



PV POWER

Newsletter of the IEA Photovoltaic Power Systems Programme

FEBRUARY
2000

Contents

- P.2 PHOTOVOLTAICS – IL VALORE DEL SOLE
- P.2 NIEUWLAND: A MODEL OF URBAN SUSTAINABILITY
- P.4 PVPS SURVEY REPORT COMING THIN & FAST...
- P.4 PV PERFORMANCE DATABASE
- P.5 SCHOLAR POWER – THE KEY TO A PV FUTURE
- P.6 PVPS NEWS
- P.7 IN BRIEF
- P.8 SOLAR STOCK EXCHANGE

At home with photovoltaics: for these children in the Netherlands, PV is a part of everyday life. We look at the 1 MWp Nieuwland project in more detail inside. [PHOTO COURTESY JAN VAN UKEN, NL]

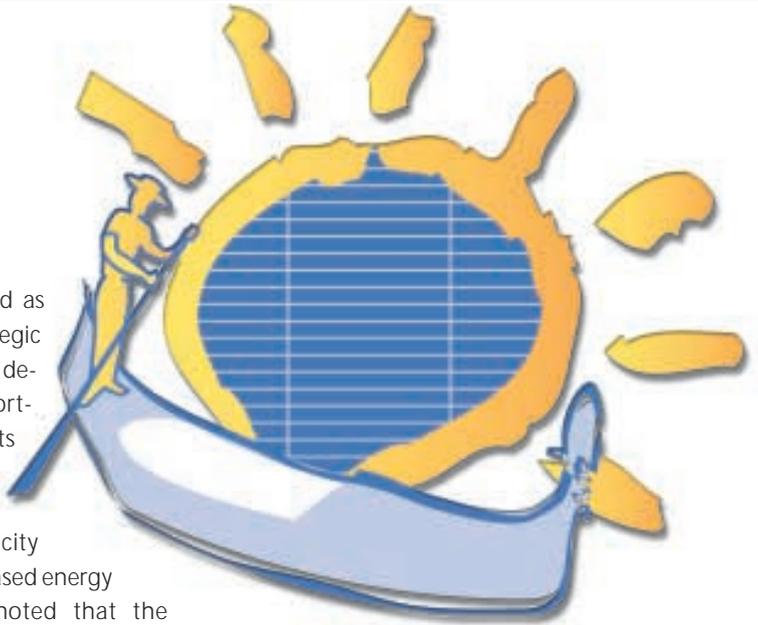
PHOTOVOLTAICS – IL VALORE DEL SOLE

‘The result of this Conference will be that the participants have widened their horizons, learned new facts, and used the opportunity for accumulating business contacts. The IEA would like to achieve something more.’

This was the challenge laid down by Hanns-Joachim Neef, Head of the IEA’s Energy Technology Collaboration Division in his concluding remarks to the third IEA Executive Conference on PV Power Systems which took place in Venice, Italy on 3-5 November 1999. More than 160 senior executives drawn from PV industry, utilities, finance, NGOs and government were invited to the conference, *Il Valore del Sole* (The Value of the Sun), to address the challenges and opportunities facing PV technology in meeting the needs of rapidly changing energy markets. During the keynote presentations and the break-out discussion sessions, Kyoto Protocol climate change

commitments emerged as one of the main strategic drivers for PV business development in the short-term, but participants were keen to look beyond 2010 to the transition of solar electricity from niche to broad-based energy markets. Mr. Neef noted that the amount of investment, and the scale of technical, political and financial capacity needed to achieve breakthroughs, will require targeted and determined international cooperation. Erik Lysen, Chairman of IEA PVPS, in his summation of the conference discussions, set out the key roles for each of the stakeholder groups in this collaborative effort. For governments, the onus is on formulating clear, long-term policy targets, and on creating the legislative framework to achieve these, such as movement away from subsidies to tax-based incentives, con-

tinuing R,D&D funding and assisting education both of users and decision makers. The PV industry itself must continue to reduce system costs, whilst working with other stakeholders, such as the building sector and utilities, to develop products matched to market needs, while for utilities, easier grid-interconnection mechanisms were identified as a major aspect of their contribution to PV market enablement. Mr. Lysen also called for more widespread implementation of measures designed to assist the deployment of new PV generation capacity,

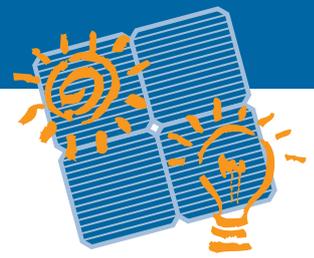


NIEUWLAND:

Whatever your feelings about PV you cannot fail to be impressed by the 1 MWp Nieuwland project, just outside Amersfoort in the Netherlands. From the multitude of innovative integration techniques to its sheer scale, everything about the project shouts out “Look, learn and be inspired!”

The 1 MW project is part of a wider new urban development that began in 1991. Marrying sustainability with a good quality

[PHOTO COURTESY JAN VAN IJKEN, NL]



including utility rate-based incentives and net-metering, and new financial products to assist PV purchases. The IEA is seen as the ideal agency to coordinate the various strands of the PV market development strategy, through its wide-reaching links to both the public and private sectors. Mr. Neef offered the IEA network as an 'honest broker' to develop an Action Plan for Photovoltaics and to assist in marshalling the institutional and financial resources needed for its implementation.

Delegates emerged from the meeting buoyed by the positive discussions, and by important policy commitments announced during the conference, notably a draft EU directive on renewables in liberalised electricity markets, Japan's indication that the residential market will be subsidy-free in the near future, and a proposed national net-metering bill for the USA. Further information is available from Rick Sellars at the IEA, Fax: +33 1 4057 6759, and from the IEA Website: <http://www.iea.org/venice>

ACTION LINES OF PROPOSED INTERNATIONAL FRAMEWORK FOR PV MARKET GROWTH.

a) Political Action

Information exchange to evaluate market facilitating policies and market rules to identify Best Practices for deploying PV technologies.

Establish voluntary targets for the deployment of PV technologies

b) Legislative and Administrative Action

Developed common rules, standards, and procedures for grid interconnection, and for PV building-integration.

c) Financial and Fiscal Action

Identify viable combination of existing and/or new sources of financing to ensure market growth meeting the proposed voluntary targets for grid-connected PV electricity.

d) Private/Public Partnership Action

Industry and the public sector to work together to conceive new and improved PV projects and to secure the required investments.

e) Information, Education and Training

Widespread dissemination, notably via the Internet and press, to publicise progress on these action lines.

A MODEL OF URBAN SUSTAINABILITY

of life was seen as an important design criteria from the outset. The local utility, REMU, was one of the first organisations to pledge their commitment to the new development and others soon followed.

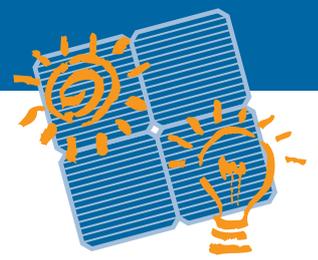
Work on the 1 MW project, which is an initiative of REMU and the Netherlands Agency for Energy and the Environment (Novem), began in 1997 and is now nearing completion. Almost 12 300 m² of photovoltaic modules giving a total capacity of 1,3 MWp, have been incorporated into pitched roofs, flat roofs, gables and canopies, and integrated into buildings ranging from a sports hall and childcare centre, to

residential houses and parking bays. This naturally required a high level of creativity to allow essentially standard modules to be used in a wide variety of designs. Modules were sourced from a number of suppliers including Shell Solar, BP Solar, Ecotec and Colt, with inverters supplied by Mastervolt, NKF and SMA.

The project has yielded many important results, most notably that Solar Power at the residential level is achievable, particularly where it is included in urban planning at an early stage. Large-scale implementation helped to bring down module costs and has provided valuable experience on ap-

proaches for integrating the systems into the electricity supply network, and testing of ownership models for PV (e.g. utility, homeowner or housing association). Above all, the project is promoting social acceptance of PV both amongst users and the building industry, and has put the Netherlands well on the way to achieving its objective to install 7,7 MWp of grid-connected PV by the end of 2002.

An overview of the project is presented in a new book by REMU. 'Bouwen op de Zon' Contact: Myrjam Bakker-Boone, REMU. Tel: +31 30 297 5686.



PVPS SURVEY REPORT COMING THIN & FAST...

Small but perfectly formed may be the best way to describe the latest PVPS International Survey Report (ISR).

The fourth ISR – Trends in Photovoltaic Applications in Selected IEA Countries between 1992 and 1998 – represents a conscious decision by PVPS to move to shorter but more timely presentation of the status of PV in the 20 member countries (PVPS-20). This fits better with the primary intention behind publication of the reports, namely to provide market status information to those responsible for developing the business strategies of PV companies, to aid the development of medium-term plans for energy service providers, and to give guidance to government officials responsible for energy policy development.

In common with previous reports, ISR #4 has four key chapters describing Implementation of PV systems, i.e. what broad types of systems have been installed, where, and how; Industry & Growth, covering national PV production levels and system prices; Framework for Deployment, which addresses new initiatives affecting the deployment of PV systems; and Summary of Trends, which updates trend information

PV System Price Evolution	Off grid 40-1000 Wp	Off grid >1 kWp	On grid 40 Wp -10 kWp	On grid >10 kWp
1998 Range	7,8 - 24	9 - 28,6	5,5 - 25,2	4,8 - 21,4
1997 Range	8,4 - 52,8	8 - 35,7	5,8 - 21,4	5,8 - 35,7

from previous ISRs. Once again PV applications are categorised under four key headings – off-grid domestic; off-grid non-domestic; on-grid distributed; and on-grid centralised. The report finds that installed capacity in PVPS-20 at the end of 1998 was 392 MWp, continuing the trend of annual increments exceeding 25 % since 1992. Overall, off-grid capacity still outweighs on-grid (54 % to 46 %), but rapid growth of on-grid distributed systems was again the main factor behind PV expansion.

Total budgets for market stimulation, demonstration and R&D increased by 30 % from 1997 figures. In general, budget emphasis since 1994 has transferred from R&D towards market stimulation, which now accounts for 47 % of total PV support budget. Japan's total budget of USD 225 million represents 50 % of the PVPS-20 total, with USA, Germany and Netherlands also providing significant funding (14 %, 12 % and 8 % of PVPS-20 total budget respectively). Overall module production rose by 43 % over the 1997 figure to 142,7 MWp, the

USA accounting for 38 %, Japan 36 %, Europe 19 % and the remainder (mainly Australia) 7 %. Crystalline silicon modules continue to account for more than 90 % of total production.

A large number of new initiatives were reported, including an increasing number of green electricity schemes, net metering, specific tariffs for PV and government grants for installations. Utilities in several countries are now involved in PV demonstration projects and large-scale implementation programmes.

Many countries have also implemented policies and set targets for electricity to be generated from renewables, partly in response to Kyoto climate change agreements. In addition, a number of countries are implementing or discussing CO₂ and energy taxes for reinvestment into PV and other renewables.

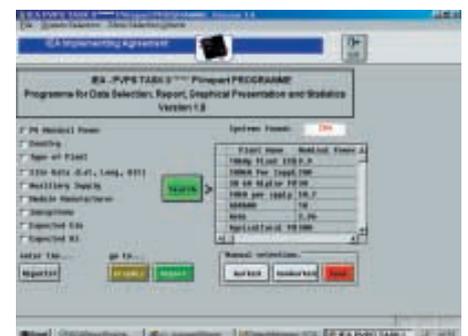
To obtain copies of the report (IEA-PVPS-1-07:1999) contact your national newsletter representative (see page 8).

PV PERFORMANCE DATABASE

PVPS Task II (Operational performance and design of PV systems) releases the first edition of the international PV database in January 2000.

Preparation of the database, which contains operational data of 266 grid-connected and stand-alone PV systems from the participating member countries (Austria, EU, France, Germany, Israel, Italy, Japan and Nether-

lands) has been one of the major activities of Task II. The information contained within the database is assisting the preparation of a Technical Report on the Analysis of PV Systems which will be published in March 2000. This will play an important role in assisting other IEA Tasks, particularly III (Stand-alone and Island Systems) and VII (Built Environment), to focus their efforts aimed at improving PV system design and



The database selection tool user interface.

performance, and reducing costs. The database software, which consists of two pro-

SCHOLAR POWER – THE KEY TO A PV FUTURE

It may be a cliché, but it is also fact: the youth of today are decision makers of the future. Educating youngsters today about PV – what it is, how it works and how it ties in with global sustainability – is essential in helping to maximise future acceptance of solar electricity. PV in schools initiatives are beginning to take off worldwide. Below we touch on a few of the most prominent examples.

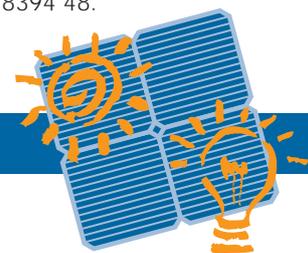
In the USA, the Utility Photovoltaic Group (UPVG) is monitoring the solar initiatives of schools nationwide through its 'Schools Going Solar' Campaign (part of a wider public education campaign supported by US Department of Energy). Schools are an ideal showcase for solar projects as changes and improvements are highly visible and closely followed. Some schools are using PV to solve on-site energy needs such as lighting, while in other cases utilities have installed PV on school buildings as part of green-pricing programmes. Students then have an opportunity to study the operation and assess the benefits of solar technologies first-hand, often as part of formal sci-

ences classes. So far Schools Going Solar encompasses 38 projects – covering passive and solar thermal applications, as well as PV – across the country. One utility has discovered a novel approach to support the introduction of PV. Under its 'SolarSchools' programme, Detroit Edison's commercial customers can help promote PV through partnership with local schools. Each participating school receives an annual credit towards its electricity bill, donated by its business partner, for 2 000 kWh of electricity generated from Detroit Edison's Southfield solar electric plant. In New South Wales, Australia, 18 schools across the state will receive 2 kWp PV systems under an initiative of energy service provider, Integral Energy. The systems were sponsored through customers' voluntary payments on top of their normal energy bill. The performances of the various systems are fully monitored with the data accessible via the Internet, which provides a valuable learning tool for students. A number of different PV in Schools programmes are under way across Europe, ranging from the collaboration between

Bayernwerk utility and Siemens Solar, which provided 500 1 kWp kits instructions and teaching materials to schools in Bavaria, to the government supported Scholar Programme in the UK – which aims to provide 100 schools with 1 kWp PV systems and computer-based monitoring facilities linked via the Internet. Under the framework of the European Union's Altener Programme, a consortium of organisations from Germany, Italy, Switzerland, and UK is currently drawing-up guidelines for a 'PV in Schools and Public Buildings' campaign which could be implemented in EU member states as part of a wider information initiative. This has involved the appraisal of existing programmes throughout the four countries to establish best practice in this area. A brochure describing the findings is being prepared and will be available from April 2000. Contacts: Bob Gibson, UPVG (USA) Fax: +1 202 223 5537; Robert Hegyi, Integral Energy (AUS), Fax: +61 42 282890; M. Sala or A. Trombadore, ABITA (EU), Fax: +39 055 504 8394 48.

workshops and seminars will be organised to help disseminate the program, and to allow feedback on areas for enhancement. The first edition of the database will be limited to a read-only CD-ROM, but future versions may include a facility to allow users to insert their own data. The CD-ROM, together with instruction manual will be available at cost-price (approximately USD 50) through Task II national representatives. For details contact: Ulrike Jahn, ISFH, Coburgerstr. 69, D-91056 Erlangen, Germany. Fax: +49 9131 481982.

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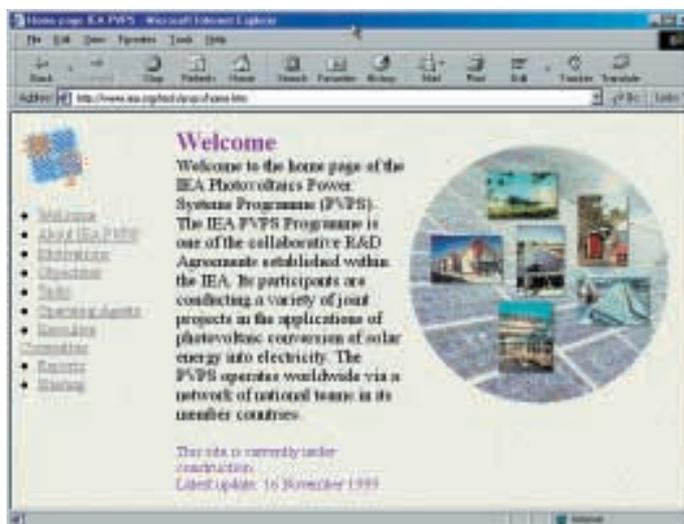
PVPS NEWS

PVPS GOES ON-LINE!

Information about the IEA's PV Power Systems Programme is now accessible via the internet

The PVPS website which currently gives details of task activities, contact points and publication of reports is located on the IEA server at <http://www.iea.org/tech/pvps/home.htm>

As the site develops, more PVPS material, including accessible reports will be made available on-line.



FORGET THE OLYMPICS...

The Second International Solar Electric Buildings Conference will take place in Sydney on March 8 to 10, 2000. This seminar, which is held under the auspices of PVPS Task VII, is one of three major meetings that form the international forum 'Renewable Energy for the New Millennium'.

The BIPV conference programme will include invited papers from international experts in the field, as well as joint sessions with other experts on engineering issues, and reports on key examples from around the world.

The gathering will provide an excellent opportunity to discuss the future of building integrated PV and to visit the Sydney Olympic Village which incorporates 600 kWp of grid-connected building-integrated photovoltaics.

The parallel events are the Electricity Supply Association of Australia's 6th Renewable Energy Technology and Remote Area Power Supply Conference, and the Solar Thermal 2000 Conference of the IEA's Solar Power and Chemical Energy Systems Programme.

Contact: The Meetings Manager Pty Ltd., Fax: +61 2 9241 5354
<http://www.esaa.com.au/renew.pdf>

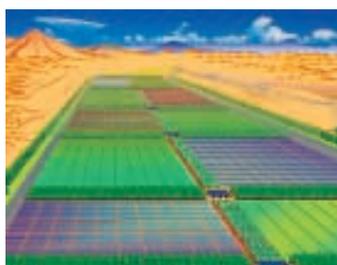
VLS-PV WORKSHOP

Experts from Task VIII (Very Large-Scale Photovoltaic Systems or VLS-PV) met in Utrecht in early December to discuss the workplan for the five-year task

One of the immediate deliverables of the Task – which will concentrate on desert installation of multi-MW to GW scale plants – will be an official brochure summarising the preliminary analysis of VLS-PV potential. This activity was undertaken as part of the preceding Task on design and operation of modular photovoltaic plants for large scale power generation, which concluded in 1997 (Task VI).

Additionally, a workshop on VLS-PV, supported by Japan's New Energy Development Organisation, NEDO, is planned to coincide with the 16th European PV Solar Energy Conference in Glasgow, May 2000.

The meeting will provide an opportunity to present the outcome of the



VLS-PV – Artist's impression.

pre-feasibility study and to call new participants into this exciting and challenging new research area.

Contact: Kazuhiko Kato, ETL, MITI
Fax: +81 298 54 5829.

PV ADDED-VALUE

As the PVPS Executive Conference in Venice emphasised, one of the critical factors that will help see more widespread deployment of PV systems is a clear understanding of their 'added-value' (other than simple energy delivery).

PVPS Task I (Information Dissemination) has also recognised this important area, and under the lead of Japan has initiated a special study to determine and quantify the electrical, architectural, environmental, social and economic added-values of PV.

A special-study workshop was held in Sapporo, Japan in September '99 following the PVSEC-II Conference. A follow-on workshop is planned for May 2000 to tie in with the European PV Solar Energy Conference in Glasgow, UK.

It is envisaged that a comprehensive summary report of this special study will be published in early 2001.

Contact: Eiichi Waki, NEDO
Fax: +81 3 5992 6440.

UPDATED PV DESIGN TOOL

A New version of PVSYSY, the design, simulation and analysis tool for PV systems has been developed under the framework of PVPS Task VII (PV in the Built Environment).

PVSYSY 3.0, devised by Geneva University and the Swiss Federal Institute of Technology in Lausanne has been improved to provide an easily accessible ergonomic graphical interface, specifically designed for architects, engineers and researchers.

The functionality of the package served to place it first in a survey of design tools undertaken by UK researchers in 1997. However, ease of use was identified as a shortcoming of earlier versions of the software. The modifications are designed to overcome this.

In addition, the new version features an expert system that guides the user towards an appropriate system configuration based on various physical imperatives such as inverter operating voltage, battery choice, operating temperature and so on.

Designers participating in Task VII's PV in the Built Environment Design Competition (as announced in PV Power #11) have the opportunity to use PVSYSY to assist with project sizing and economic analysis.

Contact: Andre Mermoud, University of Geneva, Fax: +41 22 705 00.
<http://www.unige.ch/gap-e/pvsyst/>



PVSYSY 3.0 incorporates a new user-friendly graphical interface.

IN BRIEF



Making an impressive entrance – Shell Renewables' new production facility.

SHELL GEARS UP FOR PV MARKET EXPANSION

The world's most advanced solar cell production facility – Shell Renewables' fully-automated plant in Gelsenkirchen, Germany, began operations in November.

At full capacity the factory's twin production lines will turn out 25 megawatts of multi-crystalline silicon cells each year, enough to power up to 7,000 European households. 'This major new facility demonstrates that Shell is investing now in order to become a market leader when solar is a larger part of the global energy mix,' said Jeroen van der Veer, managing director of the Royal Dutch/Shell Group.

The Gelsenkirchen plant will meet demand in Europe and other markets, such as South Africa, India and Sri Lanka where Shell Renewables has already established rural electrification businesses. A phased expansion from initial output of 10 MWp to full capacity is planned to meet increasing demand and at the same time allow the adoption of new production technology as it comes on stream in the near future.

Completed in just over a year, the plant will create 45 direct jobs and more than 200 jobs in manufacturing, marketing and the supply chain. In addition to the production capabilities, the facility also incorporates a Solar Education Centre and a roof terrace for special PV exhibits.

Contact: Susan Lankau
Fax: +49 40 6324-5248

SOLAR HOME SYSTEM PRICE BREAKTHROUGH

Free Energy Europe has succeeded in developing a new Solar Home System (SHS) concept that brings solar electricity within the reach of many households in developing countries.

The new SHS has a wholesale price of around the magical USD 100 mark. This makes it much more affordable than typical conventional technology SHS which cost in the order of 400-700 USD. The breakthrough comes from two developments: new generation 12 Wp amorphous silicon modules, and highly efficient balance of system components. This enables satisfactory basic energy services (2 area lights, a night light and radio) to be provided from the small power module. Free Energy Europe claims that its polymer injection framing solution overcomes one of the main problems of earlier generation single-junction a-si modules – namely moisture penetration which can lead to premature failure. The SHS kits have reportedly been shipping well to Asia, West Africa and Latin America, where there is a real need for smaller home systems to complement the standard 50 W products on the market.

Contact: Frank van der Vleuten,
Fax: +31 40 290 1249.

OLYMPIC PV ROOF IN OPERATION

EnergyAustralia has begun operation of Australia's biggest rooftop



Sydney Superdome's 70 kWp grid-connected PV system.

solar power installation on the roof of the new Sydney SuperDome at Homebush Bay. The 70 kWp installation is connected to EnergyAustralia's main electricity grid and forms a key component of the company's Pure Energy scheme.

EnergyAustralia developed, designed and built the rooftop installation, which uses more than 1100 amorphous silicon solar modules and produces about 85,000 kilowatt hours of electricity per year.

The firm's Managing Director, Mr Paul Broad, said the installation was in line with the sustainable energy strategy for the Sydney 2000 Games. Construction of the rooftop solar installation was completed in August, and it was commissioned soon after. Contact: Eric Aubert,
Tel. +61 2 9269 4593.



WORLD'S LARGEST SOLAR-SLATE ROOF COMPLETED

During renovation of the former federal grain warehouse in the Swiss capital, Berne, 2000 m² of solar slates were used to reconstruct the gigantic roof.

The new rooftop incorporates 16 650 of Atlantis Solar Systems' 'Sunslates', which have PV cells embedded in the slate material. The plant, which is owned and operated by Swissun Ltd., has a rated output of 200 kWp. This will provide some 167 000 kWh of electric power annually for the 'Green Power' customers of the City of Berne's electricity works (EWB).

Contact: M. Posansky,
Fax: +41 31 300 32 30.

DIARY DATES...

*Renewable Energy for the New Millennium
Sydney, Australia
8-10 March 2000*

Combined conferences of the Electricity Supply Association of Australia, ANZSES, the IEA SolarPACES Programme and IEA PVPS Tasks V & VII
☛ The Meetings Manager
Fax. +61 2 9241 5354

*16th EPSEC
Glasgow, Scotland, UK
1-5 May 2000*

16th European PV Solar Energy Conference and Exhibition
☛ WIP
Fax. +49 89 7201 291

*SOLAR MILLENNIUM CONGRESS
Toulouse, France
25-28 October 2000*

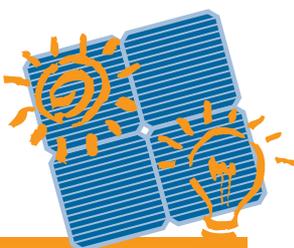
Organised by the European Solar Council
☛ European Solar Council
Fax. +33 1 44 18 00 36

*28th IEEE PVSC
Anchorage, Alaska, USA
17-22 September 2000*

IEEE PV Specialists Conference
☛ Ajeet Rohatgi,
Conference Chair
Fax. +1 404 894 5934

*Millennium Solar Forum 2000
Mexico City, Mexico
17-22 September 2000*

Organised by ANES – Mexican Section of the International Solar Energy Society
☛ Millennium Solar Forum 2000,
c/o CIE, UNAM
Fax. +52 73 250018



SOLAR STOCK EXCHANGE

CASE STUDY

PROGRAMME SUMMARY

- Location: Switzerland
- National green-pricing / rate-based incentive scheme
- Objectives: provide PV power for small users, promote PV in built environment, reduce system costs
- Number of Participants: 80 utilities and 20 000 customers
- Capacity installed: 2500 kWp
- Annual generation: 2,2 GWh
- Unit energy cost: CHF 1,0 - 1,2 (approx. USD 0,63 - 0,75)
- Total Investment: CHF 30 million (approx. USD 19 million)

Contact: Pius Huesser, Nova Energie
Fax. +41 62 834 0323

Per capita, Switzerland has the highest installed PV capacity in the world. About 80 Swiss electricity utilities now offer their customers solar-generated power. Some 20 000 customers have shown their willingness to pay more for PV power, resulting in the installation of 2500 kWp of PV plant.

In Switzerland, solar power has a good public image and expectations for PV as an energy source of the future are high.

In response to this, many utilities now offer solar-generated electricity as part of a scheme launched jointly in autumn 1996 by the Swiss national energy programme 'Energy 2000' and the Association of Swiss Electricity Companies (VSE).

The scheme builds on an initiative of Zürich's electricity utility, EWZ, which was the first to start a 'solar stock exchange', acting as a 'broker' between customer demand and third parties who wanted to sell their PV electricity. The focus is on provision



'Solar Electricity, clean and renewable' reads a Swiss brochure advertising PV power.

of solar power for small and medium-sized customers and the promotion of PV installations in built-up areas. Power is purchased at cost-covering prices, which provides an incentive to build new cost-competitive installations, with the result that system costs are dropping continuously.

Customers choose how much solar power they want to buy, paying mostly between CHF 1,00 - 1,20 (USD 0,63 - 0,75) per kWh.

IEA-PVPS

PV POWER

NEWSLETTER CONTACTS

AUSTRALIA

Greg Watt
fax +61 2 9969 1364

FRANCE

André Claverie
fax +33 493 95 79 87

MEXICO

Jaime Agredano Diaz
fax +52 73 189 854

SWITZERLAND

Pius Hüsser
fax +41 62 834 0323

AUSTRIA

Heinrich Wilk
fax +43 732 65 93 33 09

GERMANY

Peter Sprau
fax +49 89 720 1291

NETHERLANDS

Astrid de Ruiter
fax +31 30 231 64 91

UNITED KINGDOM

John Reeves
fax +44 151 347 2226

CANADA

Raye Thomas
fax +1 613 723 5980

ISRAEL

David Berman
fax +972 7 659 6736

NORWAY

Alf Bjørseth
fax +47 75 71 9013

USA

Charles Linderman
fax +1 202 508 5225

DENMARK

Peter Ahm
fax +45 86 93 36 05

ITALY

Salvatore Guastella
fax +39 095 29 12 46

PORTUGAL

Gina Pedro
fax +35 11 7939 540

EUROPEAN UNION

Paul Doyle
fax +32 2 296 0621

JAPAN

Masao Kando
fax +81 3 5992 6440

SPAIN

Jesús García Martín
fax +34 91 57 82 09 4

FINLAND

Leena Grandell
fax +358 9 865 631 99

KOREA

Kyung-Hoon Yoon
fax +82 42 86 03 739

SWEDEN

Lars Stolt
fax +46 18 55 50 95

PV POWER is written and edited by IT Power under the auspices of the IEA PVPS Programme Information Dissemination Project (Task I). Layout and production is by De Boer & van Teylingen, The Hague, Netherlands.

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*Managing Editor: Bernard McNelis
Editor: Paul Cowley*

*Office for correspondence:
IT Power Ltd, The Warren,
Bramshill Road, Eversley,
Hants RG27 0PR, UK
tel +44 118 973 0073,
fax +44 118 973 0820,
E-mail pvpower@itpower.co.uk*

