy saving features in the design and a solar hot water system.

Reliability of PV Systems

At the 2nd World Solar Electric Buildings Conference, held in Sydney in March, **results from the German 1000 Roofs programme** were presented (from a paper by Hermann Laukamp)**.** Approximately 2100 PV systems were installed under this programme between 1991 and 1995 and, since the programme has been extensively monitored, this represents probably the most comprehensive database on the reliability of BIPV systems. A very broad distribution of energy yields were recorded. This cannot be explained by slight differences in solar irradiation within Germany and so systems with a low yield were inspected and analysed further. Poor performance has been attributed to four main reasons: inverter failure; module output significantly below the nominal STC power; partial shading; and defects in the DC installation causing interrupted strings. However, the modules themselves have shown very few failures (below 0.1 % per year). For full details of the 1000 Roofs programme, contact the Fraunhofer Institut für Solare Energiesysteme (fax +49 761 45 88 217).

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

In April the DTI issued a Call for Proposals for grants to **R&D projects under the New and Renewable Energy Programme**. PV was included in the scope of the Call with cost reduction objectives as a key element. Objectives specific to building integrated PV were:

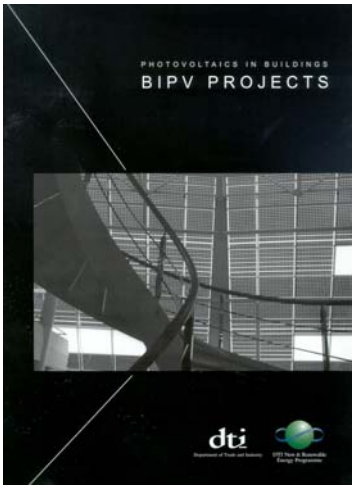
- Projects to develop and evaluate improved PV roofing and cladding systems, that have the potential to achieve commercially competitive cost, performance and durability targets, whilst continuing to meet the design needs of the client industries.

- The evaluation of approaches that improve the cost-effectiveness of BIPV systems through, for example, improved design, implementation, and operation, including, for example, integration with Building Energy Management Systems.

29 proposals were received that related to PV with 11 in the building integrated PV area. Proposals are currently being assessed, with grants to be issued over the next few months.

Design Study Publication

A new report entitled **'BIPV Projects'** was published in April. The report reviews the lessons learnt from the design studies funded by the DTI; highlighting best practice methodologies. It covers sixteen BIPV projects, four of which have been realised, nine are planning to be developed and three were design studies where design for PV installation has been applied to a project not originally considering PV. The purpose of the publication is to review recent BIPV designs and identify issues that have arisen at the various stages of realisation. It is anticipated that the findings of these projects will assist in the development of the next generation of BIPV projects. The publication aims to help clients, their agents, architects, engineers and specialists who are considering developing and in the process of developing PV installations. The publication also provides advice to the PV industry on areas for further development, eg the need to provide more support to designers who are specifying PV and how the procurement process could be eased with the provision of options for a standard range of applications. The publication is freely available from the ETSU New & Renewables Energy Enquiries Bureau, Harwell, Didcot, OX11 0QA, Tel.: 01235 432



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New Guidelines for Grid Connection

The UK Electricity Association has recently published guidelines for connecting PV systems below 5 kW to the electricity distribution network. The guidelines, known as **Engineering Recommendation G77**, have been developed over the past 5 years through a process of consultation between the EA, its member companies and the PV industry. Previously, the connection of PV systems was governed by Engineering Recommendation G59/1. However, this was developed with larger embedded generators in mind that would be connected at 11 kV and above. Publication of G77 provides a simplified connection procedure more appropriate for such small generators. G77 requires the use of a type approved inverter but witnessing of the commissioning of a system is at the discretion of the local DNO.

Copies of G77 can be purchased from Lorraine Taylor at the Electricity Association (tel. 020 7963 5801) at a cost of £30. The underpinning research and industry consultation is set out in two reports that have been recently published by ETSU (ETSU S/P2/00233/REP & ETSU S/P2/00332/REP) and these are available from the New & Renewable Energy Enquiries Bureau. This includes *Pro formas* for applying for connection and commissioning of a PV installation which will shortly be available from the PV-UK website (www.pv-uk.org.uk).

Following publication of G77 it is anticipated that the guidelines will be incorporated into the Distribution Code in about 18 months time, whereupon they will become mandatory for the DNOs. These 18 months will be used as a 'bedding in' period to review the

requirements of G77 in the light of experience from the DTI sponsored programme and other initiatives. The DTI are funding a project led by Halcrow Gilbert to:

- maintain liaison between the Electricity Supply Industry (ESI) and the PV contractors during initial implementation of the G77 guidelines in the field, and thus,

- facilitiate agreement on the final text that will be incorporated into Distribution code in about 18 months time.

EA Technology, the University of Southampton, SunDog, NADA, the Electricity Association and the DNOs are also involved in this work.

Installation Guidelines

There is likely to be a significant increase in the rate of installation of small PV systems connected to the electricity network over the next few years with both the domestic PV field trial, supported by the DTI programme, and the commercial activities of the PV industry.

Field experiences of the UK PV industry, discussions with the ESI, and feedback from international liaison all suggest that attention should now also focus on appropriate methods of installing systems. Potential safety issues that could arise from the design and use of PV systems should be addressed and guidelines on system installation produced. Other work in the UK has identified the following additional issues that need to be resolved:

- Fire resistance of PV modules and mitigating hazards to emergency services
- Lightning protection
- DC wiring – voltage levels and components selection
- AC modules and DIY installation
- Installation procedures and practices

Consequently ETSU is setting up a DTI funded project to identify and authoritatively research all safety and installation issues surrounding PV systems which will result in **practical information targeted at the needs of installation contractors** - with a particular emphasis on domestic PV systems.

Future Events

	Date and venue	**Description of Programme**
8th Task VII Experts meeting	4-5 September Stockholm, Sweden	This will be followed by a Workshop on PV in Non-Building Structure (6 September)
'PV Hybrid Power Systems 2000' Conference	7-8 September Aix-en-Provence, France	To register contact: e-mail:congres@aixenprovencetourism.com internet:www.aixenprovencetirism.com Registration fee: 300 Euro (150 Euro for students)
6th European Conference 'Solar Energy in Architecture and Urban Planning'	12-15 September Bonn, Germany	Info. Eurosolar, Tel +49 228 36 2373; Fax –1279, e-mail: inter_office@eurosolar.org
International Solar Energy Society's (ISES) Millennium Solar Forum 2000	17-22 September Mexico City, Mexico	Contact: Claudio Estrada: Fax: +52 (73) 250 018 e-mail: ises2000@mazatl.cie.unam.mx
Solar Millennium Congress	25-28 October Toulouse, France	Contact: European Solar Council, Fax +33 1 441 80 036
PV Building Integration Concepts Workshop	November Netherlands	This is being organised by Ecofys, under the auspices of Task VII. Contact Tony Schoen (Fax +31 30 280 8301) for further details.

Note: Task VII of the IEA Photovoltaic Power Systems programme is due to finish at the end of 2001 and it is anticipated that the next 18 months will be particularly productive as the Task publishes the results of its research.