IEA INTERNATIONAL ENERGY AGENCY

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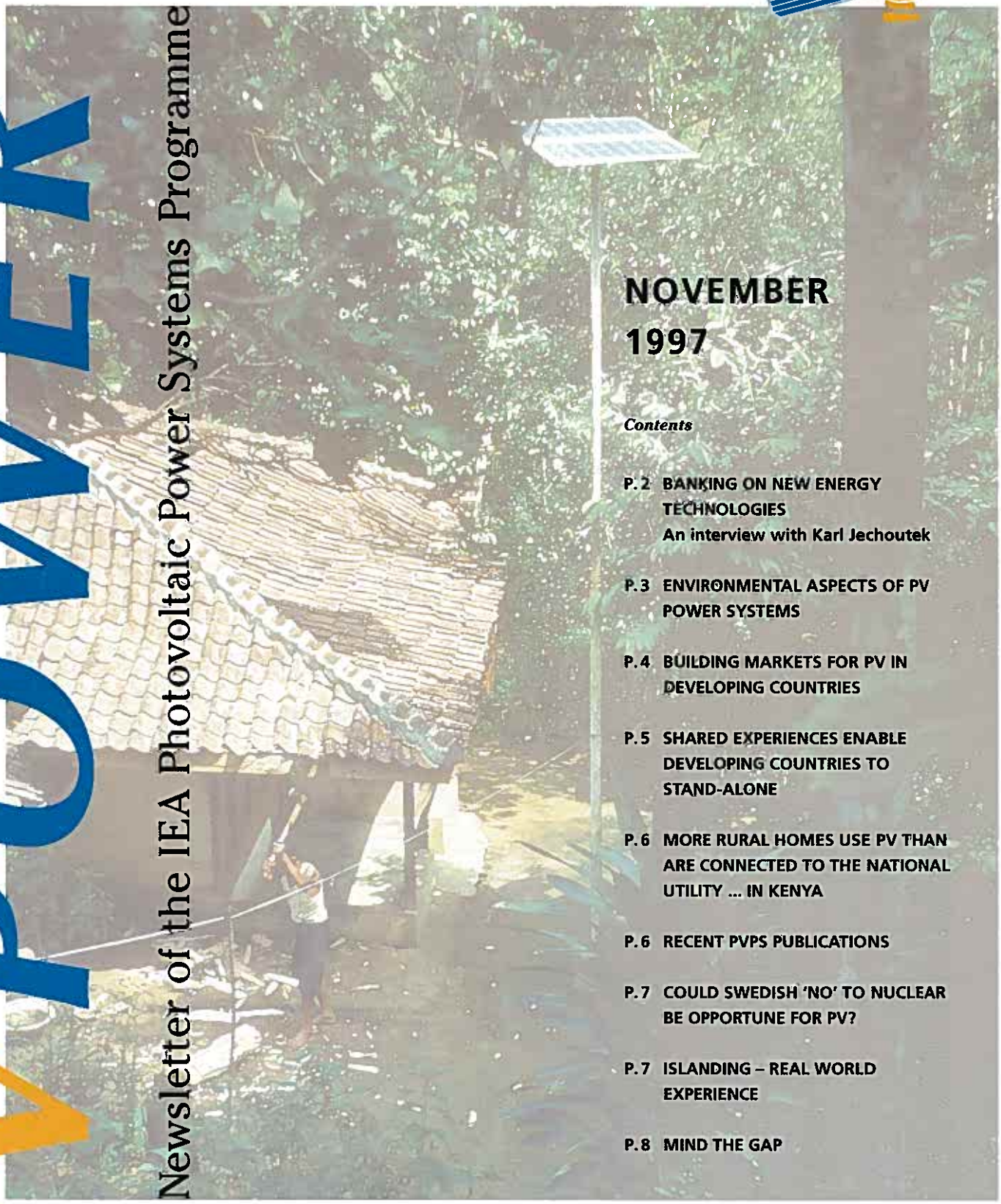
PV POWER

Newsletter of the IEA Photovoltaic Power Systems Programme



NOVEMBER 1997

Contents

PV could be one of the key energy technologies for rural development. This issue of PV Power looks at several important initiatives to stimulate sustainable markets for PV in rural areas of developing countries.

BANKING ON NEW ENERGY TECHNOLOGIES

An interview with Karl Jechoutek

Karl Jechoutek is Division Chief within the World Bank's Industry and Energy Department. The Department is the central 'anchor' group that supports the emerging agenda and new products in the Bank's energy sector assistance. This includes renewable energy, other clean technologies, rural energy development, energy efficiency, and energy sector restructuring.

Dr. Jechoutek, to the outsider there seems to be something of a revolution taking place within the bank in respect of a more prominent role for photovoltaics and other new energy technologies. Is this a fair assessment?

Yes, I think in some respects this is true. We are certainly more open now to considering 'non-conventional' energy technologies than has been the case in the past. Our long-term objectives in the energy sector – to make existing energy suppliers and consumers more efficient, and encouraging competition to give consumers the energy choices they deserve – are still valid, but we acknowledge markets in renewables, efficiency, and rural decentralised solutions need time and effort to develop for the benefit of the environment, and of the poor.

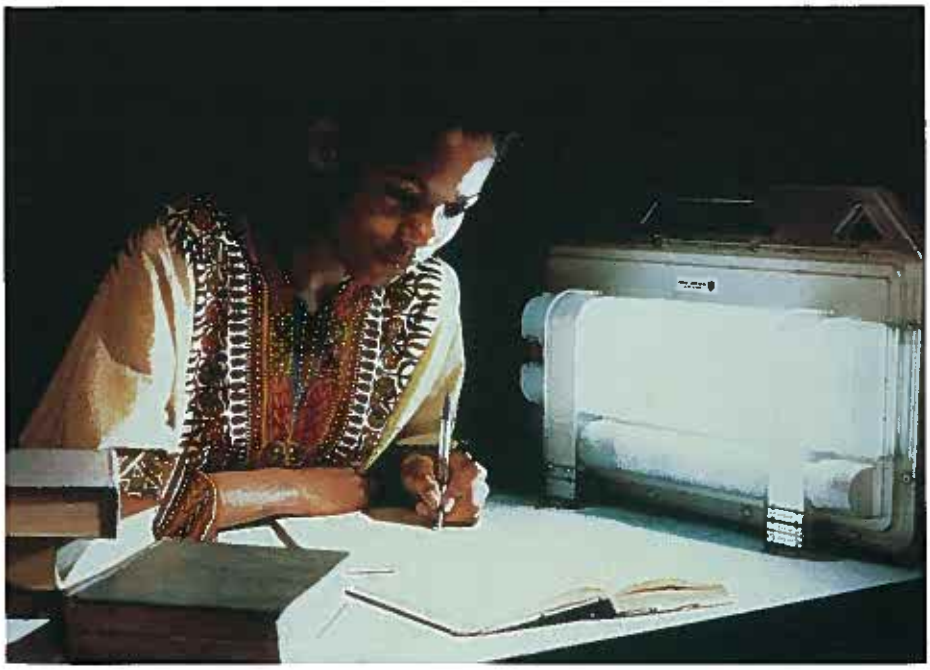
Namely rural customers in developing countries?

Exactly. This department was one of the first within the Bank to acknowledge that streamlining existing supply networks was not actually helping many people in the rural areas of developing countries. Extending the grid network to such areas usually requires substantial subsidy, which is cripplingly expensive for the governments and often the suppliers who venture down this path. So it is obvious that we need some new heroes.

Does PV have the necessary 'hero' qualities then?

Perhaps it has the potential to become one of the 'superheroes' for rural populations that are now dependent on expensive kerosene or batteries, and who have no hope that the grid will reach them. The Bank sees the provision of modern energy systems as a prerequisite to development in terms of meeting the end-users aspirations for a better standard of living. We know that the overriding priority for rural people is improved light, and then more light. Then come other services such as TV, radio and other appliances. Now for such basic requirements modular technologies like PV offer users the flexibility to decide what they need far more cost-effectively than major grid extension programmes in low-density areas.

The most fundamental need for many rural people is access to good quality lighting. PV provides a better quality of light than traditional candles or kerosene lamp.



So why isn't the market for PV systems already booming?

Well I mentioned an important word before – potential. With liberalisation of the energy market and the introduction of competition, we tend to fall into the trap of thinking that energy supply companies can simply waltz into these rural areas, set up shop and start selling systems. But we really have to nurture these markets. Rural people would welcome better services, but there are generally few delivery, after-sales or financing mechanisms to enable them to obtain these.

So you have identified some of the problems, but how are you addressing them?

One of our first priorities is to ensure that our own staff are aware of the options for relieving this rural energy poverty. Cooperative agreements partners such as IEA, ETSU, EPRI and major foundations and NGOs, for example, are helping the Bank to get its own house in order. Then we can set about connecting others with this knowledge – government departments, potential investors and so on – so that we can bring about the proverbial levelling of the playing field that would enable energy policy decisions to be made in an informed manner without prejudice in favour of, or against any technology.

Modern energy systems are a prerequisite to development, saving rural families hours each day foraging for traditional sources of fuel – hours they might otherwise be able to spend on productive work or education.

But surely this alone will not bring about the changes to resolve the issue of delivery and end-user financing?

No, that requires rather more creativity and hands-on involvement, which is where concepts like the PV Market Transformation Initiative and Solar Development Corporation [see page 4] fit in. We know that many of the potential customers are prepared and able to pay above the odds for a high quality energy service – often up to five times more per unit than they might expect to pay if they were able to obtain grid power. But if the service is not available or not affordable, then the whole idea of the rural energy market based on consumer choice falls apart. PVMTI, REEF and SDC (incidentally, all good examples of co-operation between the IFC, the GEF and the Bank) are a positive step towards addressing both of these problems. I think it has now got to the stage where we stop talking and start doing. The Bank is now 'getting out' into the potential market place, finding out what it and others can do to help systems and energy suppliers and financial intermediaries establish the necessary alliances to build the vital local infrastructure.

PV markets need to be nurtured. Creative ideas for addressing the problems of delivery and financing are needed. The 'Luz du Sol' programme in Brazil supplies PV battery charging stations, on credit, to village entrepreneurs who supply charged batteries to villagers for a monthly or per charge fee.

So are you optimistic for the future of PV in the rural development context?

Well, we are seeing a move amongst project financiers away from grants and soft loans, so cost recovery in all development projects is increasingly important. We've all seen the charts and done the sums that show PV can be a cost effective low-power density supply option, and there is no doubt that the potential market is huge so on these terms there is good cause to be optimistic. But it is going to take a lot of work from all quarters to build sustainable workable markets for PV and other new energy technologies. I would like to think that the Bank is now demonstrating its commitment to this cause and is inviting partners to join the effort.

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ENVIRONMENTAL ASPECTS OF PV POWER SYSTEMS

A group of international experts from governments, power utilities, PV industry and academia met in Utrecht, the Netherlands, in mid-June, at the invitation of PVPS Task I, to attend a workshop on 'Environmental Aspects of PV Power Systems'.

The workshop had five main goals: to review issues and approaches regarding environmental aspects of PV power systems; to come to a consensus on important aspects such as Energy Pay-Back Times; to identify issues of environmental importance relating to PV power systems ('hot spots'); to identify issues requiring further attention ('white spots') and to establish a network of researchers working on PV environmental issues.

A report including transcripts of all the papers presented at the workshop is currently in preparation, and is expected to be available later in December. Following one particular recommendation made at the workshop, an internet discussion group has been formed. Subscription to the list is open to anyone who is actively involved in photovoltaic research or management related to Health, Safety and Environment. Anyone interested in subscribing to this discussion group, should send a description of their work to: Alsema@chem.ruu.nl

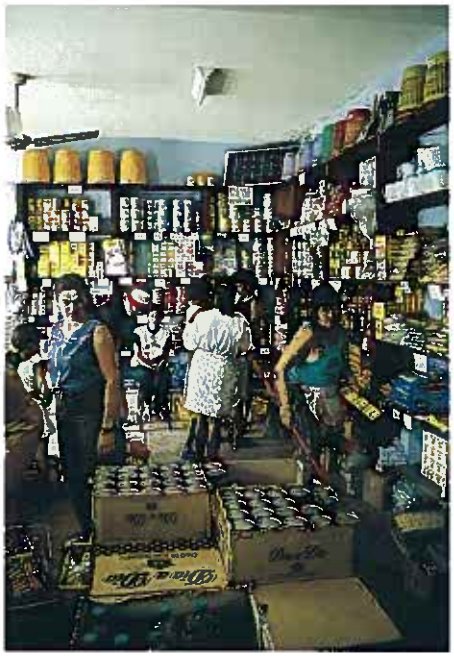
BUILDING MARKETS FOR PV IN DEVELOPING COUNTRIES

The World Bank Group has recently initiated two major projects aimed at increasing the pace of PV commercialisation in a number of key markets worldwide.

Cisolok on Java, Indonesia: local company Sudimara manufactures BOS, and assembles, sells and installs PV systems. It also provides hire purchase credit. PVMTI and SDC aim to stimulate more widespread access to such distribution and financing mechanisms.

The Photovoltaic Market Transformation Initiative and The Solar Development Corporation represent the latest efforts to overcome the barriers still preventing PV from competing in the global energy market place.

The Photovoltaic Market Transformation Initiative (PVMTI) administered by the International Finance Corporation (IFC) will use USD 25 million of Global Environment Facility (GEF) funds to support private sector, competitively solicited solar PV market development projects in India, Kenya and Morocco. It is anticipated that, with leverage, around USD 100 million will be invested in total. These investments are expected to serve as a stimulus for the formation of joint ventures, as well as pioneering innovative financing schemes, and promoting public-private partnerships.



In Valente, Brazil, a local shop stocks PV modules.

IFC has recently engaged a consortium of firms from the UK to act as External Management Agent (EMA) for the project. The appraisal phase to assess the business case for the PVMTI in each country, and investigate the likely deal flows is now nearing completion. The EMA, supported by local partner firms in each country, undertook an appraisal of the market trends, orientation and interest in PVMTI through dialogue with the PV industry, financiers and prospective investors.

The results of these discussions and the dealflow analysis in each of the selected countries are now being consolidated into a strategy for progressing to the implementation phase. Subject to final approval by IFC management and the GEF, PVMTI implementation will commence in late 1997. The aims of the Implementation Phase will be (1) to stimulate a stream of investment and grant proposals that offer the most promise for transforming the PV market, (2) to commit USD 25 million of GEF funds to the companies and projects that can both transform the market and leverage the funds at a target ratio of 3:1, and (3) to supervise the recipient companies to ensure that receivables from investments are realised.

The EMA is expected to issue a Request for Proposals (RFP) detailing the implementation framework, including the timescale of decision making, the evaluation criteria for investment, and the support available through the EMA by the end of 1997. Potentially suitable projects will subsequently be assessed by the IFC PVMTI Investment Panel. The EMA will aim to disburse all PVMTI funds as rapidly as possible, and certainly before year end 1999.

The concept of the SDC, a joint initiative of the World Bank and a number of prominent US Foundations, is to form a stand-alone company to provide market and business development services that will accelerate the growth of private firms and deepen the penetration of Solar Home Systems (SHS) and other rural PV applications. The SDC would also provide access to pre-commercial and parallel financing for private firms to expand their capability in PV distribution businesses and strengthen their ability to provide credit to end users. SDC itself will not engage in direct financing of the final consumer but will work with local financial institutions and distributors to develop tailored schemes aimed at accelerating electrification for rural families. This local flexibility means that SDC will be able to work in parallel with other initiatives supporting PV, including those emanating from multilateral and bilateral institutions.

The SDC concept has been jointly developed by a team from the World Bank Group with E&Co, a non-profit energy investment service representing the US Foundations. A

multinational consortium of business advisors was appointed in June 1997 to provide independent evaluation of the rationale for the establishment of the SDC. Preliminary desk research identified six countries as potential prime targets for involvement in the SDC concept. As with PVMTI, field missions to the key markets – Brazil, Dominican Republic, Indonesia, Philippines, Vietnam and South Africa – were undertaken to meet with the potential stakeholders and identify the market development requirements and, where applicable, possible investment projects. The detailed country reports are being used to assess the viability of the SDC Concept, and to develop a business plan for the establishment and operation of the SDC. It is intended that after a start-up period SDC should become financially self-sustaining. It is currently assumed that SDC's initial capitalisation will be around USD 50 million for an initial three year period of operations, but that once self-sustainability is demonstrated, it could handle up to USD 100 m/year of PV financing. The initial evaluation will be finalised at the end of 1997.

Further information on both these initiatives can be obtained from IT Power, phone +44 118 973 0073

SHARED EXPERIENCES ENABLE DEVELOPING COUNTRIES TO STAND-ALONE

Task III: Stand-alone PV Systems is particularly relevant to developing countries, as it is concerned with PV systems in remote areas, not connected to any major electricity grid. The Task includes technical surveys of BOS components as well as non-technical studies of institutional barriers, markets and financing mechanisms.

The Task now has participants from 15 OECD member countries. In addition, Brazil, India and Mexico are awaiting confirmation of their associate membership. The wealth of OECD experience can be usefully transferred to PV applications in developing countries. The member countries also have the opportunity to learn from surveys of existing projects in developing countries. To this end, a survey of PV applications in around 20 developing countries was initiated in 1995. The survey resulted in an extensive database of information on PV programmes in the selected countries and includes details of PV capacity installed to date, key players involved in initiating the projects, end-user and government reaction and novel financing mechanisms. The survey has been analysed and a report on the findings is soon to be presented to the PVPS Executive Committee.

A further aspect of the developing countries work has been the collaboration of Task III participants with multilateral agencies such as the World Bank. This has largely been facilitated through the Developing Countries Team. Many of the DC Team's activities have been reported in previous editions of the newsletter, but two of the most tangible results of this collaboration have been the publication in May of a Renewable Energy Briefing Note on PV (soon to be complemented by a number of 'Issues Notes' focusing on specific technical and non-technical aspects of PV systems) and a forum on batteries, held in Yogyakarta, Indonesia, following the Tenth Task III Experts' Meeting in March 1997. Indonesia was chosen as the location because of its large PV programme, with a target of 50 MWp for one million Solar Home Systems (SHS) by 2005. Batteries are often considered to be the weakest component in a SHS, and the forum presented the opportunity to review many of the major problems, as well as several novel methods of battery management. The event was attended by experts from the Indonesian Science and Technology Agency (BPPT) and the World Bank's Asia Alternative Energy Unit (ASTAE). A visit to a 20 kWp PV village electrification plant at Kenteng was also arranged. This system had experienced serious problems with the battery bank and various solutions were discussed on-site.

Experience of stand-alone PV powered street-lighting, like this example in Korea (which also doubles as an advertising hoarding) can be transferred to less developed countries.

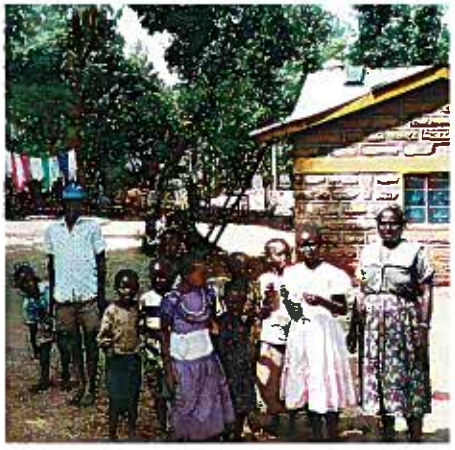
For further information contact Task III Operating Agent, Patrick Jourde: fax +33 442 25 73 73

MORE RURAL HOMES USE PV THAN ARE CONNECTED TO THE NATIONAL UTILITY ... IN KENYA

By mid 1997 about 70.000 rural homes in Kenya used PV. This is more than were connected to the National Utility, Kenya Power and Lighting Company. Solar home systems account for about 1,4 MWp of the total 2 MWp of PV installed in Kenya.

Inspecting roof-mounted PV module on non-performing system, Embu, Kenya

Nearly two percent of the rural population using solar power is a very high market penetration (with the exception of course of some small Pacific islands). This achievement is not the result of a government subsidised programme or outside aid; it is through purely private sales. This is even more remarkable, as PV prices are high in Kenya, with import duties and local taxes amounting to 44 percent. On the other hand, grid electricity is subsidised, and the rural people would be delighted to have access to it. But the government's rural electrification programme does not have the capital required to reach the areas outside the main towns (or the capacity to meet growing urban electricity demand).



Family (and neighbours) await repairs, Embu, Kenya.

Most PV systems are very small, less than 25 Wp, and are used for lighting and television. Most people buy components; PV module, battery and lamps, and assemble and install their own systems. This does not result in the highest quality, and there are increasing numbers of failures, but the users are often very capable of getting adequate service at low cost. The PV infrastructure is developing with technicians requesting training courses and several dedicated professionals and leading companies tackling the problem. However, the biggest concern for the PV community is the growing share of the market being met by low-quality 12 Wp PV modules, which degrade in output and regularly fail after months, or even weeks, of use. This regrettable situation is already getting PV a bad name, and it is to be hoped that improved awareness and the development and application of standards will alleviate the problem (the GAP should help, see page 8).

A systematic survey of 400 users was conducted for the World Bank in 1996/1997. This showed that 60% of users are satisfied with their PV systems and 94% would recommend them to a friend. Dissatisfaction results from battery problems (19%), insufficient electricity (13%), and poor quality fluorescent lights (8%).
The PV Market Transformation Initiative (PV-MTI, see page 4) will contribute to increased market growth and will also help suppliers execute quality control as well as technical, management and marketing training.

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RECENT PVPS PUBLICATIONS

For details of sources and prices (where applicable) of these publications ask your newsletter contact (see page 8).

Status Survey Executive Summary
Summary of the Survey Report's findings

Examples of stand-alone PV Systems
Booklet containing exemplary applications of PV in the participating Countries

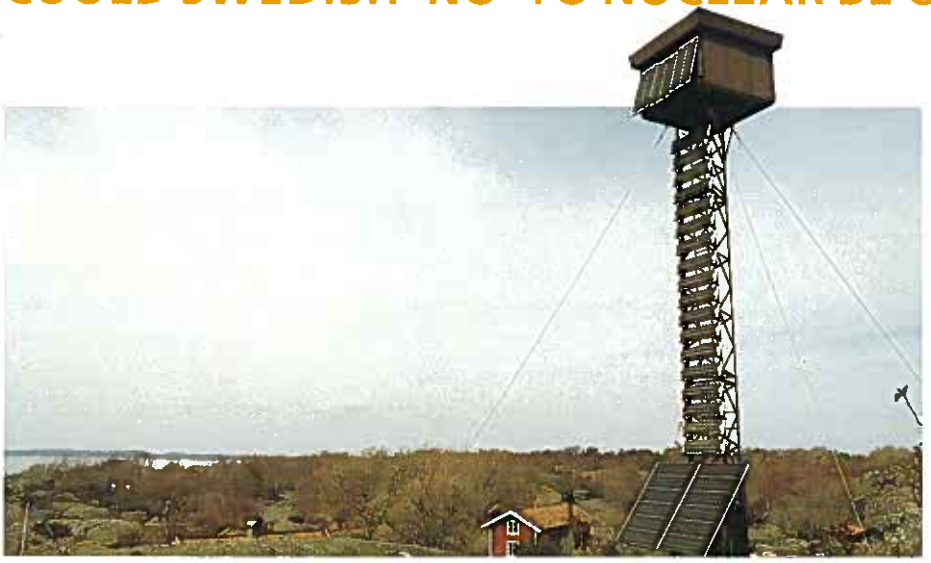
Status Survey Report
Second in the series, presenting trends in PV Systems Market development upto the end of 1995.

Information on electrical distribution systems in related IEA countries
Summary report

PV Power systems for Stand-Alone applications
Status Report, summary of questionnaires completed by participating countries.

Grid Connected PVPS: Status of existing guidelines and regulations in selected IEA Member Countries
Technical report

COULD SWEDISH 'NO' TO NUCLEAR BE OPPORTUNE FOR PV?



Sweden has an extensive grid. One of the few settlements not grid-connected is located on the island of Bullerön. This has been equipped with a 1,5 kW PV system which provides electricity all year round. The system is backed-up with a 250 W wind generator.

At present, Sweden derives nearly all its electricity from hydro and nuclear power, with a split of around 50% between the two. The political intention in Sweden is to start to phase out the nuclear capacity, leaving a large deficit in the electricity supply.

The conditions in Sweden could not be considered ideal for using photovoltaics, with low insolation levels, an electricity consumption pattern which does not match the availability of the solar resource, and an extensive grid system. Under the present circumstance, the complete replacement of the present nuclear capacity with PV is not realistic. This would require cost-effective seasonal storage, in the absence of which PV installations are limited to between 5 and 10 GWp. Significant cost reductions and upscaling of current PV module production are also required for PV to have a large-scale future in Sweden. However, the phasing out of nuclear has given PV an opening into this unlikely market.

The Swedish electricity industry is now engaged in a PV systems project. The overall motivation for the participation of these companies, is to build up in-house PV competence. The focus is on cost effective utility applications such as sectionalising switches for distribution lines and cathodic corrosion protection for power line pylons. Another issue with high priority is the environmental and life cycle analysis of PV systems.

Although the PV industry in Sweden is limited, researchers have followed international developments in PV for many years. The country boasts one of the leading international institutions carrying out research into thin film CIS solar cells. Political interest in PV has also increased recently, which has stimulated further research programmes. including a unit working with nano structured dye sensitised solar cells. The research in this area has already resulted in industrial development projects.

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ISLANDING – REAL WORLD EXPERIENCE

The next stage of Task V's ongoing efforts to develop standards and codes of practice for the safe interconnection of PV systems to the public grid took place in September.

Representatives from electricity utilities, inverter manufacturers and PV systems suppliers met in Zurich in mid-September to review the state of the art of PV grid-interconnection and identify areas for further action. The main purpose of the meeting was to transfer experiences between the various parties currently involved in the field, and in this respect the workshop was a success.

In all, 73 participants attended the event, representing a vast array of real systems experience gained through utility actions and international collaborative efforts, including Task V's demonstration tests undertaken at the Rokko Island testing centre.

Workshop discussions revolved around a number of key issues, including the cost reduction potential of various advanced inverter technologies. However, perhaps the most interesting revelations were reserved for the session on islanding prevention. Although island conditions (where the PV generator continues to feed power into the grid after a mains failure – an occurrence which could expose maintenance staff to electrocution risks) can be recreated under laboratory conditions, there are no experiences of a similar situation arising under actual field conditions.

Workshop proceedings, including a summary of the discussion sessions, is now under preparation and will be available for distribution later in the year.

MIND THE GAP

PV GAP IS A GLOBAL, PHOTOVOLTAIC INDUSTRY-DRIVEN ORGANISATION THAT STRIVES TO PROMOTE AND MAINTAIN A SET OF QUALITY STANDARDS AND CERTIFICATION PROCEDURES FOR THE PERFORMANCE OF PV PRODUCTS AND SYSTEMS, TO ENSURE HIGH QUALITY AND RELIABILITY.

In the last edition of PV Power we outlined the concept of the PV Global Approval Programme (GAP). In this edition we look a little more closely at how GAP will function in practice.

The PV community has initiated the GAP to protect the integrity of manufacturers, especially those in developing countries, and to help safeguard suppliers business. The PV 'Quality Seal' will help identify those products and systems that are manufactured and installed to this international standard and thus guide users to distinguish good quality PV products from bad.

To achieve its objectives the GAP, which is envisaged as a non-profit organisation under the control of the global PV industry, will address the following issues:

- Standards of the International Electrotechnical Commission's (IEC) will be promoted for global acceptance. Where they do not exist, Recommended Standards (RS) will be developed by reviewing and utilising existing national or regional standards.
- A list of globally accepted Testing Laboratories is to be developed, including testing laboratories in developing countries.
- One globally accepted Reference Manual will be established for use by the PV industry as well as for those who utilise PV products and systems.
- An Approval/Certification Manual will be developed, based on the ISO/IECQ system and will be administered by the IECQ (operated by the IEC's Quality Assessment System for Electronic Components). The IECQ certification body will approve the manufacturers or the independent testing laboratory's quality system.

To qualify for membership of PV GAP, the PV related industry, association or organisation must adhere to the quality standards defined by PV GAP and the IECQ and will be bound to a strict code of professional conduct.

Members will be permitted to display the PV GAP 'Quality Seal' on their products or systems, which is expected to provide a significant marketing advantage, as conferred by the international recognition of product and system quality. In addition members will have access to the PV GAP Information Service, publications and discounts on various material including publications. A news bulletin and standards list is also available to members.

For further information on PV GAP contact PV GAP Secretariat in Geneva, c/o IEC Central Office, Fax: +41 22 919 0300

IEA-PVPS

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