GrIPP-Net News

A quarterly Newsletter of the EC-ASEAN Green Independent Power Producers Network
Vol. 3, No. 2 (March 2005)

Editorial

Efficiency improvement, cost reduction and high reliability have contributed to the expansion of photovoltaic (PV) globally. Around the world there are many projects utilising PV in such diverse climates, cultures and economies. For example Germany is powering 2000 homes and US Department of Energy sponsoring a rural electrification project in Brazil for 500,000 homes. There are 100,000 families in rural developing countries of Domican Republic, Kenya, Sri Lanka and Zimbabwe, all using PV power for lighting, radio and television. Since 1988, Indonesia has led the way among the developing countries in the installation of PV. The country has tens of thousand villages scattered throughout the thousand of islands with no electric service. It is estimated that 8,000 PV systems were installed and more than 100,000 people are being served by the system *(PTM report, 2004)*

In view of the ever increasing significant role of PV towards sustainable energy development across the world, this second edition of the GrIPP Net Newsletter will focus on this issue. Hence, the newsletter will give an important overview of the PV technology situation in Southeast Asia as well as in Europe.

For an update, we are pleased to announce the First National Workshop with theme *"Update on the Development of Green IPPs in Thailand: Challenges, Strategies and Case Studies"* is now confirmed to be conducted in Bangkok, Thailand on 10 August 2005. The Regional Workshop is also scheduled from 15 – 16 September 2005 in Karlsruhe, Germany.

INSIDE

The workshops in general shall provide a platform for discussion and knowledge sharing for players in the energy market who are interested in renewable energies systems and policies. Throughout the workshop, discussion sessions shall offer all participants ample opportunities to exchange opinions on the applicability of these experiences and possible success factors in a broader context.

Upcoming Event

EC-ASEAN Green IPP Network National Workshop

"Update on the Development of Green IPPs in Thailand: Challenges, Strategies and Case Studies"

10 August 2005, Bangkok, Thailand

Opening Session (08:00 – 09:30)

- Welcome/Opening Remarks: MOE, MONRE, CEERD-FIHRD

Session 1 (10:00 – 11:30)
Keynote Presentations: Update on Policy Instruments and Regulation in Thailand

- **Presentation 1:** An Overview on Renewable Energy Strategy, Policy, and Action Plans – MOE (EPPO)
- **Presentation 2 :** CDM Policy – MONRE

Session 2 (11:30 – 12:30)
Keynote Presentations: Update on Renewable Energy Technologies and Resources in Thailand

- **Presentation 3:** An Overview on Thailand Renewable Energy Technologies and Resources – MOE (DEDE)

Session 3 (13:30 – 16:30)
Project Structures and Financing Approaches in Thailand

- **Presentation 4:** Overview of Project Structure and Financing of Renewable Energy Projects in Thailand

- **Presentation 5:** Case Study on Small and Very Small Power Producers Projects (SPP and VSSPP)
- **Presentation 6:** CDM Projects Implementation: Case Study AT Biopower, Korat Waste-to-energy project, CDM projects by UNESCAP, CDM projects by Danida and/or Energy for Environment Foundation
- **Presentation 7:** Cogeneration Projects Development: Case Study on some of the cogen projects in Thailand
- **Presentation 8:** Developers' perspective of future renewable energy project development (presentation by a project developer)

Closing Session (16:30 – 17:15)

Discussion and Conclusions

Solar Power in Europe

In 2003, installed PV power capacity in Europe increased by 26% to approximately 866 MWp. Germany took the lion share in this development and has also about half of Europe's installed capacity.

Table 1. PV power (MWp) as of the end of 2003 in selected countries.

Country	Total installed capacity	Installed in 2003
Austria	46	6
Denmark	2	0.3
Finland	3	0.4
France	21	2
Germany	410	133
Italy	26	4
Netherlands	46	20
Norway	7	231
Portugal	2	0.4
Spain	28	8
Sweden	4	0.3
Switzerland	21	1.5
UK	6	2
Japan	856	223
US	275	63
India	83	16
China	58	10

In terms of installed capacity per capita, Japan is also world leader with 7 W_p/cap, followed by Germany (5), Switzerland (3) and The Netherlands (3).

Applications of PV power systems can be divided into:

Off-grid domestic: typically about 1 kW, providing power to households and small villages; economic alternative for extending existing grids more than 1 or 2 km;

Off-grid non-domestic: provide electricity to a large range of applications, such as telecommunication, water pumping, navigational services and vaccine refrigeration;

Distributed grid-connected: often integrated into the built environment (residential, commercial or industrial) and typically 1 - 100 kW_p; power can be fed back into the grid when supply exceeds demand;

70 kWp roof system at Geneva exhibition centre

Centralised grid-connected: used as an alternative to conventional power generation or for strengthening the utility distribution systems; demonstration plants up to 6.5 MW are installed across the globe.

Solar plant in South-Australian desert

Distributed grid-connected PV application take up the largest share of the installed capacity in most countries, except for Scandinavia, Portugal and Switzerland, where off-grid systems dominate PV capacity. Development of domestic vs. non-domestic systems varies, depending on country circumstances.

Approximately 438 GWh (0.01% of total demand) was generated by PV in Europe in 2003. It has been shown that performance of newer systems, installed after 1996, is significantly better than older ones. The performance ratio accounts for losses due to shading, battery storage, inverters and wiring. Typical values for new systems are 0.75-0.80; for older ones about 0.1 lower. The spread in PR is however striking in all cases: from 0.4 to 0.9.

Reference

IEA, 2004. Trends in photovoltaic applications. Survey report of selected IEA countries between 1992 and 2003. Report IEA-PVPS T1-13:2004. www.iea-pvps.org

PV in ASEAN

ASEAN countries harbour a huge potential for application of PV power. Climatic conditions are favourable with high solar influx throughout most of the year. Most of the countries have remote regions or islands that are often unelectrified and costly to be connected to the grid.

Solar home systems and small to medium PV power plants for remote villages and niche applications such as hospitals, water pumps, communication and service buildings provide for ample solar development opportunity. In these remote areas solar power is often a competitive alternative to conventional power supply.

Currently, the PV market is picking up in some countries, on the back of active support policies. Thailand for example, supports rooftop systems with a 50% grant. The Philippines has been the field of tens of bilateral aids projects for various PV Solar applications (EIES, PRES, SPOTS, MSIP, AMORE, Pangan-An, Palawan and Shell-RESCO). Barangay Electrification programme capitalises about 600 PV Solar Charging Stations with more than 1000 SHS and 300 hybrid systems installed. Beside Off-grid PV electrification, the Philippines is also experimenting the first large PV power plant (1 MW) connected to the power grid in combination with a hydro scheme (7 MW).

One of the most attractive applications of PV technology is the use of PV in buildings or commonly known as Building Integrated Photovoltaic or BIPV, of which Malaysia plans to pursue in the next 5 years with the implementation of the Malaysian Building Integrated Photovoltaic (MBIPV). With this, the scope of PV applications is expected to increase in the country in the near future. The MBIPV project under purview of Ministry of Energy, Water and Communications aims to create the enabling environment that will lead to a sustainable BIPV market in the country and technology cost reduction. Malaysia expected to have the total installed grid-connected PV capacity of 2MWp by the time project ends.

Installed PV capacity (MW_p) as of end 2003 in selected ASEAN countries

Country	Installed capacity
Indonesia	28
Philippines	1.5
Thailand	6
Vietnam	5.4
Malaysia	2.2

Small PV power installation in Vietnam

Critical implementation conditions

From case studies across the globe, significant experience has been gained regarding successful installation and operation of PV systems.

- Usefulness for the users: the system should be of appropriate size (e.g. 120W for a typical village household), technology, and energy provision for the users;
- Sense of ownership: users need to feel connected and responsible for the system, which will increase if they use the system regularly;
- Affordability for the end-user, typically a household or village. The main problem is to guarantee affordability for households with extremely low incomes;
- Post-commissioning: ensuring that the villages can take responsibility for simple operation and maintenance actions as much as possible, and provide (both financially as in terms of the service company) for the circumstances where more demanding repair is needed. This term also includes further provisions that enable the villages to generate extra income.

Financing for PV

Adequate financing is probably the largest barrier for implementing PV systems in remote areas. Several different arrangements can be made for both individually and community owned installations.

- Cash sales: the system is sold directly to the end-user who immediately owns the system;
- Credit system: the end-user receives a credit in order to acquire the system. Banks, technology provider, public-private partnerships or the government may be providers of credit;
- Fee for service: the end-user pays a fee to an energy service company (ESCO) and in turn receives an energy service.

Many governments in ASEAN countries have subsidy schemes in place, which may significantly increase viability for end-users, energy companies or implementing organisations. The Clean Development Mechanism, particular small-scale, may also provide interesting options. Some however view subsidies as ruining the market. Selco is an example of a successful Indian company providing PV systems technology as well as credit (www.selco-india.com).

References

IEA, 2004. Trends in photovoltaic applications. Survey report of selected IEA countries between 1992 and 2003. Report IEA-PVPS T1-13:2004. www.iea-pvps.org

ECN, 2005. Providing electricity to remote villages. ECN-C--05-0

Potential and Cost for PV Power Generation

Estimates for implementation and cost reduction potential of a certain technology usually cover a wide range of possible scenarios. In case of PV, this depends on assumptions regarding climate and renewables policy, R&D, learning potential and technical power system limitations. These assumptions vary in practice among scientists, PV industry

and government publications. A brief overview of some publications may provide some insight.

For the EU-15, ECN (2003) has estimated a realisable potential of 100-4000 GWp in 2050. Using a wide range of sources, this is based on 16,000 km^2 roof and façade area, 5-8 €/W_p current investment cost, 20% cost reduction at double cumulative PV production and 12-16% load factor.

Resulting from a modelling exercise, Zwaan and Rabl (2004) conlude that "PV electricity is unlikely to play a major role in global energy supply". However, due to significant cost reductions, beyond 2020 its contribution may become significant.

An EU PV industry group, the Photovoltaic Technology Research Advisory Council (PV-TRAC), foresees a possible 4% contribution to global power production by 2030. This corresponds to well over 1000 GW_p installed capacity. Among others, it advocates strengthening the relationship with developing countries in order to bring affordable energy service to the population of these countries.

Meanwhile at European policy level, the White Paper for a Community Strategy and Action Plan sets a target of 3 GW_p installed PV capacity by 2010.

A report by an interesting alliance of Greenpeace and the European Photovoltaic Industry Association states that there are "no technical, economical or resource barriers to supplying 1.1% of the world's electricity needs from solar power by 2020".

Cost reduction

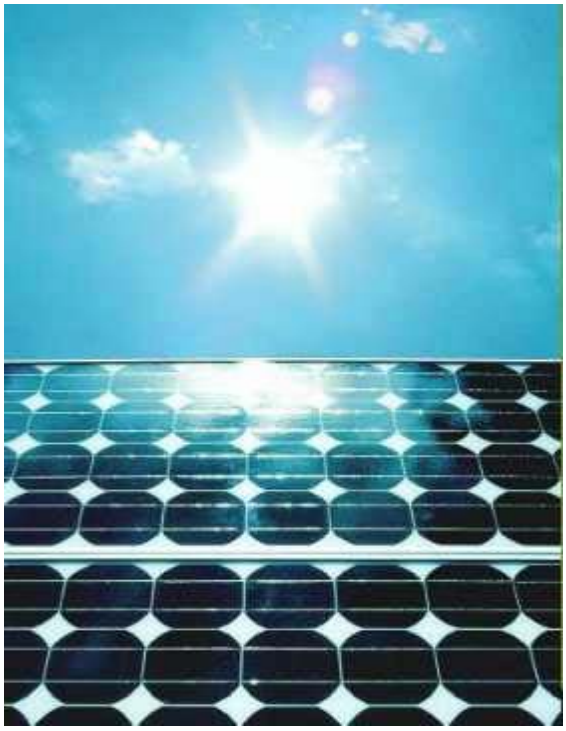
This scenario is rather optimistic according to the European roadmap for PV R&D, as it would imply strong PV system cost reduction to 1 \$/W_p before 2025. The European Commission views 1.5-2.53 \$/W_p by 2025 as more realistic.

Zwaan and Rabl (2004) use the so-called "learning curve" approach to estimate the potential for cost reduction of PV electricity. The progress ratio, the most important factor in the learning curve is estimated to be 0.8, meaning that kWh cost decrease with 20% at every doubling of cumulative installed PV capacity. To reach the break-even cost of 1 \$/W_p, capacity needs to grow to 150 GW_p. This would amount to approximately \$64 billion excess cost. These figures are however very sensitive to the progress ratio, which if decreased to 0.75 would imply only 50 GW_p installed and \$27 billion excess cost.

External cost

The authors also argue that, under conservative assumptions, accounting for the external effects such as climate change and human health, can reduce the "cost gap" between PV and fossil-based power generation. Damage is mainly caused by CO_2, particulate and acidifying emissions from coal in particular, and are conservatively estimated to be 0.01 \$/kWh or 0.25 \$/W_p. Installing 150 GW_p would then avoid the substantial amount of \$37 billion, or 37% of the excess cost.

It is important to note that although PV cost reduction has followed the 0.8 progress ratio, this by no means implies this development will continue until a mature market stage (as confirmed by the early death of many promising technologies). Therefore it is crucial that PV niche markets such as solar home systems are extensively used. In addition, strong policy support is required, possibly by setting targets for PV share in power production.



A brighter future

Solar installation in Malaysia

References

Zwaan, B. Van der and A. Rabl, 2004. The learning potential of photovoltaics: implications for energy policy. Energy policy 32 (2004) 1545-1554.

Greenpeace and EPIA, 2005. Solar generation. Solar electricity for over 1 billion people and 2 million jobs by 2020.

European Commission, 2004. PV NET. European roadmap for PV R&D. report EUR 21087 EN.

ECN, 2003. Potential and cost for renewable electricity generation. A data overview. Report ECN-C-03--006.

PTM Energy Smart Issue 0012, 2004.

PTM Draft Final Report, 2005, Information for the Commercialisation of Renewables In ASEAN (ICRA).

PTM 2004, Malaysia Building Integrated Photovoltaic. Project document

The *GrIPP Net Newsletter*, the official publication of the Green IPP Network, is published quarterly to communicate network activities and to support the dissemination of relevant information and network results. It is provided free to network members and interested stakeholders, and can be downloaded from this site: www.EC-ASEAN-GreenIPPnetwork.net.
This *Newsletter* has been produced with the financial assistance of the European Community – ASEAN Energy Facility. The views expressed herein are those of the authors and can therefore in no way be taken to reflect the official opinion of the European Commission.

GrIPP Net Calendar

June 2005

EC-ASEAN Green IPP Network First National Workshop
"Current development of Green IPPs: Experiences, challenges, and strategies"

28 June 2005, Kuala Lumpur, Malaysia

July 2005

EC-ASEAN Green IPP Network Second National Workshop
"Current development of Green IPPs: Experiences, challenges, and strategies"

Tentative dates: July 2005, Manila, Philippines

August 2005

EC-ASEAN Green IPP Network Third National Workshop
"Update on the development of Green IPPs in Thailand: Challenges, strategies, and case studies"

10 August 2005, Bangkok, Thailand

September 2005

EC-ASEAN Green IPP Network Regional Workshop
"Current development of Green IPPs: Experiences, challenges, and strategies"

15 - 16 September 2005, Karlsruhe, Germany

Calendar of Events

July 2005

International Energy Workshop 2005
5 - 7 July 2005, Kyoto, Japan

Renewable Energy Thailand 2005
7 - 10 July 2005, Bangkok, Thailand

August 2005

Production Forecasting in Upstream Oil and Gas
23 - 24 August 2005, Kuala Lumpur, Malaysia

6th European Wave and Tidal Energy Conference
29 August - 2 September 2005, Glasgow, UK

September 2005

RENEXPO 2005
22 - 25 September 2005, Augsburg, Germany

Eolica Expo Mediterranean 2005
29 September - 10 October 2005, Rome, Italy