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 2003

Prepared by

R. Bründlinger
arsenal research,
Faradaygasse 3
A-1030 Vienna,

May 2004

Supported by the
Austrian Federal Ministry of Transport, Innovation, and Technology (BMVIT)
in the framework of the
“Energiesysteme der Zukunft”
programme

Table of Contents

i 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 23 member countries. The European Commission also participates in the work of the Agency.

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

The twenty participating countries are Australia (AUS), Austria (AUT), Canada (CAN), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Israel (ISR), Italy (ITA), Japan (JPN), Korea (KOR), Mexico (MEX), The Netherlands (NLD), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), The United Kingdom (GBR) and The United States of America (USA). The European Commission is also a member.

The overall programme is headed by an Executive Committee composed of one representative from each participating country, while the management of individual research projects (tasks) is the responsibility of Operating Agents. Nine tasks have been established, and currently six are active. Information about these tasks can be found on the public website www.iea-pvps.org. The new task concerning urban-scale deployment of PV systems is now underway.

The objective of Task 1 is to promote and facilitate the exchange and dissemination of information on the technical, economic, environmental and social aspects of photovoltaic power systems.

ii Introduction

An important deliverable of Task 1 is the annual International Survey Report on PV power applications. This report gives information on trends in PV power applications in the twenty member countries and is based on the information provided in the National Survey Reports, which are produced annually by each Task 1 participant. The public PVPS website also plays an important role in disseminating information arising from the programme, including national information.

This National Survey Report gives an overview of the achievements in the area of PV power applications in Austria in the year 2003. It is a summary of the market developments, achievements of the PV industry and non technical factors which provide the framework for the deployment of PV in Austria.

iii Definitions, symbols and abbreviations

For the purposes of the National Survey Report, 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 organization carrying out the encapsulation in the process of the production of PV modules.

Off-grid domestic PV power system: System installed in households and villages that are not connected to the utility grid. Usually a means to store electricity is used (most commonly lead-acid batteries). Also referred to as 'stand-alone PV power system'.

Off-grid non-domestic PV power system: System used for a variety of 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 on consumers' premises usually on the demand side of the electricity meter. This includes grid-connected domestic PV systems and other grid-connected PV systems on commercial buildings, motorway sound barriers etc. These may be used for support of the utility distribution grid.

Grid-connected centralized PV power system: Power production system performing the function of a centralized power station.

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 the additional transport costs of installing telecommunication systems in a remote area are 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.

NC: National Currency

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.

1 Executive summary

2003 was the strongest year ever for the Austrian PV market. With the implementation of the Ökostromgesetz/Green Electricity Act – most of its clauses came into effect on 2003-01-01 – for the first time a nationwide green electricity investment incentive in the form of long-term (13 years) guaranteed feed-in tariffs together with a purchase-obligation for electricity dealers for electricity from RES was introduced.

For PV, the relatively high feed-in tariffs of 60 Eurocent/kWh for systems up to 20 kW and 47 Eurocent/kWh for larger installations triggered an enormous boom during the first weeks of the year. However there was a crucial drawback: The total installed capacity, up to which the feed-in tariffs are granted, has been limited to 15 MW. With more than 10 MW already installed at the end of 2002, and a further 6,5 MW requested between the programme launch and the first of February 2003, the budget was spent before the programme really had a chance to take-off. In the following weeks the approved plants were installed and by the end of March the entire 15 MW were on line. Since then no new applications for the higher feed-in tariffs have been granted.

Meanwhile few federal provinces have again established regional market support for PV, but a nationwide incentive is still uncertain.

Installed PV power

The overall installed PV capacity in Austria reached 16,8 MW at the end of 2003, with about 6,5 MW installed in 2003. This represents an increase of 63 % compared to the year 2002. On grid applications more and more dominate the market for PV, and now grid-connected systems account for about 87 % of the installed capacity.

About 2,2 MW off-grid systems for domestic and non-domestic applications were installed at the end of 2003. The newly installed capacity remained constant during the last few years, at about 200 kW per year.

Between the end of 1995 and the end of 2003 the average growth of the PV market was about 37 % per year.

Costs & prices

During the preceding years system costs remained on a relatively constant level, due to market overheating in several industrial countries. As a result of the increase in production capacity in Europe and new companies entering the market, a significant reduction of the turnkey prices for complete PV systems could be observed in 2003. Turnkey prices for typical on-grid systems dropped to values between 4,00 EUR/W and 7,00 EUR/W, depending on the used technology and size of the installation.

PV production

During 2003 a second company started manufacturing PV-modules. The laminates contain crystalline silicon cells and are specially designed for integration into PV-roof tiles.

There is still no traditional cell production in Austria, but recently, a spin-off from Vienna's university, started working on the commercialization of new technologies for contacting multi-crystalline silicon cells.

Also the inverter industry benefited from the strong growth of the national and international markets for PV. In total more than 42 MW of inverters for grid-connected applications were produced in Austria in 2003, whereof more than 90 % were exported. During the year a second company started large scale production and development of inverters in Austria.

The other companies manufacturing components like batteries, mounting systems or laminating foils likewise reported a growth of their PV business in 2003.

Budgets for PV

The main market incentive, the feed-in tariff system for electricity from RES 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 total amount of feed-in tariffs paid for PV in 2003 was about 6,7 MEUR.

With the introduction of the feed-in tariff system, almost all other market incentives have ceased. Only in two provinces the regional support in the form of investment subsidies was still granted in 2003. About 7,6 MEUR were spent for this purpose in these two provinces.

There is no dedicated national programme for PV R&D, however in 2003 a programme "Energy systems of the Future", was launched by the Ministry of Transport, Innovation and Technology, where PV is a side issue. Basically research activities are funded on a project base via various industrial and governmental initiatives.

Public funding for research, development and demonstration stayed on a relatively constant level during the last years and amounted to 1,5 MEUR in 2003.

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.

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 increasing option to supply infrastructure like traffic surveillance systems, communication systems, parking meters and a variety of other applications.

With improved integration into the built environment On-grid distributed systems are meanwhile becoming more and more a common place in public's interest. In Austria this sector now stands for more than 87 % of the installed capacity.

Grid-connected centralized systems in form of PV Power plants continued to play a minor role, so far about 1,2 MW are installed.

2.2 Total photovoltaic power installed

Approximately 16,8 MW of PV power has been installed in Austria by the end of 2003. Between 1995 and 2003 capacity grew continuously about 37 % each year. Until the end of 1996 the off-grid sector was the dominating PV market.

On grid applications more and more dominate the market for PV, and now grid-connected systems (GCS) account for about 87 % of the installed capacity.

Table 1 The cumulative installed PV power in 4 sub-markets.

Sub-market/ application	31 Dec 1992 kW	31 Dec 1993 kW	31 Dec 1994 kW	31 Dec 1995 kW	31 Dec 1996 kW	31 Dec 1997 kW	31 Dec 1998 kW	31 Dec 1999 kW	31 Dec 2000 kW	31 Dec 2001 kW	31 Dec 2002 kW	31 Dec 2003 kW
total off-grid	338	423	610	722	908	960	1 213	1 413	1 671	1 857	1 984	2 173
grid-connected distributed	187	346	453	569	761	1 178	1 648	2 119	3 063	4 440	7 857	13 507
grid-connected centralized	N/A	N/A	N/A	70	70	70	70	140	140	241	476	1 153
TOTAL	525	769	1 063	1 361	1 739	2 208	2 861	3 672	4 874	6 120	10 341	16 833

(Data source: Bundesverband PV, G. Faninger, Der Photovoltaikmarkt in Österreich 2003, own inquiries)

2.3 Major projects, demonstration and field test programmes

Since the introduction of feed-in tariff systems in various provinces and the nationwide support for electricity from RES (Green Electricity Act), most of the local and regional programmes initiated by communities, federal states or utilities have ceased or were adapted to the national scheme. No new programmes started during the year.

With the end of the national PV test programme for PV in 1999, also no new activities in the area of field testing can be mentioned. Projects with a broad demonstration effect like e.g. the "sunshine campaign" in Vorarlberg or the 200 roofs programme in Hartberg have been finished in the meantime.

In the framework of the EU project HIP-HIP (House Integrated Photovoltaics – High-tech In Public), installations with a total capacity of 200 kWp were realised in 2003 with the aim of optimal integration into buildings.

Two trends observed in the last years – optimal architectonical integration of BIPV in newly constructed as well as refurbished buildings and large "PV-Power plant" installations – also continued during 2003. Several installations with innovative design aesthetically integrated into buildings document this.

Among the number of projects realized with funding from the feed-in tariffs, the following large installations, which started operation in 2003, can be mentioned:

In the city of Salzburg a 237 kW system was installed at the roof of an airport hall. The project was initiated by the airport company, the local utility Salzburg AG and the installation company NET. The funding was provided by the utility.

One of the largest installations using solar trackers to improve the energy yield was realized in the "Großes Walsertal" valley in the province of Vorarlberg. Located at an altitude of 1 200 m the 420 kW system with single-crystalline modules mounted on single axis tracker is part of the energy concept of the "biosphere park", a region that shows how people can live and work in a sustainable and resource efficient way. The project was initiated by a group of private individuals and is financed on the basis of the preferential feed-in tariffs.

2.4 Highlights of R&D

Austrian PV research activities are mostly focused on national and international project base and are widespread located and decentralized orientated. Some principal descriptions of these projects highlight the general RTD trend of photovoltaics in Austria:

New and improved cell technologies:

- Organic Solar Cells based on thin plastic films have received increased attention due to their unique properties and are promising to become the cheapest solar technology in the future. Academic R&D on this topic focuses on Plastic Solar Cells based on thin films of Conjugated Polymers.

- Other areas of institutional and academic research include the improvement of photovoltaic solar cells made from lower purity or multi-crystalline silicon. Recently a novel front contact grid for multi-crystalline solar cells was patented which reduces the influence of the defects at grain boundaries on the solar cell efficiency.

- Currently thin layers of fine polycrystalline silicon deposited at very low temperatures are investigated in order to develop a new type of thin film solar cell. Most recently the work was extended to thin film solar cells prepared from microcrystalline silicon. Especially the influence of defects on the electrical properties of photovoltaic solar cells was studied.

BOS components and system aspects:

- Grid-interconnection, not exclusively related to PV but more to Distributed Generation from RES in general, is the main focus of several EU financed projects, which are jointly carried out by research institutions, industry and utilities.

- Cost reduction and optimization of new solutions for building integrated PV are addressed within several EU projects.

- Other recent activities, mainly in the framework of European projects include the development of combined PV-Thermal collectors.

- In the area of system technology, new activities for quality assurance, certification and testing of PV modules were initiated. Since autumn 2003, an Austrian research & testing institution is officially accredited to qualify crystalline silicon PV modules according to the EN/IEC 61215 standard.

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. However there is no programme dedicated to PV R&D. Renewable energy received 28 % of

the Austrian R&D energy budget in 2002. The majority of this has been spent on biomass research. The renewable field receiving the second-highest priority is solar energy, which comprises solar heating and cooling (SHAC) and PV. Total funding for all solar energy R&D was equal to 30 % of the renewable energy R&D budget.

In 2002 the overall public spending for PV research, development and demonstration was about 1,5 MEUR. For the year 2003, figures are not available yet, however a significant change is not expected.

There are no specific figures available for Demonstration or Field Test activities but since there is no field test programme running now, 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 2.

Table 2 Public budgets (in MEUR) for R&D, demonstration/field test programmes and market incentives.

	R & D	Demo/ Field test	Market *)
National/federal	1,5		0
State/regional	0		7,6
Total	1,5		7,6

* Not including feed-in tariffs. See also the comments below.

Since 2003-01-01 the support for electricity from RES is governed by the Green Electricity Act. 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 this system is not financed by a public body, but instead by all consumers of electricity the according figures have not been included in Table 2 under “Market”. The total amount of feed-in tariffs paid for PV in 2003 was 6,722 MEUR.

With the commencement of the Green Electricity Act, almost all other market incentives from local governments, communities and municipalities, or utility companies have ceased. Only in the provinces of Upper and Lower Austria, the regional support (investment subsidy between 2 700 EUR/kW and 3 700 EUR/kW installed) was still granted. The figure stated in Table 2 under “regional” represents the total funds spent for PV in these two provinces.

3 Industry and growth

3.1 Production of feedstock and wafers

No production facilities for silicon feedstock or wafers existed in Austria in 2003.

Table 3: Production and production capacity information for the year for feedstock producers and wafer manufacturers

Manufacturer	Process & technology	Total Production (t or MW)	Maximum production capacity (t/yr or MW/yr)	Product destination
1. -	-	-	-	-

3.2 Production of photovoltaic cells and modules

PVT AUSTRIA, which started the production in 2002, manufactures standard and tailor-made PV-Modules using single and multi-crystalline silicon cells imported from Germany. Standard glass-tedlar laminates are available with a rated power from 18 W to 215 W, semi-transparent, frameless or framed modules from 50 W to 80 W, respectively. For glass façades, special semi transparent modules with insulation glass are manufactured. New developments in 2003 are PV-modules made of custom-tailored colored solar cells individually designed according to the customer's requirements.

During 2003 a second company, SED started manufacturing modules specially designed for integration into PV-roof tiles. The custom laminates produced are directly stuck into standard format tiles made of recycled plastic and can easily replace conventional roofing materials. The used multi crystalline cells are imported from France.

However, both companies cover only a small part (about 15 %) of the Austrian market, which is still primarily supplied with imported modules.

Since the beginning of 2003, the company POWERQUANT, a spin-off from Vienna's university, is working on the commercialization of new technologies for contacting multi-crystalline silicon cells. By aligning the contacts of each cell to the individual crystal structure of the silicon it is expected that the yield of the individual cells can be improved by 5 % to 8 %. The system will be able to produce not only optimized cells, but also specially designed cells with contact patterns based on aesthetics.

Table 4: Production and production capacity information for the year for each manufacturer

Cell/Module manufacturer	Technology (sc-Si, mc-Si, a-Si, CdTe)	Total Production (MW)		Maximum production capacity (MW/yr)	
		Cell	Module	Cell	Module
1 PVT Austria	mc-Si / sc-Si	-	0,90	-	4
2 SED	mc-Si	-	0,15	-	-
TOTALS	-	-	1,05	-	4

Table 4a indicates the typical module prices for the year 2003 as quoted by the manufacturers. The price range reflects the prices for different module types for typical orders (5 kW).

Table 4a: Typical module prices (NC) for a number of years

Year	1992	….	2002	2003
Module price(s):				
PVT (Standard framed laminates)			4,50	3,10 – 3,20
SED (PV roof tiles, including tile)				6,70

3.3 Manufacturers and suppliers of other components

Various other companies are manufacturing components for modules and BOS-components like batteries, inverters, or mounting systems.

FRONIUS INTERNATIONAL has been engaged in solar-electronics and is now Europe's second largest manufacturer of inverters for grid connected PV systems. In 2003 about 40 MW of string-inverters for grid-connected applications were produced, whereof 90 % were exported. At the end of 2003 FRONIUS opened a subsidiary in the United States and started distributing their IG SERIES grid connected inverters on the U.S. market.

In 2003 SIEMENS AG AUSTRIA started large-scale manufacturing and development of string-inverters in the range of 1,5 kW to 4,6 kW for grid connected applications in Vienna.

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 colors and are used by many module manufacturers in the world. In 2003 encapsulation materials for about 230 MW of PV modules were produced, whereof 99 % were exported.

BANNER BATTERIES is an important manufacturer of lead-acid batteries for off-grid PV applications.

3.4 System prices

Due to the ongoing extension of production capacity in Europe and a strong pricing pressure from the German market, a significant decrease of turnkey prices for complete PV systems could be observed in 2003. The according figures for typical PV applications are shown in Table 5.

Table 5: Turnkey Prices of Typical Applications

Category/Size	Typical applications and brief details	Current prices in EURO/W
OFF-GRID Up to 1 kW	Basic electricity supply for mountain huts.	8 to 14 *)
OFF-GRID >1 kW	AC Electricity supply for larger mountain huts. System size between 4 and 8 kW.	8 to 21 *)
GRID-CONNECTED Specific case	2-3 kW roof-mounted system.	6
GRID-CONNECTED Up to 10 kW	Typical roof-mounted system for a single or multifamily house.	5 to 7
GRID-CONNECTED >10 kW	Larger system for commercial / industrial applications. PV-power plants	4 to 6

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 5a 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 during the last years. Triggered by the favorable framework, the feed-in tariffs and tough competition among installation companies, prices for standard systems dropped more than 10 % in 2003 and are now about 6 000 EUR per kW installed.

Table 5a: National trends in system prices (EUR/kW) for a typical 2 – 3 kW grid connected system

YEAR	1992		2001	2002	2003
Price /W:			7 500	7 000	6 000

3.5 Labour places

No precise numbers can be given on the number of labor places in the various sectors. The following figures represent a rough estimation, based on information from the Austrian PV-Association, manufacturing companies and R&D institutions:

- Research and development (not including companies): about 20
- Manufacturing of PV system components, including company R&D: about 150
- All other, including within electricity companies, installation companies etc.: about 50

3.6 Business value

In 2003 6,5 MW of PV systems were installed in Austria, which corresponds to a total value of the national market of 40 MEUR, based on average turnkey prices. Cells and modules are almost exclusively imported.

The value of exported PV components (mainly inverters and encapsulation materials) is estimated to be approximately 65 MEUR.

4 Framework for deployment (Non-technical factors)

4.1 New initiatives

Until the beginning of 2003, the Austrian framework for renewable energy was based on local and regional incentives. Planning and investment regulations, value and duration of subsidies, and even levy arrangements varied significantly from state to state and created a rather unfavorable environment for project implementation.

With the implementation of the nationwide Ökostromgesetz/Green Electricity Act (Official Journal BGBl I 2002/244) the green electricity investment incentives were harmonized. Most of its clauses came into effect on 2003-01-01. In general, it provided a change of the legislative responsibilities (federal instead of provincial), and introduced a system of long-term guaranteed feed-in tariffs together with a purchase-obligation for electricity dealers for electricity from RES. The support for each RES-technology is irrespective of project location. It also provided for the first time an equitable distribution of costs across the country.

The feed-in tariffs were laid down by the Minister of Economy, the Minister of Environment, and the Minister of Consumer Protection together with representatives from the provincial governments and take into account the different production costs for electricity from various RES.

In addition to feed-in tariffs and purchase-obligation, the Green Electricity Act fixed minimum percentage targets for RES-electricity which have to be reached until the year 2008: 4 % of “new” green electricity (not including small hydro) and 9 % electricity from small hydro. These individual targets reflect the 78,1 % figure for Austria stated in the RES-E directive.

The Act also requires adoption, publication and notification to the European Commission of all the reports required by the RES-E directive.

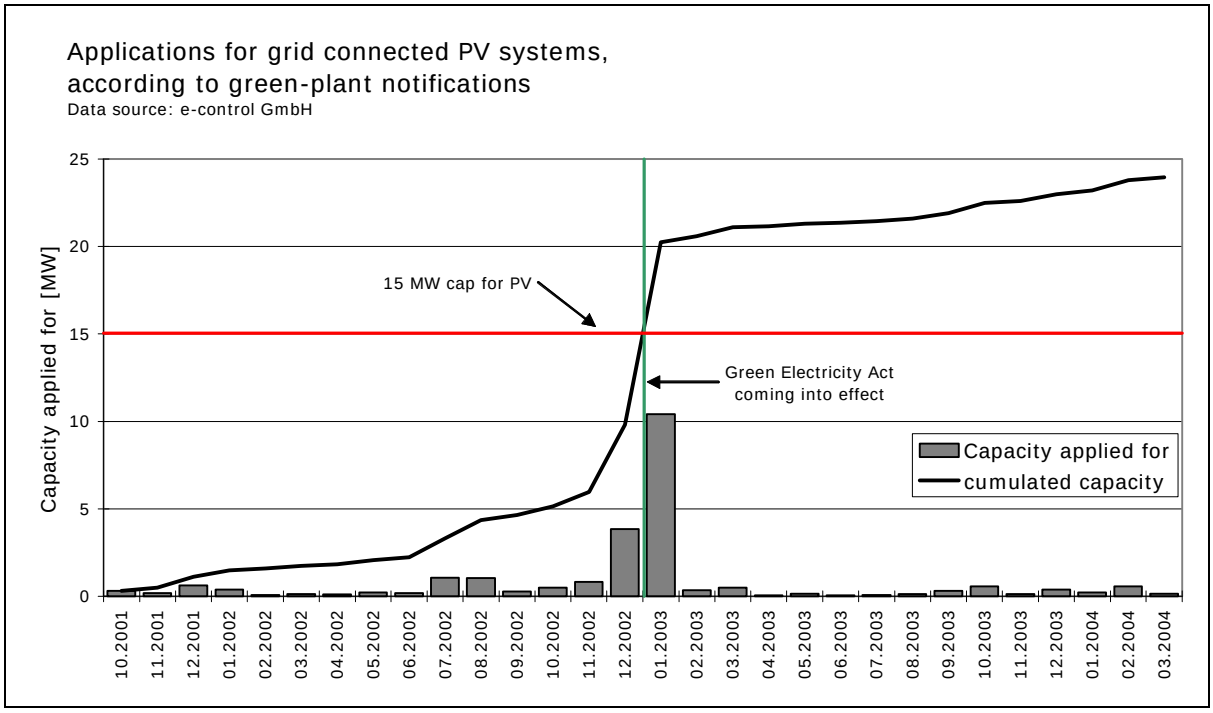
The table below shows the objectives laid down in the Green Electricity Act, namely to generate a proportion of 9 % from small-scale hydroelectric plants and 4 % from eco plants until the year 2008 by providing aid in the form of supply tariffs so that the overall objective of 78,1 % can be reached.

Target: 78,1 % of electricity from renewable sources in accordance with the RES-E directive of the European Union (RES-E 2001/77/EC)			
62 % from large-scale-hydropower > 10 MW Without support	9 % from small-scale-hydropower < 10 MW Preferential feed-in tariffs	4 % from new green power plants (PV max. 15 MW) Preferential feed-in tariffs	2-3 % from other renewable sources (E.g. mixed incineration of waste…) Without support

For grid-connected PV the feed-in tariff was set at 60 Eurocent/kWh for systems up to 20 kW, while larger systems get 47 Eurocent/kWh. Both are guaranteed for 13 years. However, there is a crucial drawback: The availability of the preferential feed-in tariff is capped to a national capacity of 15 MW installed, which is unique for PV. None of the other renewable energy technologies is limited in such a way.

With more than 10 MW already installed at the end of 2002, and a further 6,5 MW requested between the programme launch and 2003-02-01, the budget was spent before the programme really had a chance to take-off. At that date the cap – which was originally supposed to apply up to the end of 2005 – already had been reached. In the following weeks the approved plants were installed and by the end of March the entire 15 MW were on line.

The figure below shows in detail, what happened at the turn of the year 2002/2003. During a few weeks, the authorities received applications for more than 10 MW. Especially in the provinces of Vorarlberg and Salzburg, where people had been particularly aware of the opportunities given by the new framework, a real boom was triggered. After the cap had been reached on 2003-01-14, no new applications for the higher feed-in tariffs have been granted.



To prevent a complete collapse of the Austrian PV market, two provinces, Upper and Lower Austria again provided potential investors with their own support in the form of investment subsidies. However in the majority of the federal states no incentive has been available since then.

4.2 Indirect policy issues

As in most of the other countries, the reduction of greenhouse gas emissions which is the main target of the environmental policy following the Kyoto-Protocol is the major indirect policy issue for the deployment of RES. At the Kyoto conference, Austria committed to reduce 13% of its greenhouse gas emissions from today's 7,6 tons per capita and year towards around 6,6 tons per capita and year in 2010. Appropriate actions and procedures are still in discussion, and it is not yet clear if photovoltaics will be a part of the measures to contribute to a sustainable energy supply in the long term.

Also on the European Union (EU) level, increasing the share of renewable energy for electricity generation has a high priority. In this context, the "Directive on the promotion of electricity produced from RES (RES-E Directive)" was published in September 2001 by the European Commission. The goal set in the directive is to increase the share of RES-E in the European Union to 22,1 % until 2010. For Austria the individual target is to reach a share of 78,1 % of electricity from RES.

To comply with the RES-E directive, the Ökostromgesetz/Green Electricity Act (Official Journal BGBl I 2002/244) was adopted by the Austrian Parliament. The Green Electricity Act governs the aid for green energy and combined heat and power generation throughout the country.

4.3 Standards and codes

In general, the European Standards for PV are likewise applied in Austria. These standards cover most issues on design, components and systems. Grid-interconnected PV applications are covered in detail by the preliminary national standard ÖNORM/ÖVE E 2750, the national counterpart of the EN 61727. The standard defines all the safety relevant aspects regarding planning, installation, grid-interconnection, requirements for components and operation of grid connected PV installations.

The preliminary standard was substantially revised in 2003. Amongst others, the following items were revised or adapted according to recent developments and findings.

- Inverters without galvanic separation are now covered
- New options for islanding protection have been introduced (test with a balanced RLC circuit) that help to improve PV system reliability.
- Easier assessment of harmonic current emissions
- Lightning protection guidelines were adapted to comply with new requirements of the national standards.

The new edition of the standard will be published in mid 2004.

A new Quality Label for PV installers is currently developed by the Austrian Photovoltaic Association. Certified planners and installers are obliged to use products and components certified to the relevant standards as well as to have a quality assurance system.

5 Highlights and prospects

2003 was the strongest year ever for the Austrian PV market. The overall installed PV capacity in Austria increased by more than 60 % compared to the year 2002 and reached 16,8 MW at the end of 2003. On grid applications clearly dominate the market for PV, and account for about 87 % of the installed capacity. However, due to the limited availability of the feed-in tariffs up to a total installed capacity of 15 MW, the positive development has stopped completely in the meantime. Although some federal provinces now again support PV investments, it is beyond doubt that such measures cannot replace a nationwide incentive.

The table below gives an overview on the present (2004-05) situation regarding regional support initiatives for PV:

Province	Support instrument	Level of support
Burgenland	Housing Subsidy scheme	30 % max. 2 200 EUR of the investment
Carinthia	None	
Lower Austria	From 2004-01-01 one-time investment subsidy, but at the moment no subsidy is disbursed or granted for new applications.	3 700 EUR/kW installed
Upper Austria	One-time investment subsidy	3 000 EUR/kW
Salzburg	None	
Styria	None	
Tyrol	None	
Vorarlberg	None	
Vienna	From 2004-03-01 investment subsidy for “Green power plants”.	up to 40 % of the investment cost

Currently it seems rather uncertain, that the PV cap will be lifted in the near future. Unlike the feed-in tariffs themselves, which are stated in a separate decree, the cap is part of the Green Electricity Act itself. Given the constitutional status of the act, a parliamentary two-third majority will be required to approve any changes and decide whether PV in Austria can be further developed or not. Probably local incentives will again be the only driving force for the deployment of PV.

Looking at the industrial sector it can be expected that the positive situation of the international PV market will provide the basis for an ongoing growth of the Austrian PV manufacturers and help to strengthen the position of Austria as an important supplier of components for PV systems. New activities in the area of cell and module production clearly document this trend. Besides conventional technology, the industry also shows increased interest in new approaches, like e.g. combined PV-thermal collectors.

A strong industry provides an important basis for successful national PV R&D activities and allows the transfer of new developments into products and applications, which can meet the users’ demand.

Annex A Method and accuracy of data

The market statistics on installed capacity, share of grid-connected and off-grid applications has been collected by Gerhard Faninger from the University of Klagenfurt in collaboration with the Austrian Photovoltaic Association (Bundesverband Photovoltaik; http://www.bv-pv.at). The data is based on a survey among importers of PV components and distribution companies. In the annual report ("Der Photovoltaikmarkt in Österreich 2003") PV applications are divided into

- Off-grid installations (including domestic and non-domestic applications)
- Grid-connected systems

No further breakdown is made in the study between centralized and distributed systems. Therefore the share of grid-connected centralized systems had to be determined by summarizing all large PV-installations which are dedicated as power-plants.

Grid-connected PV-installations are reported by the grid-operators. Since 2003, the control zone managers (major transmission network operators) are obliged to submit data on grid-connected PV systems to e-control (Company responsible for monitoring, supporting and regulating the liberalization of the Austrian electricity and natural gas market).

The uncertainty of the figures presented is estimated to be about 5 %.

Data on funding for PV R&D is taken from the report "Energie: Forschung, Entwicklung und Demonstration - Ausgaben des Bundes, der Länder und der Industrie im Jahre 2002" by Gerhard Faninger, University of Klagenfurt. Data for 2003 will be available in June 2004.

Data on actual production, production capacity, prices and other market figures is based on information provided by manufacturers, installers and the Austrian PV association. An estimation of the corresponding accuracy cannot be provided.