



PV POWER

Newsletter of the IEA Photovoltaic Power Systems Programme

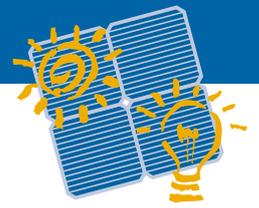


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Job creation, a cleaner environment and increased domestic energy security are some of the outcomes expected from implementation of the new US PV Industry Roadmap. See page 5. [PHOTO GE/ASTROPOWER]



ALLIANCE FOR RURAL ELECTRIFICATION

While Europe is currently the hot market for PV, with more than enough local business to keep manufacturers and suppliers busy, it is encouraging to see that the PV industry, led by the European Photovoltaic Industry Association (EPIA), has not forgotten other parts of the world where per capita energy use – and financial incentives – are much smaller, but the need for reliable energy services is far greater.



PHOTO: IEA

EPIA, which joined the IEA PVPS programme as a full member towards the end of 2004, has recently initiated the Alliance for Rural Electrification (ARE), an independent international non-profit association, focused on promoting access to electricity services from renewables with the intent of supporting sustainable development in rural areas of developing countries.

The new Alliance shares many common objectives with IEA PVPS Task 9, PV Services for Developing Countries (PVSDC), notably an emphasis on contributing to achieving the Millennium Development Goals (see PV Power #20), and a focus on supporting appropriate decision making among donors, development agencies, national governments and other relevant facilitators. The Alliance supports national policy and appropriate local infrastructure development – addressing among others financing, service and delivery chain, training and quality con-

trol – which, as the Recommended Practice Guides developed by PVSDC clearly show, are fundamental to sustainable energy services delivery. The Alliance is also well aware of the important role of the private sector and partnerships between both developed and developing countries in building long-term market-oriented service structures.

ARE also sees itself as a project initiator, with a central role in stimulating cross-border partnerships and matchmaking between complementary parties to deliver appropriate renewable energy based rural electrification services and as a strong supporting platform for joint initiatives of its members.

Though it was initiated by a regional PV industry organization, ARE has a broader renewables remit, and is open to any organization around the world that supports its mission.

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JUST DESERTS

IEA PVPS Task 8 on Very Large-Scale PV Power Systems (VLS-PV) is pursuing a number of activities which will help provide more detailed understanding of the costs, benefits, environmental and social impacts and practicalities of designing and implementing PV plants in the scale of several hundred MWs.

Key research areas include further analysis of the cost implications of alternate technology options such as concentrators versus flat-plate modules as well as life-cycle analysis of VLS-PV systems in the world's deserts. Given the vast areas involved and potential instability inherent in many desert regions, the development and optimization of site evaluation tools is also of critical importance.

Satellite imagery is being investigated as an option for initial site assessments, while a new methodology is being developed to utilize remote sensing technologies to help pinpoint sites with soil characteristics suitable for VLS-PV development.

Task 8 experts are also investigating a number of proposals with a view to practical implementation of the world's first VLS-PV system. The Gobi desert, which straddles the China-Mongolia border, covering an area of 1,3 million km² is one of the strongest contenders to eventually host a gigawatt-scale system. Preliminary discussions are currently focused on identifying a site with appropriate infrastructure, workforce potential and access to a suitable power transmission system.

Sainshand, 460 km south-east of the Mon-

golian capital Ulaanbaatar, on the railway connecting Siberia to China may have just the right ingredients for the first phase of such an initiative, a modest 1 MW pilot plant. This would serve to confirm the viability for a phase two scale-up to 40 MW demonstration, before full scale roll-out. At the same time, on the Chinese side of the border, plans are evolving for an 8 MW pilot project near Dunhuang.

Despite the discussion of these and other pilot concepts for giant desert PV systems, it is clear that successful, sustainable implementation of full-scale VLS-PV projects will be no simple matter. Task 8 is aiming to create a compendium of practical instructions and training tools to support such project development. The report is expected to be completed by the end of March 2006.

PREPARED FOR THE WORST

For most of us, dealing with a natural disaster on the scale of the Asian earthquake and tsunami – which killed upwards of 170 000 people and made a million survivors homeless – is quite unimaginable, and thankfully a situation that few of us are likely to experience first hand. Yet the amazing speed, scale and professionalism of the international disaster relief response clearly demonstrates that some agencies not only have to imagine but also have to be prepared for the worst. A question for the PV community is how can it best support such relief and reconstruction efforts in future?



The arrival of solar lighting gave some cause for cheer at this temporary camp, erected after the Rajasthan earthquake in 2001 [PHOTO GREENPEACE]

For the affected populations, priorities in the immediate aftermath of such disasters are food, shelter and clothing, medical aid and safe drinking water. Sanitation quickly also becomes critical. For relief organizations, effective communications are essential for coordinating the response between field staff and headquarters and inter-agencies, for ensuring security, and for helping to reunite displaced families. Reliable, rapidly deployable energy services can make a positive difference to the aid effort, for instance enabling emergency lighting, pumping and water purification, and establishing critical power supplies for medical facilities and communications centres.

Prior to the tsunami, solar lighting has been used to good effect in a number of emergency relief projects, but generally renewable energy technologies are currently not widely used. In part this is due to the relatively lower capital cost of diesel generators, but also it relates to relative familiarity and accessibility of the options.

Solar photovoltaic systems do offer some clear service advantages, particularly in situations where damage to transport and fuel storage infrastructure hampers the use of

diesel generators. Like diesels, PV can be quickly deployed, but they can also be easily scaled to suit a wide range of power demands and they are almost universally appropriate from the perspective of the available energy resource.

At the same time – particularly in the developing country context – what may have been conceived as a short-term fix can come to be relied upon as part of a longer term service solution. As experience in remote professional applications has clearly shown for many years, PV systems can be designed to offer excellent reliability which is not only a critical consideration for immediate aid, but may also have implications if viewed from the reconstruction and development perspective.

One positive outcome of the recent tragedy, in addition to the offers of immediate support and equipment donations, has been the response by some segments of the renewable energy community to establish closer relationships with relief agencies. This is vital both to gain a better understanding of the needs and constraints from the field perspective, but also to help response agencies identify appropriate applications for PV, and particularly to help deliver solutions that can support the longer-term reconstruction and broader development goals for affected communities.



PHOTO KYOCERA SOLAR



BETTER SYSTEM PERFORMANCE

IEA-PVPS Task 2 supports improved operational and economic performance of new PV systems by providing analysis, and resources that help designers, researchers and others to understand factors governing existing systems' performance. One of the main outputs of the Task is the Performance Database which consolidates monitored data from over 400 systems in 14 countries.

A summary report presenting graphical analyses covering 395 of the systems constructed before early 2002 has just been published. Using the monthly datasets from the database, the report is an analysis of the equivalent of over 1 200 years of consistent, high quality PV operational data.

The full dataset is dominated by grid-connected plants (total of 339 systems, of which 20 are façade integrated), but useful information on 43 stand-alone, and 13 stand-alone



hybrid systems is also provided. Germany, Japan and Switzerland contribute the majority of reported systems, with 108, 82 and 62 respectively, while Austria, Italy and the Netherlands each contribute between 20 and 30 systems.

Normalized graphs of nominal array power, outages, irradiation, final yield, module temperature, performance ratio, module and inverter efficiency are presented, both as a whole for each system type and again

by country for the grid-connected systems. One of the interesting observations from the analysis of the grid-connected subset is that there has been a clear improvement in the average performance ratio (PR) over time. PR is an indication of a system's actual output compared to the output expected based on its rated capacity and available irradiation. It takes into account losses due to temperature, incomplete utilization of available irradiation, and inefficiencies or failures of system components. For the 132 plants constructed prior to 1995, the average PR was 0,657, while the 207 plants installed from 1996 onwards registered an average PR of 0,702. This is largely mirrored across the reporting countries. An updated version of the PV Performance Database, incorporating new systems' data as well as additional data for many of the existing systems will be released in June 2005. Both the report and database can be accessed via the PVPS website.

EU ON THE RIGHT TRAC

A strong regional PV sector and implementation of PV as an electricity source are seen by the European Union as important to help achieve its policy goals of greater energy supply security, reduction of greenhouse gases and sustainable development. While the PV sector globally has been demonstrating encouraging growth, the EU is aware that – outside of Japan – this has been largely brought about by a rather ad-hoc mix of technology and policy drivers. Certainly

the perception from within Europe has been that the EU lacks a common long-term vision for the PV sector, and has not had a clear strategic plan how to bring about the rapid expansion of a world class, cost-competitive, European PV industry.

To address these shortcomings, a high-level advisory group, the Photovoltaic Technology Research Advisory Council (PV-TRAC), drawn from many of the major European PV stakeholders, was established in late 2003.

The Council has now released its initial recommendations in the report *A Vision for Photovoltaic Technology*.

Looking towards the year 2030, the report forecasts that PV electricity will become competitive with conventional utility peak power in southern Europe by 2010, and in most of Europe by 2030, when it could potentially contribute around 4 % of electricity production worldwide.

To achieve this will require further substantial cost reductions to deliver 2030 system prices in the order of 1 EUR/W. In turn, to achieve this ambitious price goal requires a coordinated, strategic research focus encompassing basic research (into materials,

US SOLAR POWER FUTURE

It seems like only yesterday, but it is in fact almost six years since the US solar industry started its previous roadmapping exercise with the intent of plotting a course to ensure US industry and technology leadership in PV out to 2020.

Still, six years is a long time in a relatively young, dynamic technology sector, and rather than consolidating the world leading position it enjoyed through the 1980's and 90's, the US has progressively fallen behind Japan and Europe both in terms of domestic applications and global market share. Understandably that is not a situation that US industry is comfortable with, so it has recently devised a new plan to 2030 and beyond, *Our Solar Power Future*, with which it hopes to reclaim market leadership and maintain technology ownership.

So what has gone wrong? The US industry stands by the strategy outlined in its original roadmap (which was eventually released in the document *Solar Electric Power* as recently as 2001), asserting that, 'where investments have been made in technology and market development, the solar power industry has



PHOTO: POWERLIGHT

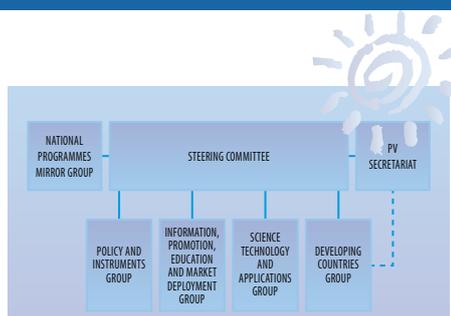
delivered strong growth, has reduced costs and improved products, just as predicted.' California is presented as prima facie evidence in support of this argument.

Where the US has reportedly failed is partly in delivering the targeted increase in national R&D funding called for by the industry, but more importantly in enunciating and implementing a national commitment to market development to support R&D investments. The new US strategy calls for national leadership to create market incentives to ignite explosive and continued industry growth, targeting an acceleration to 38 % annual production growth by 2010, subsequently moderating to 26 % in 2020 for a total installed domestic generation capacity of 36 GW. Federal tax credits of up to 50 %

are proposed as the key additional market support mechanism, coupled to uniform net metering and interconnection standards, and 100 million USD annual budget for government procurement. Significant increases in funding for prioritized R&D are also sought.

Interestingly, and uncommon with almost any other national or regional industry development roadmap, *Our Solar Power Future* has virtually no export orientation, arguing that manufacturing will likely be established abroad to serve promising markets in other countries.

The roadmap can be downloaded from the Solar Energy Industries Association website: www.seia.org



The proposed Technology Platform will coordinate policy, information and R&D functions between EU Member States, integrating these also with the needs of Developing Countries

devices and conversion principles), applied R&D, demonstration and enabling fields (such as standards, quality assurance, and socio-economic issues).

The Council's recommendation to estab-

lish a 'PV Technology Platform' to support implementation of its Strategic Research Agenda is the main conclusion of the report and the basis for achieving the 2030 vision. The Technology Platform is something of a coordinating 'supergroup', conceived to foster effective public-private partnerships between the research community, industry and policy makers.

The Platform is intended to provide, for instance, better linkages and dialogue on activities being undertaken within the individual Member States (to avoid unnecessary replication and better focus resources, as well as to encourage harmonization of standards and policy tools, when appropri-

ate), within different disciplines (to allow cross-fertilization from complementary research sectors), and within separate stages in the technological and market development cycle (to overcome issues such as transition from laboratory to manufacturing scale).

While the prime focus of the Platform is very clearly on strengthening European industry and energy security, there is recognition that international exchange, notably with Japan, US and IEA-PVPS can bring broad benefits. PV-TRAC also recommends stronger partnerships with multi- and bilateral development agencies, the finance sector and relevant NGOs to support energy services for developing countries.



IN BRIEF

AUSTRALIA

The Federal government's 75 million AUD Solar Cities programme is gathering pace following the release of a call for Expressions of Interest on April 15. Proponents have until July 8 to prepare their outline submissions for assessment by the Australian Greenhouse Office. A number of concepts will then be invited to develop full business proposals, from which four Solar Cities trials will eventually emerge.

The initiative is predominately focused on improving energy performance and reducing peak demand of existing residential and commercial buildings. Each of the projects must incorporate PV, energy efficiency measures, smart metering and load management strategies. Adelaide, which faces some of the most severe electricity network and generation constraints and highest retail tariffs in the country is assured to host one of the trial projects. As many as twenty Consortia across the country are believed to be preparing bids.

CANADA

The Royal Architectural Institute of Canada (RAIC), in collaboration with Dr. Raymond Cole, School of Architecture, University of British Columbia and the Canadian Photovoltaic Programme delivered a series of 1-day workshops on Building-Integrated Photovoltaics as part of the Institute's professional development series. RAIC is a voluntary national association representing more than 3 000 architects and faculty and graduates of accredited Canadian schools of architecture. The course was designed to heighten the architectural community's understanding of this emerging and exciting technology. More than 175 architects and building engineers in six cities across Canada participated in the workshops.

In Japan, Fujipream installed its own design of curved multicrystalline silicon PV modules along the parapet of its Kohto Factory under the FY2003 Advanced PV Power Generation Technology Programme. [PHOTO RTS CORP]

JAPAN

Applications for the Residential PV Programme for 2004 Fiscal Year closed on February 7 – almost eight weeks early – as requests for funds reached the available annual budget. A total of 61 407 applications were received for the year, consisting of 59 747 systems for private homes, 562 ready-equipped houses (newly built by developers) and almost 1 100 local government (social) houses. This will take the total residential PV system capacity installed in Japan to over 233 MW.

NEDO, the New Energy and Industrial Technology Development Organization, approved a further 300 larger scale projects, totalling almost 8,7 MW under the Advanced PV Power Generation Technology, Field Trial. This programme is aimed at encouraging the adoption of new PV technologies and larger systems (above 10 kW) for public and industrial facilities.

KOREA

The Korean Government allocated a total of 16 billion KRW (16 million USD) for residential PV system dissemination in 2005, an increase of 150 % over the 2004 figure of 6,3 billion KRW. Grants are available for 1-3 kW systems for single family houses and 5-300 kW for multi family or collective houses. The Government supports up to 70 % of the initial investment.

MEXICO

Rural electrification is once again a top priority for the federal government, raising expectations of growth in installed PV capacity over the next



few years, as PV presents one of the feasible alternatives for remote and rural power supply. Preliminary studies and proposals for implementation strategies will be completed by mid-2005.

At the same time, distributed generation is attracting the attention of the national utility as an option for supporting the electrical grid in some areas, and could become an important application in the near future. PV roofs are one of the technologies under consideration.

NORWAY

Norway is now one of very few countries in Europe without any government incentives directly supporting PV. Despite this, small PV systems have proven very popular for recreational (weekend) cottages, with an estimated 100 000 systems (6 MW) installed to date. The local PV industry, which is largely focused upstream of the cell manufacturing stage is also thriving; one of the world's largest producers of metallurgical silicon expects to market solar grade silicon in the very near future.

PORTUGAL

The PV market in Portugal is expected to grow significantly in the next few years driven by an ambitious target and very favourable incentives for grid-connected systems. Cabinet Resolution 63/2003 established a goal of 150 MW of PV to be installed by 2010; this intent has been underpinned by a new Decree-Law establishing a range of feed-in tariffs for renewable electricity, which came into

force in January 2005. The new tariffs are crucial for the development of the first phase of the world's largest centralized PV power plant (64 MW) planned for installation in Moura, South of Portugal. At the other end of the scale, the feed-in tariff has already stimulated a large increase in requests to the Portuguese authorities for grid interconnection of systems up to 5 kW.

SPAIN

One year on from the entry into force of Royal Decree 436 (establishing new feed-in tariffs for renewable electricity), the development of grid-connected PV in Spain seems to have experienced a notable increase. PV installed power is estimated to have totalled 17 MW as of December 2004. Additionally the average size of each installation has also increased, as well as the number of applications for new units.

SWEDEN

The market deployment initiative for PV in public buildings, originally set to run for 18 months from 1 January 2005, has already been extended to 31 December 2007. The bill containing the initiative was passed late in 2004. At the time of writing, the details of the programme had not been finalized, but it is expected to provide an important boost for PV in Sweden.

For further information about any in-brief articles, contact the relevant national newsletter representative (see list on P7).

PVPS NEWS

PVSDC AT WORLD BANK

IEA PVPS PV Services for Developing Countries organized its 12th Experts' meeting to coincide with the World Bank's Energy Week in March. Although decentralized new renewables continue to struggle to gain profile and acceptance against large-scale conventional power projects, the meeting was useful for establishing links with EPIA's Alliance for Rural Electrification (see P2) and for welcoming new developing country representatives to the programme; Zambia and Tanzania will now participate in PVSDC with support from the Swedish International Development Agency, SIDA.

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MORE OF WHAT YOU WANT

This year's *Trends in Photovoltaic Applications* report, published annually by IEA-PVPS, will continue to evolve – just like the PV markets it has been tracking for over a decade. And like these markets, the industry chain and PV applications in general, each year brings new issues of interest. We have listened to what our readers have been saying, and the 2005 Trends report, due for publication in August, will reflect this.

NEW ON OUR WEBSITE

The IEA-PVPS website holds numerous PV related statistics, reports, news and other features to view or download. The site is regularly updated.

Recent additions include:

Two reports from Task 2:
Country Reports on PV System Performance;
The Availability of Irradiation Data.

Visit www.iea-pvps.org

If you are not familiar with this series of reports, it is highly regarded as a reliable, freely-available analysis of key industry and market developments from year to year.

The focus of the report is the analysis of trends rather than presentation of current news items, though the reader will find useful summaries of national policies and landmark projects. The report is based on the material provided by each country participating in the IEA-PVPS Programme, and presented in the national survey reports (NSRs). The NSRs are finalized by the end of May each year, and are immediately made available on the PVPS website

Some things to look out for this year: PV is growing rapidly outside the 20 member countries of the IEA-PVPS Programme and presentation of this information will receive more and more attention as globalization of manufacturing increases, and the importance of transfer of knowledge continues to grow. Industry growth has been spectacular – and the question of who is investing (and why and how), and the production chain from raw materials to systems are matters of great interest. Market growth underpins these issues and given that extensive public funding supports PV programmes in many countries, we aim to provide some critical analysis of the relative merits of some of the key support measures.

Watch out for impressive installation growth in Germany

[PHOTO SOLAR ENGINEERING DECKER & MACK GMBH]



DIARY DATES...

20th European PV Solar Energy Conference and Exhibition
Barcelona, Spain

6-10 June 2005

☛ WIP-Munich

Tel: +49 (0)89 7201 2735

www.photovoltic-conference.com

Renewable Energy Finance Asia & Carbon Markets Asia

Hong Kong

15-16 & 17 June 2005

☛ Greenpower Conferences

www.greenpowerconferences.com

2005 Solar World Congress (ISES) and Solar 2005 (ASES)

Orlando, FL USA

8-12 August 2005

☛ Cindy Nelson, ASES

Tel: +1 303 4433 130

www.ases.org

7th Renewable Energy Finance Forum

London, UK

22-23 September 2005

☛ Euromoney Energy Events

energyevents@euromoneyplc.com

www.euromoneyenergy.com

Solar Power 2005

Washington DC, USA

5-9 October 2005

☛ Solar Electric Power Assoc.

Tel: +1 202 8570898

ebrown@seia.org

www.solarpowerconference.com

15th International PV Science & Engineering Conference

Shanghai, China

10-15 October 2005

☛ Shanghai Jiao Tong University

Tel: 86 21 6293 3549

pvsec15.sjtu.edu.cn

IEA-PVPS NEWSLETTER

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If you have any comments or require further information about any articles appearing in PV Power, or if you have suggestions for new features, please contact your national representative. Full contact details are provided on the PVPS website.

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PV POWER

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OFF-GRID PV IN SOUTHERN LAOS

CASE STUDY

PROJECT SUMMARY

- Southern Provinces Rural Electrification Project, Lao PDR
- > 5 300 Solar Home Systems installed to date
- Target: 150 000 SHS by 2020
- System options: 20, 30, 40, 50 W
- Installation fee: 15 to 25 USD
- Monthly repayment: 1 to 5 USD
- Effective subsidy 18 to 38 %
- Repayment rate: 96 %

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Laos is one of the least developed economies in Asia, and while the country generates 30 % more electricity than it uses, only 43 % of all households and as few as 30 % of rural homes currently have access to reliable electricity supplies.

The Lao government has, however, set ambitious targets to see 70 % of households electrified by 2010 and 90 % by 2020. Off-grid electrification systems, and solar PV in particular, are expected to meet 10 % of the national target, predominately in the less accessible rural areas of the country.

Since 1999, the Lao Ministry of Handicrafts (MIH), with support from the World Bank and Global Environment Facility, has been piloting a programme for village off-grid electrification using Solar Home Systems and other village-scale generating sets. SPRE – The Southern Provinces Rural Electrification Project – has established Energy Service Companies (PESCOs) in five provinces. The PESCOs train and administer a network of 130 Village Electricity Managers whose business is to deliver affordable energy services to rural households. Customers have a choice of solar home systems with varying repayments options. The fee, paid monthly over 5 or 10 years, is typically equivalent to



what would have been spent on kerosene and batteries. Users are responsible for buying and replacing components other than the PV module, mount and battery charge controller.

MIH is currently initiating the second phase of the project, to extend the service to all 17 provinces and some 10 000 more households over the next three years. The ultimate target is 150 000 SHS by 2020, with a focus on supporting productive applications (e.g. home businesses) and ensuring customer satisfaction through service reliability.

ENVIRONMENTAL HEALTH AND SAFETY



As an industry claiming particular relevance in the fight to address climate change and other environmental impacts associated with our seemingly insatiable demand for energy, it makes sense that the PV community should pursue the goal of understanding the full range of impacts associated with production, use and disposal of PV equipment.

Of course, this is not a new topic; researchers have for many years been monitoring and developing solutions to limit resource and health and safety implications of some of the more exotic raw materials used in PV

manufacture. They have also been at pains to report aspects such as energy payback time for modules and complete systems to counter accusations that PV manufacture requires more energy than a system generates during its lifetime. That particular ‘urban myth’ has been robustly dispelled, as reported for instance by IEA-PVPS back in 1997 (see report IEA-PVPS T1 1998 4). But in this age of corporate social responsibility broader life-cycle issues – such as materials handling, component reuse, recycling and safe disposal – are increasingly hot topics.

IEA-PVPS, through Tasks 1 (Information Exchange) and 10 (Urban-scale PV) has also re-

cently renewed its activity in the area, and is now defining a specific new Task on Environmental Health and Safety (EH&S) with a view to overcoming knowledge and awareness gaps on the sustainability of the technology, and to assist long-term ethical analyses of the industry, particularly for investors.

A Task Definition Workshop will be held in Barcelona on 8th June, coinciding with the European PV Solar Energy Conference, to focus IEA-PVPS research into EH&S issues. Further details on the scope of the new task will appear in future editions of PV Power.

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