

# PHOTOVOLTAIC POWER SYSTEMS PROGRAMME

## IEA

The International Energy Agency (IEA), founded in November 1974, is an autonomous body within the framework of the Organisation for Economic Co-operation and Development (OECD), which carries out a comprehensive programme of energy co-operation among its member countries. The European Union also participates in the work of the IEA.

Collaboration in research, development and demonstration of new technologies has been an important part of the Agency's Programme. The IEA R&D activities are headed by the Committee on Research and Technology (CERT), supported by a small secretariat staff, with headquarters in Paris. In addition, four Working Parties on End Use, Renewable Energy, Fossil Fuels and Fusion, are charged with monitoring the various collaborative energy agreements, identifying new areas for co-operation and advising the CERT on policy matters. The Renewable Energy Working Party (REWP), chaired by the first PVPS chairman, Mr. Roberto Vigotti, oversees the work of ten renewable energy agreements and is supported by a Renewable Energy Unit at the IEA secretariat in Paris.

## IEA-PVPS

The IEA Photovoltaic Power Systems Programme (PVPS) is one of the collaborative R&D Agreements established within the IEA, and since its establishment in 1993, the PVPS participants have been conducting a variety of joint projects in the application of photovoltaic conversion of solar energy into electricity.

The overall programme is headed by an Executive Committee composed of representatives from each participating country, while the management of individual research projects (Tasks) is the responsibility of Operating Agents. By mid 2007, twelve Tasks were established within the PVPS programme, of which seven are currently operational. The latest task (Task 12) started in 2007.

The twenty-one PVPS members are: Australia, Austria, Canada, Denmark, EPIA, European Union, France, Germany, Israel, Italy, Japan, Korea, Mexico, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States. Turkey has shown an interest to revive its membership. The European Photovoltaic Industry Association (EPIA) joined PVPS in 2005.

## IEA-PVPS MISSION

The mission of the IEA PVPS programme is:

To enhance the international collaboration efforts through which photovoltaic solar energy becomes a significant renewable energy option in the near future.

The underlying assumption is that the market for PV systems is continuously expanding from the earlier niche markets of remote applications and consumer products, to the rapidly growing markets for building integrated and other diffused and centralised grid-connected PV generation systems.

This market expansion requires the availability of and access to reliable information on the performance of PV systems, technical and design guidelines, planning methods, financing, etc. to be shared with the various actors.

## IEA-PVPS OBJECTIVES

The PVPS programme aims to realize the above mission by adopting the following objectives related to reliable PV power system applications for the target groups such as utilities, energy service providers and other public and private users:

### 1. To stimulate activities that will lead to a cost reduction of PV power systems applications

National RD&D programmes, industrial R&D and expansion of PV manufacturing capacity as well as utility investments in PV projects are examples of activities with a direct effect on the cost of PV systems and their application. International co-operation within IEA PVPS can indirectly contribute to cost reduction by undertaking or supporting activities such as: sharing the activities and results of national RD&D programmes, objective information and operational experience, creating and facilitating networks as well as providing guidelines.

### 2. To increase the awareness of PVs' potential and value and thereby provide advice to decision makers from government, utilities and international organisations.

Key issues for the awareness of the potential and value of PV power systems among target groups are: cost/performance indicators, market developments, innovations and breakthroughs, new applications and services, national and international programmes and initiatives, policy and financing schemes, developments and standards.

### 3. To foster the removal of technical and non-technical barriers of PV power systems for the emerging applications in OECD countries

Over time, photovoltaic-based electricity supply can play a key role in urban-scale developments. Such developments should follow a holistic approach to maximise society's total energy efficiency and use of renewable energy opportunities. There is already increasing awareness of the principles of sustainable design and maximum use of (active) solar energy potential but this can be further expanded. PV power systems can play a key role in providing the reduced electrical energy services needs of houses and buildings and have the potential to become a major grid-connected electricity supply source. Through effective knowledge sharing, PVPS aims to enhance the opportunities for large-scale application of grid-connected photovoltaics in the urban environment as part of an integrated approach that maximises building energy efficiency, use of solar thermal and photovoltaics. There is a significant learning investment in many of the participating countries that have undertaken rooftop programmes and other sustainable community development initiatives.

TABLE 1 – STRATEGIES AND DELIVERABLES OF THE FOUR IEA-PVPS OBJECTIVES

In Table 1 the strategies and deliverables for each of these objectives are given.

OBJECTIVE	STRATEGIES	DELIVERABLES
<p>1 – To stimulate activities that will lead to a cost reduction of PV power systems applications.</p>	<ul style="list-style-type: none"> <li>To collect, analyze and disseminate information on the technical performance and cost structure of PV systems and their applications.</li> <li>To share the knowledge and experience gained in monitoring selected national and international PV projects.</li> <li>To provide guidelines for improvement of the design, construction and operation of photovoltaic power systems and subsystems.</li> <li>To contribute to the development of improved photovoltaic systems and subsystems.</li> </ul>	<ul style="list-style-type: none"> <li>Objective information on the technical performance, reliability and cost structure of PV systems, in an accessible form;</li> <li>Recommended practices for improved design, construction and operation and maintenance of PV systems and subsystems, in an accessible form;</li> <li>Recommendations concerning remaining technical issues for the interconnection to the grid of small-dispersed systems as well as large and very large PV systems;</li> <li>Recommended practices for the main components of PV systems.</li> </ul>
<p>2 – To increase the awareness of PVs' potential and value and thereby provide advice to decision makers from government, utilities and international organisations.</p>	<ul style="list-style-type: none"> <li>To collect and analyse information on key awareness issues, such as policies, markets, applications, experiences, barriers and success stories;</li> <li>To present/publish the reliable and relevant parts of this information in appropriate forms (brochures, reports, books, internet etc.);</li> <li>To disseminate these information products, relevant for the deployment of PV systems, to target groups;</li> <li>To monitor the use of this information and the effects on the awareness among target groups;</li> <li>To bring actors of different groups together, and to encourage the creation of national and international networks;</li> <li>To identify the most successful policy mechanisms leading to a self-sustained market growth;</li> <li>To provide objective policy advice to governments, utilities and international organisations;</li> <li>To encourage private and public sector investments that are required to bring PV Power systems into the main stream market.</li> </ul>	<ul style="list-style-type: none"> <li>Continuous update of the web page content and accessibility to ensure that the information developed by PVPS is readily available for all stakeholders, at the website: <a href="http://www.iea-pvps.org">www.iea-pvps.org</a>;</li> <li>PVPS fact sheets covering the development of key parameters and issues, e.g. industry shipments, installed capacity, potential, cost, etc. ;</li> <li>The Trends In Photovoltaic Applications Report intends to present and interpret year-to-year trends in both the PV systems and components being used in the utility sector, as well as the changing applications within that sector, in the context of business situations, policies and relevant non-technical factors in the reporting countries. The Trends report is to present an accurate, comprehensive and useful description of the PV products, applications and markets in the reporting countries. The Trends report is published in printed form on an annual basis;</li> <li>The Annual Report, which describes the main outcomes of the PVPS programme, the status of each task, the concise description of the status and prospects of each participating country's PV programme. The Annual Report is published in printed form in the spring of the following year;</li> <li>The PVPS Newsletter, published twice a year, informs the main target groups on the results of the collaborative work of the PVPS programme as well as on other important issues and initiatives regarding the deployment of PV power systems;</li> <li>An overview of the activities, available information such as reports and contact points of the PVPS programme on the Internet;</li> </ul>
<p>3 – To foster the removal of technical and non-technical barriers of PV power systems for the emerging applications in OECD countries.</p>	<ul style="list-style-type: none"> <li>To develop a major education and awareness effort to remove informational barriers among key target audiences, including consumers, developers and utilities;</li> <li>To conduct occupant surveys and gather key market data on targeted projects managed within participating countries;</li> <li>To evaluate the inclusion of PV within the standard design and construction process in selected communities worldwide;</li> <li>To assess the buildability, saleability, pricing and financing options for BIPV rooftop products and providing feedback to industry and manufacturers;</li> <li>To assess the impact of BIPV rooftop products on the distribution network and other connection issues, particularly benefits dealing with time of day pricing and summer time demand side management;</li> <li>To develop material that will assist in the development of standardised net metering contractual agreements between homeowners and utilities;</li> <li>To address mortgage and insurance issues;</li> <li>To identify steps in streamlining installation procedures and electrical inspections.</li> </ul>	<ul style="list-style-type: none"> <li>A Flyer describing the objectives and the structure of the programme and containing a list of the contact persons in each country is updated regularly;</li> <li>International (executive) conferences are organised together with other national or international, private or public organisations. They are intended to provide information and enhance awareness on key issues for the deployment of PV power systems. The participants are carefully selected among important decision-makers in the different target groups in order to assure maximum benefit of the outcomes;</li> <li>International workshops on important specific (technical and non-technical) issues are organised. They are intended to actively enhance the discussion and information exchange with participation from the concerned target groups;</li> <li>Input to national workshops is provided by the participation of PVPS experts;</li> <li>Summaries of the outcomes of the PVPS programme in national information networks and media are encouraged.</li> <li>Compilation of jurisdiction within participating countries where net billing and net metering has increased the accessibility;</li> <li>Compilation of homebuilders providing solar home options to customers;</li> <li>Overview of PV financing methods in OECD countries;</li> <li>Planning methods to evaluate and maximise the benefits of grid-connected photovoltaic systems to the electric grid and to the customers;</li> </ul>
<p>4 – To enhance co-operation with non-OECD countries and address both technical and non-technical issues of PV applications in those countries.</p>	<ul style="list-style-type: none"> <li>To stimulate the awareness and interest of multilateral and bilateral agencies and development banks on the technical and economic potential and best practice of PV systems;</li> <li>To stimulate co-operation between IEA PVPS members and selected non-IEA countries;</li> <li>To increase awareness on the opportunities of PV systems amongst targeted groups in developing countries via workshops, missions and publications;</li> <li>To stimulate PVPS membership of selected non-IEA countries;</li> <li>To identify opportunities and provide best practice for emerging applications (non-domestic systems, community systems, hybrids, mini-grids, weak grids);</li> <li>To promote adequate measures for quality assurance and standards;</li> <li>To identify the opportunities and conditions to implement adequate mechanisms of the Kyoto protocol as well as WSSD initiatives.</li> </ul>	<ul style="list-style-type: none"> <li>Specific studies on important issues (e.g. non-technical barriers, financing, potential assessments, PV in competitive energy markets, etc.).</li> <li>Collation and analysis of relevant existing publications on PV in developing countries;</li> <li>Guidance and documents to foster the successful introduction and expansion of PV systems drawing from past experiences and lessons learned from technology cooperation projects and programmes. These will be disseminated by appropriate means in selected developing countries;</li> <li>A regular electronic newsletter containing an information update on the CDM process and latest news on Task 9 publications, workshops and other relevant events;</li> <li>Staff workshops for multilateral and bilateral agencies;</li> <li>Workshops in non-IEA countries, co-ordinated with bilateral and/or multilateral agencies and/or NGOs;</li> <li>Active participation of target groups in selected developing countries;</li> <li>Dialogue and contact point with staff of multilateral and bilateral agencies.</li> </ul>



IEA PVPS Executive Committee, Ebeltoft, Denmark, October 2007.

#### 4. To enhance co-operation with non-OECD countries and address both technical and non-technical issues of PV applications in those countries

PV power systems in non-OECD countries represent a fast growing market segment, both in remote areas for rural electrification as well as increasingly in urban environments of these countries. Applications of PV in those countries move gradually from domestic applications (typically solar home systems) to non-domestic applications, community systems, mini-grids and applications in weak grid areas. Depending on the local framework conditions, the infrastructure available as well as appropriate quality management, financing and capacity building schemes, such applications represent new opportunities where PV can increasingly provide the required energy service on a competitive basis. Some of the Kyoto mechanisms may in future provide additional opportunities for PV applications, in particular if they can be aggregated to larger volumes. The sustainable and large-scale introduction of PV is supported by bilateral and multilateral agencies and development banks. At the same time, this large-scale introduction is hampered by various barriers such as acceptable accessible financing structures, institutional and social barriers, infrastructure issues and sometimes technical problems. PVPS expertise can be instrumental to help overcome some of these barriers.

#### IEA-PVPS TASKS

In order to obtain these objectives, specific research projects, so-called Tasks, are being executed. The management of these Tasks is the responsibility of the Operating Agents. Within IEA PVPS the following Tasks have been established:

- Task 1. Exchange and Dissemination of Information on PV Power Systems;
- Task 2. Performance, Reliability and Analysis of Photovoltaic Systems (concluded in 2007);
- Task 3. Use of PV Power Systems in Stand-Alone and Island Applications (concluded in 2004);
- Task 4. Modelling of Distributed PV Power Generation for Grid Support (not operational);
- Task 5. Grid Interconnection of Building Integrated and other Dispersed PV Systems (concluded in 2001);
- Task 6. Design and Operation of Modular PV Plants for Large Scale Power Generation (concluded in 1997);
- Task 7. PV Power Systems in the Built Environment (concluded in 2001);
- Task 8. Very Large Scale PV Power Generation Systems;
- Task 9. PV Services for Developing Countries;
- Task 10. Urban Scale PV Applications. Begun in 2004. Follow-up of Task 7.
- Task 11. PV Hybrid Systems within Mini-Grids. Begun in 2006. Follow-up of Task 3.
- Task 12. Environmental Health and Safety Issues of PV. Begun in 2007.

The **Operating Agent** is the manager of his or her Task, and responsible for implementing, operating and managing the collaborative project. As such the Operating Agent compiles a status report, with results achieved in the last six months, as well as a work plan for the coming period. These are being discussed at the Executive Committee meeting, where all participating countries have a seat. Based on the work plan, the Executive Committee decides whether activities in the coming period should continue, or intensify, or stop. In case the Executive Committee decides to continue the activities within the Task, the participating countries in this Task commit their respective countries to an active involvement by national experts. In this way, a close co-operation can be achieved, whereas duplication of work is avoided.