

# AUSTRIA

PHOTOVOLTAIC TECHNOLOGY STATUS AND PROSPECTS  
HUBERT FECHNER, UNIVERSITY OF APPLIED SCIENCES, TECHNIKUM VIENNA



Fig. 1 - PV Production at Solon Hilber, Tyrol (© photo: das fotoatelier Steinach).

## GENERAL FRAMEWORK AND NATIONAL PROGRAMME

In general, the Austrian situation in photovoltaics has slightly improved in 2009. The internationally acting production companies could perform quite well, in spite of the global economic crisis. The home market improved a bit, improved a bit. The continuity in public support schemes is still lacking. Traditional export rates of the individual production companies are 90 % or even more.

A wide public support for PV installations (in order to match leading photovoltaic markets) as well as for other "new renewables" (Austria has about 60 % electricity from large hydro) will also most probably not be achieved within the upcoming year. The revised green-electricity act (GEA) is in operation.

Even though the "new RES" are supported by this act, mainly via up to 13 years guaranteed feed-in tariffs, the financial cap is much too low to significantly increase the share of renewables in the Austrian electricity system. The feed in tariffs are stated by the federal Ministry for Economics and financed by a supplementary charge on the net-price and a fixed price purchase obligation for electricity dealers.

The main pillars of the new regulation are:

- Annual additional funding volume reduced to 21 MEUR for all renewable energy sources
- Photovoltaics will receive about 10 % of the support volume
- The duration of the program is 10 years constant + 2 years declining support

Through these feed-in-tariffs only systems > 5kW will be supported. Systems up to 5kW can apply for investment cost funding through the Austrian Climate and Energy Fund. This support initiative, launched once a year, will support only small systems (private households) and was opened for the first time in August 2008 by one tender with a total budget of about 10 MEUR to support private PV Systems (< 5 kW) which lead to another about 900 PV Systems with a total of about 4 MW. In 2009, the budget was doubled leading to about 7-8 MW of PV installations. This support scheme provided additional financial benefits to building integrated systems (BIPV).

The announced Austrian Climate and Energy Fund' increased budget for 2010 for PV support in the range of 35 MEUR could lead to another 20 MW of installations, since the support per kW installation will be reduced according to the lower PV prices. Besides this, some regional states have announced increases in PV support budgets, as well.

National PV stakeholders question the effectiveness of the support system mainly because of the complexity of the support system, the modest financial limits and the uncertainty of the available budget, which might not be able to significantly bring up an internationally noticeable Austrian PV home market. Differently to other countries the feed-in-tariff system will only be responsible for the minor part of the supported PV in Austria.

## RESEARCH AND DEVELOPMENT

The European 20-20-20 targets led to a governmental energy strategy process on how to achieve the given national targets for renewables, which should increase from the current 23 % to 34 % in 2020.

The Austrian Ministry of Transport, Technology and Innovation ordered a revision of the existing national PV technology roadmap in order to explicitly address the 2020 targets.

The revised roadmap was introduced into this process in early December 2009. In this new roadmap, two realistic but ambitious targets were worked out, reaching 5 % respectively 8 % of the total Austrian electricity by photovoltaics in 2020, provided the frame conditions will be changed immediately. Beside the energy output, in these scenarios up to 36 000 employees could find a job in the Austrian PV industry; these numbers mainly due to the design and installation of PV systems. National Industry producing PV components for the world market could further increase these numbers.

The National PV Technology Platform, founded in September 2008 along with the 6<sup>th</sup> Austrian PV conference, was further developed. The PV Technology Platform brings together about 15 leading Austrian PV industries in order to discuss their needs for a long term strategy towards an international competitive positioning on the growing world market. Currently, about 2 200 employees are working in the PV industry in Austria. This initiative is coordinated by the University of Applied Science Technikum Vienna.

For many years, the Austrian PV research activities are mostly focused on national and international projects: The involved research organisations and companies are participating in various national and European projects as well as in different tasks of the IEA-PVPS Programme as well as concerning grid interconnection in the IEA ENARD Implementing Agreement. The RTD development and approach is widespread located and decentralised orientated.

Two national research programmes, "New Energy 2020" by the Austrian Climate and Energy Fund, as well as "Buildings of Tomorrow Plus" again by the Ministry of Transport, Innovation and Technology, were launched already in 2008 and cover quite broad research items on energy technologies, including PV with a focus on PV building integration. In 2009, PV research was addressed explicitly for the first time in a separate subpart of the programme. On the European level, the ongoing initiatives to increase the coherence of European PV RTD programming (PV-ERA-NET) are actively supported by the Austrian Ministry of Transport, Innovation and Technology. Austria actively participates in the PV-ERA-NET and is funding Austrian participation in transnational ERA-NET calls on PV.

Electricity companies are more and more investing in research on renewable energy. Departments were founded to establish a business, mainly by investments in new and existing renewable energy plants. Due to the insufficient national support for renewables, they mainly invest in other European countries. For PV, most relevant activities were done by Verbund - Austrian Renewable Power, with many PV activities as well as the Upper Austrian Energie AG, which just designed Austria's first 1 MW PV systems near Eberstalzell; to be operational in 2010.

#### Research Highlights of Photovoltaic in Austria are:

- The Christian Doppler Laboratory at the University of Salzburg "Applications of Sulfosalts in Energy Conversion" installed a new method to grow single sulfosalt crystals using melt solution growth and a new photoacoustic spectroscopy system for semiconductor band gap determination. The improvement of solar cell efficiencies by use of buffer layers was investigated and sulfosalt candidates with high Seebeck coefficients combined with high electrical conductivity for applications in thermoelectrical energy conversion were identified.
- The research topics of another Christian Doppler Pilot Laboratory at the Technical University in Graz "for Nanocomposite Solar Cells" are focused on the preparation of nanocomposite materials with controlled morphology for photovoltaic applications. The basic research program will focus on the formation processes and the investigation of the morphology of nanocomposite layers, consisting of inorganic and organic semiconductor phases.
- Crystalsol is aiming at developing a new type of flexible photovoltaic module with a significant cost and versatility advantage, compared to currently known photovoltaic technologies. The core innovation is the light absorbing layer made of a patented new crystalline semiconductor powder and the low-cost roll-to-roll production process. For this innovative technology development, Crystalsol received the Austrian State Award Environmental and Energy Technology 2010.
- Austrian Institute of Technology, Energy Department (formerly arsenal research) investigates methods for characterization and analysis of different PV module technologies (Crystalline, thin-film, concentrators) and their performance according to power, energy yield, lifetime and spectral influence. The research field includes integrating existing and emerging systems to design an intelligent multifunctional façade. The existing laboratory infrastructure will be extended with the opening of a thin film laboratory in the second half of the year 2010. The integration of PV into Smart Electricity Networks is the focus of national and EU financed projects which started in 2009. As the main highlight, the new IEA-PVPS Task 14, which was initiated by international collaboration, will be coordinated by Austria.
- Due to the intensive investigation of thin-film Organic Solar Cells at the Johannes Kepler University, **Konarka Technologies**, a US-based PV-company is operating a Research and Development centre in Linz.
- HEI develops and manufactures novel, self-sufficient solar LED-lighting systems with tube-shaped PV panels which are fully integrated to the light pole. The lights are dedicated for professional lighting of roads, squares and pathways. The company started production in 2007 and is now expanding fabrication facilities.
- **Vienna University of Technology**, Energy Economics Group (EEG), major topics of teaching and research on Photovoltaics:
  - diffusion of technology and market penetration on national and international level
  - non technical obstacles and supporting factors for diffusion of technology (e.g. socio-economic impact parameters)
  - energy policy design and political economy effects of PV
  - PV integration in buildings
  - medium and long term diffusion scenarios of PV

- At the Energybase, the largest passive solar office building in Austria, and home of the new Programmes "Renewable Urban Energy" of the **University of Applied Sciences Technikum Vienna**, the Master course commenced in September 2009 with a strong focus on PV and other solar technologies.
- The **Austria Solar Innovation Center (ASIC)** covers consultation for PV, as well as teaching and training in collaboration with the Upper Austria University of Applied Sciences, degree programme Eco-Energy Engineering (BSc, MSc). Students have lectures and laboratory classes. Students practice with a 17 kWp PV system - 5 different module types, 5 different inverter types, 2 monitoring/ data logging systems, and a meteorological station.

### IMPLEMENTATION & MARKET DEVELOPMENT

Approximately 32 MW of PV power had been installed in Austria, by the end of 2008. No figures are yet available for 2009, but it is expected that currently, not more than about 40-45 MW are totally installed in Austria. The annual growth rate in 2008 was, with a total 4,7 MW, still modest.

Despite the weak home market, Austria has some internationally well positioned manufacturers nearly exclusively involved in foreign trade; mainly focusing on the neighbouring large German market, as well as the well-developed markets of Spain and Italy.

The main applications for PV in Austria are grid connected distributed systems, representing more than 90 % of the total capacity. Grid-connected centralised systems in form of PV-Power plants play a minor role. Building integration is an important issue and a few remarkable installations were realised in 2009.

Besides on-grid applications, off-grid systems are widely used to provide electricity to technical systems or for domestic use in alpine shelters or households lying far away from the grid.

### INDUSTRY STATUS

Austrian market framework conditions the Austrian PV industry could still expand their activities during 2009; focussing on the export of their products predominately to the booming German market and other International markets. In Austria, about 2 200 employees in the PV business seems to be a success, but this is very much dependent on the development outside the country's borders.

In 2009, AT&S has industrialized a new PV module technology aiming at higher efficiency, based on back-contacted cells. They are targeting a commercial launch in 2010.

**Blue Chip Energy** started production of silicon solar cells in the energy autarkic municipality of Güssing (Burgenland) in 2008.

**Energetica** is a module manufacturer and system supplier located in Carinthia and offers complete solutions in the field of photovoltaics. Production of photovoltaic modules, production of inverters and the planning and mounting of photovoltaic- and solarthermal systems are within the scope of Energetica.

The **Ertex Solartechnik GmbH** is a company of the ERTL Glas Group. One of their main product is the VSG, a laminated safety glass which can be also assembled easy to insulating glass. In recent years, Ertex-solar realized a few projects all over the world. The focus in 2009 was Italy, France, Germany and Portugal.

**Falconcell Produktions GmbH** is a manufacturer of mono- and multicrystalline silicon solar cells. Founded in 2006, Falconcell began operations in 2007 with a production capacity of 30 MW.

**Kioto-Photovoltaic**, since 2004 produces mono- and multi-crystalline solar modules based on 6" wafers in St.Veit/Carinthia.

**PVT Austria**, the first manufacturer of PV modules in Austria produces standard and tailored modules from imported crystalline silicon cells. The company successfully increased their output taking profit of the German PV boom.

**SED** manufactures PV-roof tiles for BIPV applications. The custom laminates produced are directly stuck into standard format tiles made of recycled plastic and can easily replace conventional roofing materials. SED also manufactures PV elements for noise barrier walls. The glassless flexible laminates are mounted on aluminium carriers and fit all custom noise barrier types.

**SOLON HILBER Technology**: The company produces modules with a yearly capacity of 50 MW and all kind of installation systems/trackers (Tixed Tilt, Single Axis, Dual Axis, Bus Ports and Alpine Solutions). SOLON HILBER also installs turn key projects all over the world. The references are in Europe, USA and Australia with a total capacity of more than 150 MW. The company belongs to the German SOLON SE. Currently, more than 200 employees are working in this company.

**Sunplugged**, based in Tyrol, is developing a new type of flexible CIGS Cells. Energy supply for efficient cooling systems on commercial vehicles will be one specific application of this new development.

Besides PV-Module and cell production, various other companies are manufacturing components for modules and BOS-components like batteries, inverters, cell-wiring or mounting systems:

**Fronius International** has developed and produced inverters for grid-connected PV systems since 1994. With a current production capacity of approx. 2 000 MW of inverter power Fronius is the second-largest manufacturer in the world and is selling its products in more than 30 countries worldwide.

**ISOVOLTA AG** is the world market leader for flexible composite materials used for encapsulation of solar cells. The ICOSOLAR back sheet laminates are available in various colours and are used by many module manufacturers in the world.

**PLANSEE-METALL GmbH** in Tyrol is manufacturing refractory metals for diverse applications; more particularly metallic targets for thin film solar cells.



Fig. 2 - Development of composite films for encapsulating photovoltaic modules (photo: Isovolta).

Ulbrich of Austria is manufacturing string- and buswires for PV Cells and modules with a total capacity of more than 1,5 GW.

PTS in Klagenfurt offers complete turnkey module production systems with their "string@once" technology.

The Energy Department of the Austrian Institute of Technology, (formerly arsenal research) is known as the internationally accredited PV module test institute for crystalline modules (since 2003) according to the IEC/EN 61215, and for thin film modules, according to the IEC/EN 61646 and module safety qualification according to the EN 61730. Another industry related activity at the AIT are PV inverters, in particular their performance (MPP, efficiency aspects) and their grid compatibility (Control, Fault-Ride-Through). The AIT PV inverter laboratory attracts worldwide inverter manufacturers for collaboration.

#### ACCOMPANYING MEASURES FOR ACCOMPANYING MEASURES FOR MARKET DEVELOPMENT

The National Photovoltaic Association is very active in public relations and has built a national network for dissemination of information on PV and initiates various workshops, press conferences and other awareness raising activities. By fostering political contacts, intensive political lobbying work and a broad series of articles in newspapers for PV, the association aims at changing the legislative frame conditions for PV by introducing stable and supportive PV market incentives, preferably based on feed in tariffs. At the end of 2009, well over 100 companies and individuals involved in the PV business were Association members.

The Annual National Photovoltaic Conference (a three days event) organised by the University of Applied Sciences Technikum Vienna and supported by the Ministry of Transport, Innovation and Technology is established as THE annual gathering of Austrian PV stakeholders. In 2009, this event was combined with the General Assembly of the European Photovoltaic Technology Platform, bringing together about 450 experts in Vienna in June 2009.

The "Certified PV Training," offered by the Austrian Institute of Technology has increased their PV program significantly by performing

8 day-trainings courses all over the country, with a total of more than 120 participants in 2009.

#### FUTURE OUTLOOK

The situation of the steadily growing export oriented Austrian PV industry is expected to be further improved, due to the international booming PV market, and the small home market.

The Austrian PV market will remain limited, relying on various incentives which will only partly support the market.

Some strategic initiatives to show the potential of PV for Austria are PV Technology-Roadmap, PV-Technology Platform, PV Lobbying by the Association, PV Conferences, etc.

PV research and development will be further concentrated on international projects and networks, following the dynamic know-how and learning process of the world-wide PV development progress. Mainly within IEA PVPS, the new Task 14 on "High Penetration Photovoltaics in Electricity Networks," lead by Austria, might become a focal point of the research activities.

The direct links to the new members of the European Union in Central and Eastern Europe (Czech Republic, Slovakia, Slovenia, Bulgaria, etc.) in energy related items are to be mentioned, where PV increasingly plays an important role.

The level of the public know-how and interest about the potential and perspectives of PV is continuously growing. Several renewable energy education courses are already implemented and some new ones are currently under development. All of them include PV as an essential part of the future energy strategy. The importance of proper education for installers and planners of PV systems will increase depending on the market situation. The training is already available and can be extended easily. Meanwhile, at the University of Applied Science Vienna (Technikum-Wien), about 200 students are studying at the Bachelor and Master courses in "Urban Renewable Energy Technologies" with solar, and specifically, PV systems as one core element of the education.