INTERNATIONAL ENERGY AGENCY

CO-OPERATIVE PROGRAMME ON PHOTOVOLTAIC POWER SYSTEMS

Task 1

Exchange and dissemination of information on PV power systems

National Survey Report of PV Power Applications in Austria 2012

Final version

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Definitions, Symbols and Abbreviations

For the purposes of this and all IEA PVPS National Survey Reports, the following definitions apply:

PV power system market: The market for all nationally installed (terrestrial) PV applications with a PV power capacity of 40 W or more.

Installed PV power: Power delivered by a PV module or a PV array under standard test conditions (STC) – irradiance of 1 000 W/m^2, cell junction temperature of 25^{o}C, AM 1,5 solar spectrum – (also see 'Rated power').

Rated power: Amount of power produced by a PV module or array under STC, written as W.

PV system: Set of interconnected elements such as PV modules, inverters that convert D.C. current of the modules into A.C. current, storage batteries and all installation and control components with a PV power capacity of 40 W or more.

Module manufacturer: An organisation carrying out the encapsulation in the process of the production of PV modules.

Off-grid domestic PV power system: System installed to provide power mainly to a household or village not connected to the (main) utility grid(s). Often a means to store electricity is used (most commonly lead-acid batteries). Also referred to as 'stand-alone PV power system'. Can also provide power to domestic and community users (plus some other applications) via a 'mini-grid', often as a hybrid with another source of power.

Off-grid non-domestic PV power system: System used for a variety of industrial and agricultural applications such as water pumping, remote communications, telecommunication relays, safety and protection devices, etc. that are not connected to the utility grid. Usually a means to store electricity is used. Also referred to as 'stand-alone PV power system'.

Grid-connected distributed PV power system: System installed to provide power to a grid-connected customer or directly to the electricity grid (specifically where that part of the electricity grid is configured to supply power to a number of customers rather than to provide a bulk transport function). Such systems may be on or integrated into the customer's premises often on the demand side of the electricity meter, on public and commercial buildings, or simply in the built environment on motorway sound barriers etc. They may be specifically designed for support of the utility distribution grid. Size is not a determining feature – while a 1 MW PV system on a rooftop may be large by PV standards, this is not the case for other forms of distributed generation.

Grid-connected centralized PV power system: Power production system performing the function of a centralized power station. The power supplied by such a system is not associated with a particular electricity customer, and the system is not located to specifically perform functions on the electricity grid other than the supply of bulk power. Typically ground mounted and functioning independently of any nearby development.

Turnkey price: Price of an installed PV system excluding VAT/TVA/sales taxes, operation and maintenance costs but including installation costs. For an off-grid PV system, the prices associated with storage battery maintenance/replacement are excluded. If additional costs are incurred for reasons not directly related to the PV system, these should be excluded. (E.g. If extra costs are incurred fitting PV modules to a factory roof because special

precautions are required to avoid disrupting production, these extra costs should not be included. Equally, additional transport costs for installing a telecommunication system in a remote area are to be excluded).

Field Test Programme: A programme to test the performance of PV systems/components in real conditions.

Demonstration Programme: A programme to demonstrate the operation of PV systems and their application to potential users/owners.

Market deployment initiative: Initiatives to encourage the market deployment of PV through the use of market instruments such as green pricing, rate based incentives etc. These may be implemented by government, the finance industry, utilities etc.

Final annual yield: Total PV energy delivered to the load during the year per kW of power installed.

Performance ratio: Ratio of the final annual (monthly, daily) yield to the reference annual (monthly, daily) yield, where the reference annual (monthly, daily) yield is the theoretical annual (monthly, daily) available energy per kW of installed PV power.

Currency: The currency unit used throughout this report is EUR

RES: Renewable Energy Sources

PV support measures:

Enhanced feed-in tariff	an explicit monetary reward is provided for producing PV electricity; paid (usually by the electricity utility) at a rate per kWh somewhat higher than the retail electricity rates being paid by the customer
Capital subsidies	direct financial subsidies aimed at tackling the up-front cost barrier, either for specific equipment or total installed PV system cost
Green electricity schemes	allows customers to purchase green electricity based on renewable energy from the electricity utility, usually at a premium price
PV-specific green electricity schemes	allows customers to purchase green electricity based on PV electricity from the electricity utility, usually at a premium price
Renewable portfolio standards (RPS)	a mandated requirement that the electricity utility (often the electricity retailer) provides a portion of their electricity supplies from renewable energies (usually characterized by a broad, least-cost approach favouring hydro, wind and biomass)
PV requirement in RPS	a mandated requirement that a portion of the RPS be met by PV electricity supplies (often called a set-aside)
Investment funds for PV	share offerings in private PV investment funds plus other schemes that focus on

	wealth creation and business success using PV as a vehicle to achieve these ends
Income tax credits	allows some or all expenses associated with PV installation to be deducted from taxable income streams
Net metering	in effect the system owner receives retail value for any excess electricity fed into the grid, as recorded by a bi-directional electricity meter and netted over the billing period
Net billing	the electricity taken from the grid and the electricity fed into the grid are tracked separately, and the electricity fed into the grid is valued at a given price
Commercial bank activities	includes activities such as preferential home mortgage terms for houses including PV systems and preferential green loans for the installation of PV systems
Electricity utility activities	includes 'green power' schemes allowing customers to purchase green electricity, large-scale utility PV plants, various PV ownership and financing options with select customers and PV electricity power purchase models
Sustainable building requirements	includes requirements on new building developments (residential and commercial) and also in some cases on properties for sale, where the PV may be included as one option for reducing the building's energy foot print or may be specifically mandated as an inclusion in the building development

Foreword

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 28 member countries. The European Commission also participates in the work of the Agency.

The IEA Photovoltaic Power Systems Programme (PVPS) conducts joint projects in the application of photovoltaic conversion of solar energy into electricity. Currently seven research projects, so-called Tasks, are established within the IEA PVPS Programme.

Currently the member countries are: Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), China (CHN), Denmark (DNK), France (FRA), Germany (DEU), Israel (ISR), Italy (ITA), Japan (JPN), Korea (KOR), Malaysia (MYS), Mexico (MEX), Netherlands (NLD), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), Turkey (TUR), United Kingdom (GBR) and the United States of America (USA). Besides the European Union, the European Photovoltaic Industry Association (EPIA), the Solar Industries Association (SEIA) and the Solar Electric Power Association (SEPA) participate in the IEA PVPS programme.

The overall programme is headed by an Executive Committee composed of one representative from each participating country, while the management of individual Tasks (research projects / activity areas) is the responsibility of Operating Agents. Information about the active and completed tasks can be found on the IEA-PVPS website www.iea-pvps.org

Introduction

The objective of Task 1 of the IEA Photovoltaic Power Systems Programme is to facilitate the exchange and dissemination of information on the technical, economic, environmental and social aspects of photovoltaic power systems. An important deliverable of Task 1 is the annual Trends in photovoltaic applications report. In parallel, National Survey Reports are produced annually by each Task 1 participant. This document is the Austrian National Survey Report for the year 2012. Information from this document will be used as input to the annual Trends in photovoltaic applications report.

The PVPS website www.iea-pvps.org also plays an important role in disseminating information arising from the programme, including national information.

1 EXECUTIVE SUMMARY

Supported by various promotion mechanisms of the federal provinces and the federal government a new stronger market diffusion of photovoltaic (PV) systems could be reached in Austria in 2012. As a result grid-connected plants with a total capacity of 175,493 MWp were installed during the year.

Hence, in 2012 the total PV market in Austria increased to 175,712 MWp, which led to a cumulated total installed capacity of 362,885 MWp. As a consequence the estimated renewable electricity produced by PV amounted to 337,5 GWh in 2012 and lead to a reduction in CO_2 - emissions by 130 798 tons[1].

During the last years the Austrian photovoltaic industry has focused on the production of PV modules and inverters as well as additional PV components and devices. Furthermore, there is a high density of installers of PV systems and significant trade of modules takes place. Finally, specialized institutions and universities play an important role in international photovoltaic research & development (R&D). An estimated 4 850 people are full-time employed in those sectors.

1.1 Installed PV power

The domestic PV system market in 2012 showed a significant increase compared to 2011. In 2012, off-grid and grid connected PV systems with a total PV power of 175,712 MWp have been installed, which represents a 91,67 % growth of the domestic market compared to the year before.

The overall installed PV capacity in Austria showed a growth of 175,712 MWp to reach 362,885 MWp at the end of 2012. On-grid applications dominate the market for PV, with grid-connected systems (GCS) accounting for about 358,163 MWp of the total installed capacity at the end of 2012.

As during the previous years, the off-grid sector plays a minor role in the Austrian PV market. In 2012 only a cumulated 4,72 MWp were installed in this sector for domestic and non-domestic applications.

On a 10 years basis, an average market growth of 45,62 % per year for all PV installations can be reported.

Despite this very positive development, the domestic PV market is still behind the development of other European countries such as Germany, with more than 4,3 times the installed capacity per capita in 2012.

[1] Reference: ENTSO-E, yearly average value of ENTSO-E Mix 2012

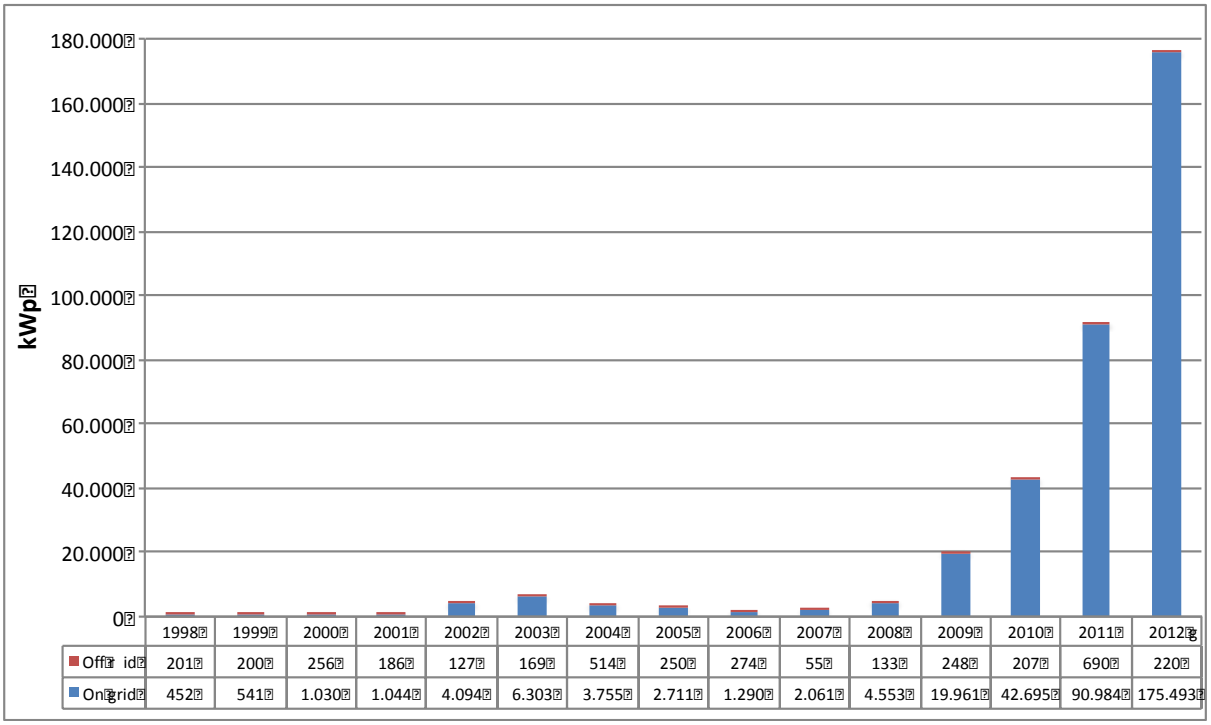

Figure 1: Annual PV market development in Austria (on grid/off grid distinction)

1.2 Costs & prices

Compared to the previous year, module prices in Austria decreased in 2012. The average wholesale price in 2012 was 0,848 EUR/Wp, although the average sales-price of Austrian PV module producers was 0,946 EUR/Wp.

In 2012, turnkey prices for installed PV systems dropped slightly compared to the previous years. However, the reduction was still small, following the continued high demand of the European PV market and the stringent supply of PV modules on the world market. Turnkey prices for typical 5 kWp on-grid systems varied between 1,6 EUR/Wp and 3,7 EUR/Wp depending on the used PV-technology, size and type of the installation, with a typical mean prize of 2,2 EUR/Wp for grid-connected systems.

1.3 PV production

The most important products manufactured in Austria include PV inverters and PV modules as well as back-sheet laminates for module encapsulation or PV Ribbon Wires.

In 2012, most of the Austrian PV industry was not able to expand their business. Domestic PV module manufacturers reported a downturn of their output. The overall PV module production in Austria in 2012 amounted to 70,89 MWp (2011: 86,6 MWp [2]), which represents a reduction of 18,1 % compared to the previous year.

Austria's PV inverter industry reported a 24,8 % decrease of the production of inverters for grid-connected applications. In 2012, PV inverters with a capacity of approximately 752 MW A.C. nominal power (2011: 1 000 MW) were produced. More than 97 % of the production was exported.

1.4 Budgets for PV

The nationwide feed-in tariff system for electricity from RES introduced in the national Green Electricity Act is financed by all consumers of electricity via supplements on the electricity price and an obligatory purchase price for Green Electricity, which has to be paid by electricity dealers. The feed-in tariffs paid for PV in 2012 increased to approximately 36,8 MEUR (2011: 19,3 MEUR), this is a growth of 90,5 %. Accordingly, the share of produced electricity climbed from more than 39,4 GWh to 101,3 GWh. The mean tariffs amounted to 36,34 Cent/kWh which is a decline of 25,9 % (compared to 49,02 Cent/kWh in 2011).

Besides the feed-in support, also further short-term incentives in form of rebates for new PV installations are provided on the national (National Fund for Climate and Energy) as well as provincial level. The total funds spent for this purpose in 2012 were approx. 28,47 MEUR (compared to 30,4 MEUR in 2011).

There is no national R&D programme dedicated to PV. Two national programmes ("New Energy 2020" by the national Fund for Climate and Energy and "Buildings of Tomorrow Plus" by the Ministry of Transport, Innovation and Technology), which explicitly address PV in a separate subchapter of the programme ended in 2012. The follow up project of "New Energy 2020" is called **eMission+** and follows in the footsteps of its predecessor to further the goal of more research in the areas cost reduction of clean power and highly efficient technologies. In the absence of a dedicated programme, R&D is mainly funded on a project base.

The share of public funding dedicated to PV related RTD can be estimated to 9,2 MEUR in 2011 (2010: 7,6 MEUR).

[2] In the context of the data acquisition for 2012 also the PV module production of 2011 was collected again. Thereby one producer was scaling down its reported production in 2011 in a large dimension, so the overall PV module production in 2011 has to be adjusted to 86,6 MWp.

2 THE IMPLEMENTATION OF PV SYSTEMS

The PV power system market is defined as the market of all nationally installed (terrestrial) PV applications with a PV capacity of 40 W or more. A PV system consists of modules, inverters, batteries and all installation and control components for modules, inverters and batteries.

For the purposes of this report, PV installations are included in the 2012 statistics if the PV modules were installed between 2012-01-01 and 2012-12-31 although commissioning may have taken place at a later date.

2.1 Applications for photovoltaics

As in most of the other IEA countries, Off-grid installations were the first economic alternative for PV systems. Small autonomous systems provide electricity to technical systems or for domestic use in Alpine areas or mountain huts far away from the grid. But not exclusively in remote areas, also on urban sites PV is an option to supply infrastructure like traffic surveillance systems, communication systems, parking meters and a variety of other applications.

With the introduction of favourable support schemes On-grid Distributed Systems have meanwhile become a common place in public's interest.

With the support schemes limited to small, residential scale systems, Grid-Connected Centralized Systems in form of PV Power plants play a minor role.

2.2 Total photovoltaic power installed

The domestic PV system market in 2012 showed a significant increase compared to 2011. In 2012, off-grid and grid connected PV systems with a total PV power of 175,712 MWp have been installed, which represents a 91,67 % growth of the domestic market compared to the year before. This led to a cumulated total installed capacity of 362,9 MWpeak at the end of 2012. On-grid applications dominate the market for PV, with grid-connected systems (GCS) accounting for about 175,493 MWp of the total installed capacity at the end of 2012.

As during the previous years, the off-grid sector plays a minor role in the Austrian PV market. In 2012 only a cumulated 4,72 MWp were installed in this sector for domestic and non-domestic applications.

On a 10 years basis, an average market growth of 45,19% per year for all PV installations can be reported.

Table 1 shows the PV power installed in 4 sub-markets during 2012.

Table 1: PV power installed during calendar year 2012 in 4 sub-markets.

Sub-market/ application	off-grid domestic	off-grid non-domestic	grid-connected distributed	grid-connected centralized	Total
PV power installed in 2012 (kWp)	220	n.a.	175 492	n.a.	175 712

A summary of the cumulative installed PV power, from 1992-2012, broken down into four sub-markets is shown in Table 2.

Table 2: The cumulative installed PV power in 4 sub-markets.

Sub-market	Until 1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Stand-alone domestic	1 213	1 413	1 671	1 857	1 984	2 173	2 645	2 895	3 169	3 224	3 357	3 605	3 812	4 502	4 722
Stand-alone non-domestic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grid-connected distributed	1 648	2 119	3 063	4 440	7 857	13 507	17 262	19 973	21 263	23 721	27 274	48 991	91 686	182 670	358 163
Grid-connected centralised	70	140	140	241	476	1 153	1 153	1 153	1 153	1 756	1 756	n.a.	n.a.	n.a.	n.a.
TOTAL (kW)	**2 861**	**3 672**	**4 874**	**6 120**	**10 341**	**16 833**	**21 060**	**24 021**	**25 585**	**27 701**	**32 387**	**52 596**	**95 498**	**187 172**	**362 885**

2.3 PV implementation highlights, major projects, demonstration and field test programmes

PV implementation

In view of the growth of the international PV technology market R&D development has become an issue in Austria. However, effective and broad PV implementation programmes are missing in Austria and they will also most probably not be introduced in the upcoming year. The revised Green Electricity Act (GEA) is in operation forming the framework for PV implementation (find chapter 4 for details).

Besides the federal feed-in tariff scheme, the national Fund for Climate and Energy launched a PV-initiative in 2008. The initiative, which provides rebates to newly installed private PV systems up to 5 kW this year from April until June with a first tender and a total budget of about 25,5 MEUR. In 2009 7,1 MEUR, in 2010 18,4 MEUR and in 2011 30,4 MEUR were granted. In 2012 the amount of 28,47 MEUR was granted under this funding scheme.

However, almost all Austrian provinces are still running separate regional rebate-programmes, aiming at overcoming the limitations of federal incentives. In most cases the support is subject to limited budgets and is linked to further requirements. Generally, the regional support is only granted in case the installation is not supported by the federal feed-in tariff scheme, but some provinces offer a support scheme in cooperation with the federal Fund for Climate and Energy. In 2012 the regional funding initiatives helped to install a total PV capacity of 18,9 MW.

2.4 Highlights of R&D

For many years, the Austrian PV research activities have mostly been 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 and, concerning grid interconnection of renewables, in the IEA ISGAN Implementing Agreement (with Austria joining in 2011). The RTD development approach is widely spread and orientated in a decentralised fashion.

Two national 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 in 2008 and ended in 2012. Both covered broad research items on energy technologies including a specific PV focus and were actively supported by the Austrian Ministry of Transport, Innovation and Technology.

The follow up project **eMission+** follows in the footsteps of its predecessor to further the goal of more research in the areas cost reduction of clean power and highly efficient technologies. It is important to provide Austrian companies with the possibility to thrive in this very important sector. The project connects science and economy on a profitable level with a focus on scientific breakthroughs and sustainable product placement in the market.

The trend of involvement of Austrian electricity companies investing more and more in renewable power generation has been continued. Sometimes specific 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 frequently invest in other European countries.

PV and the high penetration in some parts of the low voltage network become more and more important drivers for the comprehensive and internationally orientated "Smart Grid" activities in Austria, which are coordinated and supported by the Ministry of Transport, Innovation and Technology. The international "Smart Grids Week" is meanwhile established as one of the main international Smart Grid Events, taking place in different locations in Austria, each time hosted by another utility company.

In addition, the following paragraphs highlight some of the specific PV RTD activities and trends in Austria:

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 photo-acoustic 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 latest development is a method to extract thin films from new low cost semiconductor materials and the research of phase stability in the mentioned new materials. New Materials are important for the development of low cost cells in the future.

In the Christian Doppler Laboratory for Nanocomposite Solar Cells scientists of **Graz University of Technology** and **NanoTecCenter Weiz Forschungsgesellschaft** are working in cooperation with the industry partner ISOVOLTAIC AG on new nanostructured materials for flexible organic based photovoltaic modules, which can be fabricated with roll-to-roll processing technologies.

The **AIT Austrian Institute of Technology GmbH**, Energy Department focuses on the strategic research fields "Electrical Infrastructure" and "Energy for the Built Environment." The integration of PV into Smart Electricity Networks is in the centre of research efforts in the field of distributed energy resources (DER). Low and high voltage technology, power quality, safety and reliability analysis are investigated. Further, AIT Energy runs a fully-fledged Photovoltaic Module Test Laboratory, accredited according to EN 17025, for R&D on crystalline and thin-film modules. With this background, research focuses on new PV technologies, advanced experimental investigation, characterisation and modelling of PV modules, cells and systems. Regarding PV performance, the simulation of system output and life cycle testing as well as building integrated PV systems (BIPV) are addressed. For the analysis of ageing and failure detection, quantified electroluminescence measurement is available for PV cells and modules of all technologies (crystalline and thin film) as well as the spectrometer radiation measurement in the range of ultra violet, visible light and infrared. On a European level, AIT Energy is participating in the DERlab Network of Excellence, which will become a key partner in the Smart Grid International Research Facility Network (SIRFN). It is involved in large-scale projects like METAPV and EcoGRID as well as in the EU projects DERri (Distributed Energy Resources Infrastructure) and SOPHIA (Photovoltaic European Research Infrastructure), offering access to its research infrastructures in the areas PV,

inverter and power technologies. Within the European Energy Research Alliance (EERA) the AIT contributes to develop next-generation energy technologies. On an international level, AIT Energy is engaged in standardisation development for distributed generation and PV systems. It takes part in several IEA PVPS activities, such as Task 13 (Performance and Reliability of Photovoltaic Systems), and holds the lead in Task 14 (High Penetration of PV Systems in Electricity Grids).

Vienna University of Technology, Energy Economics Group (EEG), are covering major topics of teaching and research on Photovoltaics: diffusion of technology and market penetration on national and international level, technology roadmapping and monitoring, 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 as well as medium and long term diffusion scenarios of PV.

At the ENERGYBase, one the largest passive solar office building in Austria, the **University of Applied Sciences Technikum Vienna** offers Bachelor and Master Programmes with a strong focus on PV and other solar technologies. Research at the Institute for renewable energy systems is focused on PV strategies as well as on system and building integration. Currently the most promising research project is SOLARROK. By SOLARROK the leading European Solar Energy Clusters develop a Joint Action Plan for the future of the Photovoltaics in Europe. The objective of SOLARROK is to strengthen competitiveness and to foster industrial innovation in the Photovoltaic sector. SOLARROK is jointly elaborated by leading clusters in Spain, France, Germany, Belgium and the Netherlands, Lithuania and Austria, plus industry and research partners in Slovenia and Norway. Austria is represented by the Department of Renewable Energy at the University of Applied Sciences Technikum Vienna.

The research activities of **Austria Solar Innovation Center (ASIC)** are in the field of data evaluation of PV-power plant as well as the development of fault detection systems for inverters. Besides this, ASiC offers 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, where also the 17 kWp PV system - 5 different module types, 5 different inverter types, 2 monitoring/data logging systems, meteorological station - are used for practical training.

The **Institute of Polymeric Materials and Testing (IPMT)** at the **Johannes Kepler University Linz (JKU)** was established in 09/2009 and has now completed its first phase of laboratory investments, thus achieving full operation capability. Key individuals of the IPMT have a broad experience in the field of plastics for solar applications and expertise and know-how related to coordination and management of large research projects. In 2010, the JKU with the IPMT started a Project entitled "Solar-electrical Systems based on Polymeric Materials: Novel Polymeric Encapsulation Materials for PV Modules."

The **Polymer Competence Center Leoben (PCCL)** is working in the field of polymeric encapsulation materials for solar cell and PV module encapsulation. Since 2003 the main focus of the research was set on durability testing, lifetime modelling and aging characterization of polymeric materials and components as well as the evaluation and qualification of new materials for PV encapsulation. A newly installed research focus is the establishment of correlations between material properties, processing parameters and PV module failure.

Scientists at the **Johannes Kepler University (JKU) Linz** have reeled in a large-scale project in photovoltaics designed to develop new synthetic materials to encapsulate solar cells. By researching how to develop more efficient and economical procedures, the project supports the current trend to increase the added value of synthetic materials for

photovoltaics while simultaneously reducing costs. Due to the highly promising yield from this technology the institute is expanding their capacities.

2.5 Public budgets for market stimulation, demonstration / field test programmes and R&D

The major institution dealing with research and development policy is the Federal Ministry of Transport, Innovation and Technology (BMVIT). This ministry is the major organizer and facilitator for public R&D activities in Austria. The majority of public R&D programmes operate under the BMVIT and there are several programmes, which focus on energy-related fields. There is no programme specifically dedicated to PV R&D, but the topic is mainly funded within the framework of the energy R&D programmes such as "Energy Systems of the Future" (http://www.energiesystemederzukunft.at/english.htm).

Until April 2013, no data on public funding for Energy R&D in 2012 were available. Therefore the following numbers refer to data for the year 2011. The total amount of energy related research funding indicated for the year 2011 was 121 MEUR.

In 2011 renewable energy received about 32,8 MEUR (27,1 %) of the Austrian Energy R&D budget (27,8 % in 2010). The area of energy efficiency received 52,6 % (2010: 46 %). These two areas clearly show the priority of the publicly financed energy research in Austria. More than 900 R&D projects and activities were registered and analysed for the year 2011 (2010: 1.100). In 2010 the overall public spending for PV research and development was about 9,2 MEUR (2010: 7,6 MEUR).

Not included in these figures is the return from European Community (EC) R&D projects. As a member of the European Union, Austria contributes to the EC R&D framework programmes (FP), hence the return can be ultimately regarded as a part of public spending. However, no reliable data was available on these funds in 2011.

There are no specific figures available for the share of Demonstration or Field Test activities but as there was no demonstration or field test programme running in 2011, it can be assumed that the share of these activities is negligible.

The total governmental budget allocated for PV R&D, Demonstration and market incentives is shown in Table 3.

Table 3: Public budgets for R&D, demonstration/field test programmes and market incentives.

	R & D (2011 figures!) [1]	Demo/Field test	Market incentives
National/federal	9,2 MEUR (2011)	N/A	28,47 MEUR[2]
State/regional	N/A	N/A	12,12 MEUR
Total	9,2 MEUR (2011)	N/A[3]	40,59 MEUR

[1] No 2012 figures available as of April 2013.
[2] Actual rebates paid in 2012 by the federal Fund for Climate and Energy (KliEn)
[3] In 2010 no demo/field test programmes were reported.

The Green Electricity Act (GEA) has governed the support for electricity from RES starting in 2003. The feed-in tariff system is funded by supplements on the electricity price and an obligatory purchase price for Green Electricity, which has to be paid by electricity dealers. Because of the fact that no public body finances this system, all electricity consumers have to come up with coverage.

The total amount of feed-in tariffs paid for PV in 2012 was approximately 36,8 MEUR (2011: 19,3 MEUR), which represents a 90,5 % increase compared to the previous year. The average feed-in tariff paid for PV in 2012 was 36,34 Eurocent/kWh which represents a 25,9 % reduction compared to the previous year (2011: 49,02 Eurocent/kWh).

Besides the feed-in support, the federal Fund for Climate and Energy (founded in 2007) provided a limited incentive in form of a non-refundable rebate for new installations for private households up to 5 kW. The total funds spent for this purpose in 2012 were 28,5 MEUR.

In addition to the federal incentive governed by the Green Electricity Act, almost all provinces continued running their regional support in form of rebates on the costs of the PV system (investment subsidies) in 2012. Vorarlberg, Tyrol, Styria and Vienna offer a support scheme in cooperation with the federal Fund for Climate and Energy. Additionally there are some provinces (Carinthia, Lower Austria, Upper Austria, Styria, Salzburg), which offer additional funding by the subsidized housing scheme.

Although some subsidy schemes exclude each other, whereas others do not, this situation shows the complex nature of the incentives and the data provided. By this standard only a rough estimate for the total funds spent by the provinces can be provided.

3 INDUSTRY AND GROWTH

3.1 Production of feedstock, ingots, wafers and thin film photovoltaic components

No production facilities for silicon feedstock or wafers existed in Austria in 2012.

However there is substantial production of photovoltaic thin film components. The company **Plansee** High Performance Materials – headquartered in Tyrol - manufactures components made of refractory metals and metallic composite materials. For the production of back contacts and absorber layers in CIGS solar cells the company supplies high quality sputtering targets. Sputtered layers are highly reflective and conductive and are therefore used for increasing the efficiency on solar panels. The material portfolio includes: molybdenum, tungsten, copper, aluminium, CuGa, CuInGa, and new alloys such as molybdenum-sodium and corrosion resistant molybdenum-tantalum.

3.2 Production of photovoltaic modules and R&D

Compared to the important increase of the installed capacity in 2012 the Austrian PV industry wasn't able to keep pace in terms of production. In total, Austrian module manufacturers had to register a reduction of their output compared to the previous year. The total module production in 2012 amounted to 70,89 MW. Compared to 86,6 MW in 2011 [3] this figure represents a decrease of 18,1 % (see Figure 2). At the same time, the export rate of Austrian modules decreased by 29,0 % from 68,3 MW in 2011 to 48,48 MW in 2012.

Currently the following Austrian companies are involved in the production of PV-modules, or inverters, namely:

crystalsol develops an entirely new type of flexible photovoltaic film mainly for integration into building elements with a significant cost and versatility advantage compared to all currently known photovoltaic technologies. Core innovations of crystalsol's technology are the unique light absorbing active layer made of crystalline semiconductor powder and the low-cost roll-to-roll production process, which ensures high throughput and yield. For its innovative technology crystalsol received several awards, amongst others the Austrian State Prize Environment and Energy Technology, the Energy Globe and the Wiener Zukunftspreis.

Although present in PV market as a contractor from 1995, **Energetica** has been producing PV modules since 2004 at its own production facility. The core competences are the production of PV-modules but Energetica also acts as a system provider and project contractor on a global scale.

Ertex Solartechnik GmbH realized approximately 700 BIPV projects in the past 9 years. Their main product is the laminated safety glass module (VSG), which can be also easily assembled to insulating glass. In 2012, ertex solar got the approval for the German DIBt (Deutsches Institut für Bautechnik) and also the microgeneration certification scheme MCS 017 for BBIPV solutions on the UK Market.

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

[3] In the context of the data acquisition for 2012 also the PV module production of 2011 was collected again. Thereby one producer was scaling down its reported production in 2011 in a large dimension, so the overall PV module production in 2011 has to be adjusted from 156,6 MWp to 86,6 MWp.

PV Products GmbH is one out of three module producers, which has the national technical approval of the German approval body Deutsches Institut für Bautechnik (DIBt) for glas-glas-modules (Z-70.3-181). The focus of PV Products GmbH for the future is on Building Integrated Photovoltaic (BIPV) and on special modules for green houses.

PVT-Austria is the first manufacturer of high quality silicon solar panels in Austria since the year 2001. In 2006 PVT-Austria started it´s own silicon solar cell production, the first and only one in Austria and produces standard silicon solar cells, coloured silicon solar cells, transparent silicon solar cells and silicon solar cells with asymmetric angles.

SED Produktions GesmbH focuses on the production of PV-roof tiles and small size modules 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 structures with PV modules and special PV elements for noise barrier walls. The glassless flexible laminates are mounted on aluminium carriers and fit all custom noise barrier types. Most of the modules produced include cells imported from various countries, such as Germany, Spain, the U.S., Taiwan, China and others. Virtually, the whole production is exported.

Sunplugged GmbH, based in Tyrol, develops and manufactures flexible photovoltaic modules for the integration into vehicles, devices and building skins. Sunplugged´s expertise comprises lightweight PV modules for mobile applications as well as a proprietary flexible thin-film solar cell for building and product integrated photovoltaics.

AT&S used their knowledge as European market leader and one of the world's strongest performing PCB manufacturers and transferred it into the PV segment. The outcome is, that AT&S installed a 40 MW automated manufacturing line for conductive backsheet foils, which will be the base for every backcontact technology module manufacturer. In addition, AT&S offers specific solutions of PV modules for all types of applications (e.g. triangles; colorized; semi-transparent; personalized, etc.).

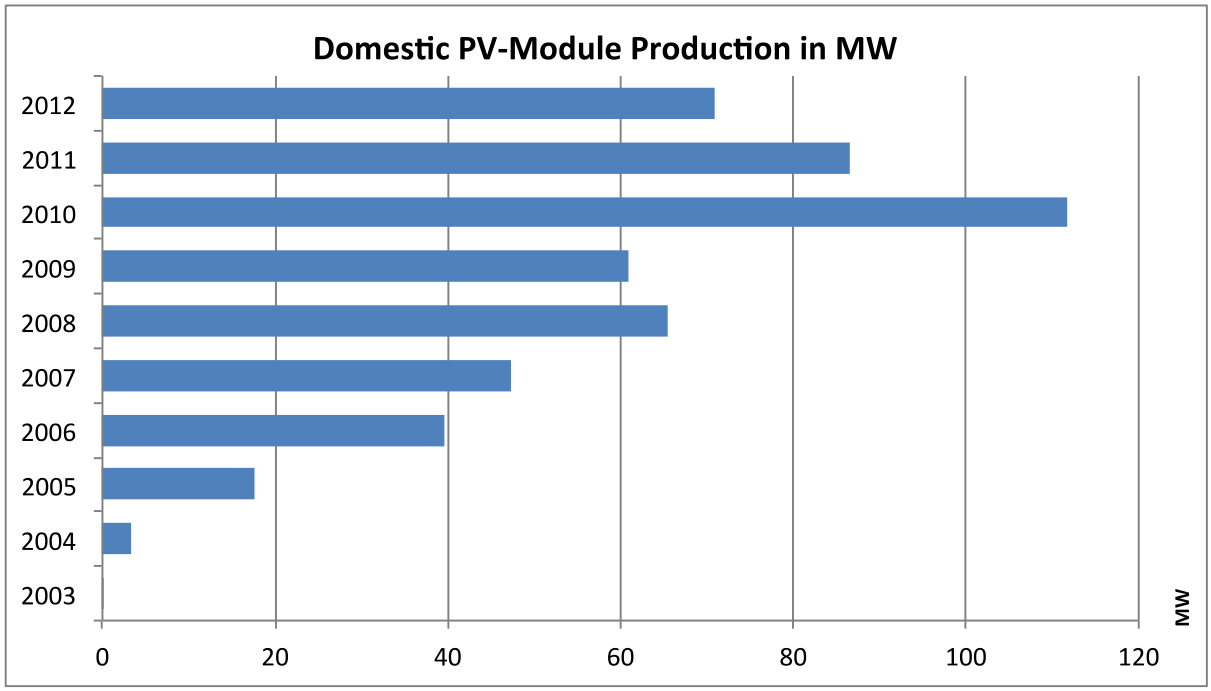

Figure 2: Development of domestic PV module production in Austria since 2003; Data source /graph: Technikum Wien/AIT

Total PV module manufacturing in Austria for 2012 together with production capacity information is summarised in Table 4 below.

Table 4: Production and production capacity information for 2012 for each manufacturer

Module manufacturer	**Technology** (sc-Si, mc-Si, a-Si, CdTe)	**Total Production 2012 (2011) (MW)**		**Maximum production capacity 2012 (2011) (MW/yr)**	
		Cell	Module	Cell	Module
Wafer-based PV module manufactures					
PVT Austria	mc-Si / sc-Si	-	4,9 (20)	-	35 (N/A)
Energetica Holding GmbH	mc-Si	-	12 (14)	-	45 (50)
KIOTO Photovoltaics	mc-Si	-	40 (50)	-	120 (120)
ERTEX Solar	mc-Si / sc-Si /a-Si	-	1,6 (0,9)	-	3,0 (0,9)
SED	mc-Si / sc-Si	-	0,19 (0,12)	-	1 (1)
PV Products GmbH	mc-Si / sc-Si	-	12 (N/A)	-	30 (30)
AT&S	mc-Si / sc-Si	-	N/A (0,14)	-	N/A (0,3)
SunValue	mc-Si / sc-Si	-	N/A (N/A)	-	N/A (N/A)
Thin film manufacturers					
Crystalsol	a-Si	-	only research in 2012 and 2011	-	-
Cells for concentration					
-	-	-	-	-	-
TOTALS (estimates)					

3.3 Module prices

Table 6 indicates the typical module prices for the year 2012 as quoted by the manufacturers and installation companies. The price range reflects the prices for different module types for typical orders (5+ kW).

Compared to the previous years, module sales price of manufacturers dropped in 2012. The average wholesale price in 2012 was 0,95 EUR/W. The average wholesale-price of planners was 0,87 EUR/W in the year 2012 (2011: 1,4 EUR/W).

Table 5: Typical module prices for manufacturers over a number of years

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Standard module price(s): Typical (EUR/W)	4,5	3,1 – 3,2	3,6 - 3,7	3,6 – 3,9	3,6 – 4,3	3,6 – 4,3	3,00 – 3,20	2 – 2,3	1,9 - 5,5	1,4 - 5,4	0,8 - 3,8
Best price (EUR/W)	N/A	N/A	N/A	N/A	N/A	N/A	3	2	1,9	1,4	0,8
PV module price for concentration (EUR/W)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

3.4 Manufacturers and suppliers of other components

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

Austria has a long tradition as one of the largest inverter producing countries in Europe. The large manufacturers experienced a slight stagnation in 2012 following the overall expansion of the worldwide PV market. In 2012 a total of 752 MW of inverters (rated AC output capacity) were produced. Comparatively to 2011 with an output of 1 GW and the previous year 2010 with an output of 1,2 GW there was slight reduction in the market. Since the majority of the market for the local producers lies in export, the global situation of budget cuts carries through to the sales numbers.

Fronius International has developed and produced inverters for grid-connected PV systems since 1992. With a current production capacity of approx. 2,200 MW of inverter power, Fronius is among the top inverter manufacturers in the world. The company has sales subsidiaries in 15 countries such as Australia, Germany, Italy, France, Turkey and USA.

Besides inverter manufacturing, Austria hosts some of the largest manufacturers of specialised BOS and other components for the production of PV modules.

ISOVOLTAIC AG, headquartered in Lebring/Styria, is the global market and technology leader in the development and production of backsheets for photovoltaic modules. The well-established ICOSOLAR® backsheets and encapsulants provide longterm protection for solar cells and ensure that sunlight can be efficiently converted into energy. The company has 25 years of experience in the development and production of high-quality composite protective sheets for solar cells. 98% of all production is exported.

Ulbrich of Austria is manufacturing string- and buswires for PV cells and modules with a total capacity of more than 2 GW. In 2012 more than 1,2 GW were disposed to European module producers.

PLANSEE SE in Tyrol is a subsidiary of the PLANSEE Group manufacturing refractory metals for diverse applications; more particularly metallic targets for thin film solar cells.

HEI Eco Technology GmbH is a leading Austrian Energy Technology Company specialised in developing and manufacturing of solar stand-alone as well as grid-connected LED outdoor lighting systems. The products marketed under the brand "hei solar light™" combine superior design together with innovative technology into a uniform and integrated whole. The company started production in 2007 and is rapidly expanding fabrication facilities. At present, lighting projects are done mainly in Southern Europe, the Middle East and North Africa.

Lisec Maschinenbau GmbH provides fully automatic production lines for any kind of PV modules based on the Lisec encapsulation technology, which benefits from 50 years of experience in the production of insulating glass. The tempered thin glass used for the glass-glass modules guarantees more robust, absolutely diffusionproof and highly efficient PV-modules.

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

Austrian Institute of Technology, Energy Department, (formerly arsenal research) is known as 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.

Welser Profile focuses on facade systems because their know-how lies with aluminium profiles. During the 'Fensterbau Frontale 2012' exhibition, which took place from 21st-24th April, RP Technik, a subsidiary of Welser Profile presented one of their latest developments in façade construction to trade visitors. At this international exhibition for windows, doors and facades, the façade system RP-ISO-Hermetic 60 N was presented, an innovative mullion and transom steel construction with intelligent building integrated photovoltaic.

Ebner Industrieofenbau is a leading manufacturer of industrial controlled atmosphere heat treatment furnace facilities. In the area of renewable energy solutions for the thermal treatment of Thin Film precursors are offered. These applications befit from the experience Ebner has collected in supplying precision controlled atmosphere furnace technology for the steel, aluminium and copper-base metal industries. The pioneering concepts in the renewable energy create new perspectives in offering environmentally friendly and energy efficient solutions.

Phoenix Contact, has many years of experience in overvoltage limiting devices which are produced for the photovoltaics industry.

Infineon Technologies Austria is working with semiconductors and system solutions for photovoltaic applications for mobility as well as buildings.

Since 2008, the **Austrian Photovoltaic Technology platform** brings together industries with a production site in Austria well as the relevant R&D institutes and universities. The platform aiming at joint innovation processes as well as improving the frame conditions for the Austrian PV industry development. The University of Applied Sciences Technikum Vienna currently coordinates the platform.

3.5 System prices

In 2012, turnkey prices for installed PV systems again dropped compared to the previous years. However, the reduction was small, following the continued high demand of the European PV market and the stringent supply of PV modules on the world market.

In 2012 turnkey prices for typical on-grid systems varied between a range of 1,6 EUR/W and 3,7 EUR/W, depending on the used PV-technology, size and type of the installation.

The according figures for typical PV applications are shown in Table 5. The considered installations are typical domestic rooftop systems.

Remark: Prices for specific building integrated systems are typically considerably higher and depend on the specific case. They are not reported here.

A summary of typical system prices is provided in the following tables.

Table 6: **Turnkey Prices of Typical Applications**

Category/Size	Typical applications and brief details	Current prices EUR/W
OFF-GRID Up to 1 kW	Basic electricity supply for mountain huts.	up to 10 *)
OFF-GRID >1 kW	AC Electricity supply for larger mountain huts. System size between 1 and 8 kW.	up to 10 *)
On-Grid 1 kW	Small domestic roof-top system	2,7
ON-GRID Specific case	5 kW roof-mounted system	2,2
ON-GRID 10 kW	Typical roof-mounted system for a multifamily house.	1,9
ON-GRID >10 kW	Larger system for commercial / industrial applications. PV-power plants	< 1,9
GRID – CONNECTED (centralized, if relevant)	Not relevant in Austria	N/A

Prices do not include VAT. All figures are estimated based on information provided by installation companies.

*) For off-grid systems prices vary widely depending on the application (DC appliances or AC island grid) and the mounting-site.

Table 7a shows the development of turnkey prices (excluding VAT) for a typical residential, grid-connected roof-mounted system with a power of 2 kW to 3 kW (now 5 kW) since 2002.

Table 7a: National trends in turnkey system prices (EUR/kW) for a typical grid connected PV system

YEAR	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Turnkey price EUR/kW:	7 000	6 000	5 500	5 500	5 400	5 400	5 140	4 370	3 680	2 970	2 220

3.6 Labour places

In total it can be estimated that at the end of 2012 approximately 4 850 full-time jobs (2011: 4 200 jobs) were directly linked to PV R&D, manufacturing and installation in Austria.

In the various sectors the following figures (Table 7) represent an estimation of existing work places, based on information from the manufacturing companies and R&D institutions.

Table 7: Estimated PV-related labour places in 2012

Research and development (including companies)	267
Manufacturing of products throughout the PV value chain from feedstock to systems, inverter technologies	
System and installation companies	4 580
Utilities and government	N/A
Other	N/A
Total	4 847

3.7 Business value of installation

The average specific price of a grid-connected photovoltaic plant in Austria decreased from 2 967 Euro/kW to 2 216 Euro/kW, i.e. a reduction of 25,31 %. This observation confirms a high economic learning rate, which is highly correlated to the strongly increasing world market. Austrian photovoltaic R&D is conducted in thin layer technology, grid integration and building integration and especially the latter can represent a very attractive market segment for future development of the Austrian photovoltaic industry.

In 2012 about 175,712 MW (2011: 91,7 MW) of PV systems were installed in Austria which represents an important growth and led to a cumulated total installed capacity of 362,9 MWp. As a consequence the sum of produced renewable electricity by PV plants in operation amounted to 337,5 GWh in 2012.

The estimated value of the national installation market increased to about 390 MEUR (2011: 271 MEUR), based on average turnkey prices for off-grid and grid connected systems.

Due to the variety of PV related products manufactured by Austrian industry, no reliable estimation can be provided for the import/export and business value of these products.

Table 9 provides an overview on the estimated value of PV business in Austria, total Export and Import of PV products as well as the domestic market.

Table 8: Value of PV business

Sub-market	**Capacity installed *in 2012* (MW)**	**Price EUR/W** *(from table 6)*	**Value (MEUR)**	**Totals (MEUR)**
Off-grid domestic	**0,22**	**10**	*2,2*	*2,2*
Off-grid non-domestic				
Grid-connected distributed	**175,5**	**2,2**	*388,9*	*388,9*
Grid-connected centralized				
Total	**175,72**			*391,1*
Export of PV products *(including information from Tables 4 & 5)*				*N/A*
Change in stocks held *(including information from Tables 4 & 5)*				*N/A*
Import of PV products *(including information from Tables 4 & 5)*				*N/A*
Value of PV business				***N/A***

4 FRAMEWORK FOR DEPLOYMENT (NON-TECHNICAL FACTORS)

Table 9 lists the main support measures (definitions at start of guidelines) for PV, which have been effective during 2011 in Austria. Further details on these are to be provided on the following pages.

Table 9: PV support measures

	On-going measures	Measures that commenced during 2012
Enhanced feed-in tariffs	National level, Green Electricity Act	-
Capital subsidies for equipment or total cost	In selected provinces.	National level: Short-term initiatives
Green electricity schemes	Various	-
PV-specific green electricity schemes	UZ46, green electricity scheme established on the national level.	-
Renewable portfolio standards (RPS)	-	-
PV requirement in RPS	-	-
Investment funds for PV	-	-
Income tax credits	-	-
Net metering	Selected DNOs	-
Net billing	-	-
Commercial bank activities e.g. green mortgages promoting PV	-	-
Electricity utility activities	-	-
Sustainable building requirements	-	-

Until today public support schemes for PV in Austria have been mainly characterized by discontinuity:

The Austrian Photovoltaic Industry is composed of mainly internationally acting production companies which could perform well in 2012; Traditional export rates of the individual production companies are frequently 90 % or even more, because the home market is still too small, even though the on-going increase might be a step to a larger home-market.

The public support schemes are more or less continuously under discussion and experience a yearly change, which allows private users and investors only short time planning.

The total available budget for supporting PV Systems generally addresses only a small amount of the huge number of prospective buyers of PV systems in Austria.

Austria has mainly three levels of supporting PV systems. Different from other countries, the feed-in-tariff system will only be responsible for the minor part of the supported PV systems in Austria:

- Feed-in Tariff is provided via the national green-electricity act (GEA), first issued in 2002, and meanwhile revised several times. Even though the "new RES" are supported by this act, mainly via up to 13 years guaranteed feed-in tariffs, the

financial cap (current regulation: new PV-installations leading to another expenses of 8 MEUR per year) is low. 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. A significant change of the 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. Photovoltaic-Feed-in-tariffs for new installations are defined on a yearly basis in a separate Feed-in Decree. According to the 2012 Feed-in Decree tariffs ranged from 27,5 €Cent/kWh for installations above 5kWp down to 19 €Cent/kWh for >20kWp systems:

	2006 (€cent/ kWh)	2007 (€cent/ kWh)	2008 (€cent/ kWh)	2009 (€cent/ kWh)	2010 (€cent/ kWh)	2011 (€cent/ kWh)	2012 (€cent/ kWh)
up to 5 kW_{peak}	49	46	45,99	45,98	-	-	-
above 5 kW_{peak} up to 10 (20) kW_{peak}	42	40	39,99	39,98	(35 – 38)	(35 – 38)	(23 – 27,6)
above 10 (20) kW_{peak}	32	30	29,99	29,98	(25 – 33)	(25 – 33)	(19 – 25)

- Systems up to 5kW are supported by the also limited sources of the governmental Austrian Climate and Energy Fund. This public 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 8 MEUR. In 2009, the budget was more than doubled to 18 MEUR. In 2010 the support per kW installation was reduced significantly according to the lower PV prices. This support scheme provides additional financial benefits to building integrated systems (BIPV). For the year 2011 the budget remained the same as in 2010 (35 MEUR) and for 2012 the budget has been reduced to 25,5 MEUR.
- Other provinces have joined the regional support scheme, others modified their regional support scheme.

The Austrian Photovoltaic Association announced 8 % of total electricity by PV to be realistic until 2020, if the support system will become more reliable and some framework conditions will be changed accordingly. At the end of 2012, about 0,60 % of the total electricity was provided by photovoltaic.

The Federal Ministry of Economy, Family and Youth, as well as the Federal Ministry of Agriculture, Forestry, Environment and Water Management, managed an energy strategy process involving more than 100 experts in order to derive a strategy in compliance with the European 20-20-20 targets; to achieve the 34 % renewable target for Austria until 2020. Currently Austria stays with 30 % in 2009, making 34 % in 2020 quite an easy target.

4.1 Indirect policy issues

The promotion of electricity from renewable energy sources (RES) is a high European Union (EU) priority for several reasons, including the security and diversification of energy supply, environmental protection and social and economic cohesion.

The Directive follows up the 1997 White Paper on renewable energy sources, which sets a target of 12 % of gross inland energy consumption from renewables for the EU-15 by 2010, of which electricity would represent 22.1 %. With the 2004 enlargement, the EU's overall objective became 21%. The Directive also constitutes an essential part of the package of measures needed to comply with the commitments made by the EU under the Kyoto Protocol on the reduction of greenhouse gas emissions.

European companies are currently among the world leaders in developing new technologies connected with RES electricity. The Directive aims to give a boost to stepping up the contribution of these energies while respecting the principles of the internal market. (Source: http://europa.eu)

The starting point for evaluating the energy yield and the CO_2 reduction by installed PV power is the cumulated installed capacity of 362.885 kWp in the year 2012. Furthermore the emission coefficient of the substituted electrical energy of 387,6 g_{CO2equ}/kWh is considered and the number of full load operation taken from literature (Fechner et al., 2007). The calculated electricity generated by cumulated Austrian PV installations is 337,5 GWh. Based on these values a CO_2 reduction potential of 130.798 tons of CO_2equ. can be established.

For Austria the individual target is to reach a share of 78,1 % of electricity from RES. However, in 2011 RES cover only 64,6 % of the electricity demand in Austria. (Source: http://www.statistik.at)

Furthermore, the European 20-20-20 targets are set for the share of RES in the total energy consumption. For Austria, this target has been set 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 consumption to be covered by photovoltaics in 2020, provided the frame conditions will be changed immediately.

4.2 Standards and codes

Generally European PV Standards are likewise applied in Austria. Grid-interconnected PV applications are covered in detail by the new national standard ÖVE E8001-4-712 published in December 2009 (Formerly ÖNORM/ÖVE E 2750), which defines all safety relevant aspects regarding planning, installation, grid-interconnection, requirements for components and operation of grid connected PV installations.

5 HIGHLIGHTS AND PROSPECTS

By far the largest share of the Austrian PV production is exported to those European Union countries, where attractive and stable incentives created a substantial market for PV. In

spite of the consequences of the economic crisis it is expected that an ongoing positive development of the international PV market will provide the basis for growth of the Austrian PV manufacturers and will help to strengthen the position of Austria as an important supplier of components for PV systems.

New industry activities in the field of cell production and further extension of module production and product portfolio clearly document this trend.

5.1 Stakeholder initiatives and awareness raising

The federal association *Photovoltaic Austria* is a corporate, non-party association with the aim to improve the framework conditions for photovoltaics implementation in Austria. They have significantly expanded their activities by creating a national network for dissemination of information on PV and initiating awareness raising activities. By fostering political contacts, intensive political lobbying work and press coverage, the association aims at initiating stable and supportive PV market conditions, preferably based on feed in tariffs.

By the end of 2012, more than 158 members involved in the PV business took part in the Association.

The annual National Photovoltaic Conference 2012 (a two day event), organised by some of the main PV stakeholders and supported by the Ministry of Transport, Innovation and Technology, was once again a great success, with more than 350 experts participating. This conference is established as THE annual come together of the Austrian PV stakeholders.

As an intermediate institution the **Technology Platform Photovoltaic (TPPV)** was founded in 2009 by companies involved in the PV production of PV components. During 2012 the platform was transformed to an association with the purpose to optimize innovation in cooperation with research institutions and the industry. The goal is the expansion of value creation for the Austrian market.

5.2 Market & deployment initiatives

When looking at the domestic market, the situation of PV in Austria remains unsatisfactory mainly because of complex, unstable and primarily significant and yet highly limiting frame conditions. The 2012 revision of the main nationwide framework, the Green Electricity Act (GEA) currently in effect provides some moderate support for PV if compared to international standards.

The "new RES" are supported by the GEA, mainly by guaranteed feed-in tariffs over a timeframe of 13 years, which 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.

Feed-in-tariffs are exclusively available for privately owned systems larger than 5 kW. Smaller systems may apply for investment funding by the Austrian Climate and Energy Fund, which again approach the private sector. It started for the first time in August 2008 by one tender with a total budget of 8 MEUR. The effect was the installation of about 200 PV Systems with a total of 1 MW. In 2009, the budget was more than doubled leading to about 3 MW of PV installations. For 2010 and 2011 35 MEUR budget per year were available. For 2012 the budget has been reduced to 25,5 MEUR, nevertheless the installations reached an all-time record.

It is important to mention that these budgets carry over to the following years due to bureaucratic reasons. The budgets from 2008 to 2011 show the majority of their PV-systems installed in the following year. Until 2012 this capped support scheme was only available over the Internet for a short period of time and the funds depleted within minutes. This is valid for all provinces although the days to open the scheme vary.

This support scheme provided additional financial benefits to building integrated systems (BIPV).

ANNEX A: REFERENCES, METHODS AND ACCURACY OF DATA

The market statistics on installed capacity, share of grid-connected and off-grid applications as well as the industry data have been collected by Hubert Fechner and Kurt Leonhartsberger, University of Applied Science Technikum Wien, under the coordination of Peter Biermayr, TU Wien by order of the Federal Ministry for Transport, Innovation and Technology (BMVIT).

Funding organisations on federal as well as provincial levels have provided data for the installations used. In the annual report ("Innovative Energietechnologien in Österreich, Marktentwicklung 2012") PV applications are divided into off-grid installations and grid-connected systems (including centralised and distributed systems). No further breakdown is conducted in the study between centralized and distributed systems.

With the establishment of the organisation managing the feed-in tariff scheme, OeMAG now reports all statistics on renewable energy installations funded under the feed-in tariff scheme. Furthermore OeMAG provides data on the total amount of budget spent for PV feed-in tariffs. However, as a considerable share of new PV installations is installed outside this feed-in tariff framework, data on these systems, which are supported by regional initiatives or other programs, are not included in the national energy statistics, since the capacity of these installations is below 1 MW. Thus the installations reported by OeMAG do not provide a complete picture of the situation in Austria.

The uncertainty of the figures related to the installed capacity is estimated to be about ± 10 %.

Data on funding for PV R&D is taken from the report "Energieforschungserhebung 2011, Ausgaben der öffentlichen Hand in Österreich, Erhebung für die IEA" compiled by the Austrian Energy Agency by order of the Federal Ministry for Transport, Innovation and Technology (BMVIT).

Industry data on actual production, production capacity, workforce, new products, prices and other market figures is based on information provided by manufacturers, and installation companies. An estimation of the accuracy of these data cannot be provided.

ANNEX B: COUNTRY INFORMATION

This annex provides some background about the national environment in which PV is being deployed. The data are not guaranteed to be 100 % accurate nor intended for analysis, and the reader should do their own research if they require more detailed data.

Electricity in Austria 2011/2012 (Source: VEÖ Association of the Austrian Electricity companies, Statistik Austria)

General data about Austria: (Source: http://www.statistik.at, http://www.e-control.at)

- Territory: 83 879 km²
- Inhabitants (2011): 8 443 018
- Domestic electricity consumption (excl. PS) (2012): 55 748 GWh
- Electricity consumption per inhabitant (2012): 6,60 MWh/year

Number and capacity of power plants installed 2012 (including estimations):

(Source: http://www.e-control.at)

- 691 (5 215 MW) run-of-river plants
- 111 (7 18 MW) pumped-storage plants
- 1 869 (221 MW) (estimated) other hydro-power plants
- 583 (8 249 MW) (estimated) thermal power plants
- 10 573 (1 179 MW) (estimated) other power plants (wind, PV…)

Number of electricity grid levels: 7

- Levels 1-3: high and ultra-high voltage
- Levels 4-5: medium voltage
- Levels 6-7: low voltage

Retail electricity prices (2012)

	Net-price	Energy tax	VAT	Total taxes	Final price
	EUR/kWh	EUR/kWh	EUR/kWh	EUR/kWh	EUR/kWh
Electricity price (Industry)	0,09	0,02	0,02	0,04	0,13
Electricity price (household)	0,14	0,02	0,03	0,05	0,20
Source: Statistik Austria					

1) Typical annual household electricity consumption 2011:

   4685 kWh (3-person household, Source Statistik Austria http://www.statistik.at)

   Typical metering arrangements and tariff structures for electricity customers (for example, interval metering? time-of-use tariff?)

   For normal households: Typically fixed tariff (no time-of-use) or day/night time dependent tariff.

2) Typical household income:

   31 759 EUR per year (2011 data) – according to EU SILC 2011 (Source Statistik Austria http://www.statistik.at)

3) typical mortgage interest rate:

   N/A

4) voltage (household, typical electricity distribution network)

   Single phase 230 V, 3 phase 400 V; 50 Hz;
   Electricity networks structured in Transmission (220 kV – 400 kV), sub-transmission (110 kV), medium voltage distribution (10 kV – 30 kV), and low voltage distribution (400 V)

5) price of diesel fuel (2011):

	Net-price	Energy tax	VAT	Total taxes	Final price
	EUR/l	EUR/l	EUR/l	EUR/l	EUR/l
Diesel fuel (private use)	0,67	0,44	0,22	0,66	1,33
Source: Statistik Austria http://www.statistik.at/					

6) Typical values of kWh / kW for PV systems in parts of your country
   950 kWh/kWp to 1.100 kWh/kWp
   Source: Authors estimation.