IEA INTERNATIONAL ENERGY AGENCY

FH University of Applied Sciences TECHNIKUM WIEN

National Survey Report of PV Power Applications in Austria

2016

PHOTOVOLTAIC POWER SYSTEMS PROGRAMME

PVPS

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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 member countries

The IEA Photovoltaic Power Systems Technology Collaboration 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 participating countries and organisations can be found on the www.iea-pvps.org website.

The overall programme is headed by an Executive Committee composed of one representative from each participating country or organization, 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

Cover: DAS Energy

Introduction

The objective of Task 1 of the IEA Photovoltaic Power Systems Programme is to promote and facilitate the exchange and dissemination of information on the technical, economic, environmental and social aspects of PV power systems. Task 1 activities support the broader PVPS objectives: to contribute to cost reduction of PV power applications, to increase awareness of the potential and value of PV power systems, to foster the removal of both technical and non-technical barriers and to enhance technology co-operation. 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 country National Survey Report for the year 2015. 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 INSTALLATION DATA

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. Other applications such as small mobile devices are not considered in this report.

For the purposes of this report, **PV installations are included in the 2016 statistics if the PV modules were installed and connected to the grid between 1 January and 31 December 2016, although commissioning may have taken place at a later date**.

1.1 Applications for Photovoltaics

Grid-connected plants with a total capacity of 154,802 kWp were installed. Thereof 1084 kWp are roof-integrated and 929 kWp façade integrated. As during the previous years, the off-grid sector plays a minor role in the Austrian PV market (off-grid PV-capacity installed in 2016: 952 kWp). Data about market segments (residential, commercial) is not available.

1.2 Total photovoltaic power installed

After the absolute highest market diffusion of photovoltaic (PV) systems in Austria in 2013, the PV market has stabilized in 2015 and 2016. In 2016, off-grid and grid connected PV systems with a total PV power of 154,802 kWp have been installed, which represents a 6.48 % increase of the domestic market compared to the year before. This led to a cumulated total installed capacity of 1,096.0 MWp at the end of 2016. On a 10 years basis, an average market growth of 45.61 % per year for all PV installations can be reported. As a consequence the estimated renewable electricity produced by PV amounted to 1,096.1 GWh in 2016 (~ 1.88 % of the total electricity consumption in Austria) and lead to a reduction in CO_2 emissions by 920,653 tons (emission coefficient 2016: 840.0 gCO_2-equ/kWh).

Table 1: PV power installed during calendar year 2016

AC			**MW installed in 2016 (mandatory)**	**MW installed in 2015 (optional but HIGHLY NEEDED)**	**AC or DC**
Grid-connected	BAPV	Residential	145.51		AC
		Commercial			
		Industrial			
	BIPV (if a specific legislation exists)	Residential	2.01		M°Y
		Commercial			
		Industrial			
	Ground-mounted	cSi and TF	6.66		M°Y
		CPV			
Off-grid		Residential			
		Other	0.95		
		Hybrid systems			
		Total	**155**		

Table 2: Data collection process:

If data are reported in AC, please mention a conversion coefficient to estimate DC installations.	Not available
Is the collection process done by an official body or a private company/Association?	Institute of Renewable Energy University of Applied Sciences Technikum Wien
Link to official statistics (if this exists)	PV Market Study 2016: https://nachhaltigwirtschaften.at/resources/nw_pdf/201713-marktentwicklung-2016.pdf
	Data provided by federal (Austrian Climate and Energy Fund, OeMAG Abwicklungsstelle für Ökostrom AG) and regional funding bodies

Table 3: PV power and the broader national energy market.

MW-GW for capacities and GWh-TWh for energy	2016 numbers	2015 numbers
Total power generation capacities (all technologies)	Not available	24,336 GW[1]
Total power generation capacities (renewables including hydropower)	Not available	16,868 GW
Total electricity demand (= consumption)	~ 59 TWh / 62 TWh (including grid losses and own requirements) [2]	~ 58 TWh / 60 TWh (including grid losses and own requirements) [3]
New power generation capacities installed during the year (all technologies)	Not available	Not available
New power generation capacities installed during the year (renewables including hydropower)	155 MW PV 228 MW Wind	152 MW PV 323 MW Wind
Total PV electricity production in GWh-TWh	~1,096.1 GWh	~937 GWh
Total PV electricity production as a % of total electricity consumption	~ 1.88 %	~ 1.6 %

[1] http://oesterreichsenergie.at/stromerzeugung-231.html

[2] https://www.e-control.at/statistik/strom/betriebsstatistik/betriebsstatistik2016

[3] https://www.e-control.at/statistik/strom/betriebsstatistik/betriebsstatistik2015

Table 4: Other informations

	2016 Numbers
Number of PV systems in operation in your country (a split per market segment is interesting)	< 5kWp: 73,972 PV systems (74.882 MWp) > 5kWp: 21,716 PV systems (75.540 MWp) For the rest (4.380 MWp) no information is available.
Capacity of decommissioned PV systems during the year in MW	No reports about decommissioned systems
Total capacity connected to the low voltage distribution grid in MW	No data available
Total capacity connected to the medium voltage distribution grid in MW	No data available
Total capacity connected to the high voltage transmission grid in MW	No data available

Table 5: The cumulative installed PV power in 4 sub-markets.

Sub-market	Stand-alone domestic	Stand-alone non-domestic	Grid-connected distributed	Grid-connected centralized	**TOTAL (MW)**
Until 2004	2.645		17.262	1.153	**21.060**
2005	2.895		19.973	1.153	**24.021**
2006	3.169		21.263	1,153	**25.585**
2007	3.224		23.721	1.756	**27.701**
2008	3.357		27.274	1.756	**32.387**
2009	3.605		48.991	N/A	**52.596**
2010	3.812		91.686	N/A	**95.498**
2011	4.502		182.670	N/A	**187.172**
2012	4.722		258.163	N/A	**362.885**
2013	5.190		620.784	N/A	**625.974**
2014	5.498		779.757	N/A	**785.25**

2015	5.535		931.563	N/A	**937.098**
2016	6.487		1.089.529	N/A	**1.096.016**

2 COMPETITIVENESS OF PV ELECTRICITY

2.1 Module prices

Table 6 indicates the typical module prices for the year 2015 as quoted by the Austrian manufacturers and installation companies. Compared to the previous years, module sales price of Austrian manufacturers dropped again in 2015. The average wholesale price of Austrian manufacturers in 2015 was 0.60 EUR/W. The average wholesale-price of Austrian planners was 0.56 EUR/W in the year 2015 (2014: 0.60 EUR/W).

Table 6: Typical module prices for a number of years

Year	2011	2012	2013	2014	2015	2016
Standard module crystalline silicon price(s): Typical	1.45 1.40	0.94 0.85	0.75 0.64	0.67 0.60	0.60 0.56	0.61 0.59
Lowest prices	0.95	0.63	0.54	0.52	0.47	0.46
Highest prices	3.6	1.25	0.90	1,05	0.70	0.70

2.2 System prices

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

Table 7: **Turnkey Prices of Typical Applications – local currency**

Category/Size	Typical applications and brief details	Current prices per W
OFF-GRID Up to 1 kW	Prices for off-grid systems vary widely (from 3 to 6.5 EUR/W) depending on the application (DC appliances or AC island grid) and the mounting-site.	~ 5 EUR
OFF-GRID >1 kW		
Grid-connected Rooftop up to 10 kW (residential)	For a 5 kWp System per kWp	1,645 EUR
Grid-connected Rooftop from 10 to 250 kW (commercial)	For a system > 10 kWp per kWp	< 1,393 EUR
Grid-connected Rooftop above 250kW (industrial)	No data available	
Grid-connected Ground-mounted above 1 MW	No data available	
Other category (hybrid diesel-PV, hybrid with battery…)		

Table 8: National trends in system prices (current) for different applications – local currency

Price/Wp	2008	2009	2010	2011	2012	2013	2014	2015	2016
Residential PV systems < 10 KW	5.140	4.370	3.680	2.970	2.216	1.934	1.752	1.658	1.645
Commercial and industrial	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Ground-mounted	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

2.3 Cost breakdown of PV installations

2.3.1 Residential PV System < 10 kW

Table 9: Cost breakdown for a residential PV system – local currency

Cost category	Average (local currency/W)	Low (local currency/W)	High (local currency/W)
Hardware			
Module	0.712 EUR/W		
Inverter	0.266 EUR/W		
Other (racking, wiring…)	0.362 EUR/W		
Soft costs			
Installation	0.305 EUR/W		
Customer Acquisition	N/A		
Profit	N/A		
Other (permitting, contracting, financing…)	N/A		
Subtotal Hardware	1.339		
Subtotal Soft costs	0.305		
Total	1.645 EUR/W	1250 EUR/W	2.200 EUR/W

2.3.2 Utility-scale PV systems > 1 MW

Table 10: Cost breakdown for an utility-scale PV system – local currency

Cost Category	Average (local currency/W)	Low (local currency/W)	High (local currency/W)
Hardware			
Module			
Inverter			
Other (racking, wiring, etc.)			
Soft cost			
Installation Labor			
Customer acquisition			

Profit			
Other (contracting, permitting, financing etc.)			
Subtotal Hardware			
Subtotal - Soft cost			
Total Installed Cost	N/A	N/A	N/A

2.4 Financial Parameters and specific financing programs

In 2012 Wien Energie, one of Austria's biggest electric supply companies, started a public participation model for PV in Vienna and Lower Austria, which became very popular especially in urban areas. Private persons have the possibility to buy single PV modules (950 EUR / module) of a solar power plant. After selling all modules successfully, the solar power plant is built and operated by Wien Energie and the private investors will get a 1.75 % revenue every year for leasing their modules to Wien Energie. The minimum contract term is 5 years. At the end of the lifespan of the solar power plant Wien Energie will rebuy the PV modules and the complete amount of the investment will be refunded to the private investors. So far, Wien Energie has built 26 solar power plants, with a capacity between 80kWp and 2,7 MWp each.

A similar public participation model is offered by Energie AG Oberösterreich Fair Energy GmbH in Upper Austria. Private investors will receive an annual remuneration of 3.3 % of their investment. So far, the Energie AG built 20 solar power plants with a total power of 5 MWp. But also other electric supply companies are offering such public participation models.

Table 11: PV financing scheme

Average rate of loans – residential installations	
Average rate of loans – commercial installations	1.75 % - 3.3 %
Average cost of capital – industrial and ground-mounted installations	

2.5 Specific investments programs

Third Party Ownership (no investment)	
Renting	
Leasing	
Financing through utilities	
Investment in PV plants against free electricity	
Crowdfunding (investment in PV plants)	
Other (please specify)	

2.6 Additional Country information

Table 12: Country information

Retail Electricity Prices for an household (range)	0.203 EUR (2016)[4]
Retail Electricity Prices for a commercial company (range)	0.127 EUR (2016)
Retail Electricity Prices for an industrial company (range)	0.127 EUR (2016)
Population at the end of 2016 (or latest known)	8.7 Mill (1.1.2017)[5]
Country size (km^2)	83,879
Average PV yield (according to the current PV development in the country) in kWh/kWp	950 kWh/kWp to 1.100 kWh/kWp [6]
Name and market share of major electric utilities.	More than 140 electricity provider

[4] Österreichs Energie, Eurostat (choosen countries), data status 1. halfyear 2016

[5] http://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/bevoelkerung/bevoelkerungsstand_und_veraenderung/bevoelkerung_zu_jahres-_quartalsanfang/index.html

[6] Authors estimation

3 POLICY FRAMEWORK

This chapter describes the support policies aiming directly or indirectly to drive the development of PV. Direct support policies have a direct influence on PV development by incentivizing or simplifying or defining adequate policies. Indirect support policies change the regulatory environment in a way that can push PV development.

3.1 Direct support policies for PV installations

3.1.1 New, existing or phased out measures in 2016

Description of support measures excluding BIPV, and rural electrification

In general self-consumption of PV electricity is allowed in Austria, except for PV systems which receive a Feed-In tariff by the national GEA. Until 2013 self-consumption was not charged with a tax, but in March 2014 the Ministry of Finance announced, that self-consumption of PV electricity over 5,000 kWh per year will be charged with 1.5 Cent/kWh in the future. In July 2014 the yearly exemption limit was increased from 5,000 kWh to 25,000 kWh. This tax is not new, but exists since 1996.

3.1.1.1 BIPV development measures

Building integrated PV systems up to 5 kWp are supported by the Austrian Climate and Energy Fund, which provides an additional investment subsidy of 100 EUR/kWp (375 EUR/kWp for BIPV instead of 275 EUR/kWp). Some provinces offer higher subsidies from the "Wohnbauförderung" (subsidized housing scheme) if a PV system is installed.

3.1.1.2 Rural electrification measures

The Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management supports renewable energy systems (e.g. PV, wind power, storages, etc.) in areas not connected to the grid with an investment subsidy up to a maximum of 35 % of the eligible costs.

3.1.1.3 Support for electricity storage and demand response measures

Since January 2014 decentralized electricity storages in combination with PV systems are supported in the some province. Styria has a subsidy of 200 to 600 EUR/kWh depending of the storage technology for storage up to 7.5 kWh. Upper Austria supported again the decentralized electricity storages in the second half year of 2015. Since June 2015 in Vienna a limited incentive of 500 EUR/kWh is granted depending on the storage capacity. Burgenland has a non-refundable rebate of 275 EUR/kWh for storages up to 5 kWh.

Table 13: PV support measures (summary table)

	On-going measures residential	Measures that commenced during 2016 - residential	On-going measures Commercial + industrial	Measures that commenced during 2016 – commercial + industrial	On-going measures Ground-mounted	Measures that commenced during 2016 – ground mounted
Feed-in tariffs	Yes	No	Yes	No	Yes	Yes
Feed-in premium (above market price)						
Capital subsidies	*No*	*No*	*No*	*No*	*No*	*No*

Green certificates						
Renewable portfolio standards (RPS) with/without PV requirements	*No*	*No*	*No*	*No*	*No*	*No*
Income tax credits	*No*	*No*	*No*	*No*	*No*	*No*
Self-consumption	Yes	*No*	Yes	*No*	Yes	*No*
Net-metering	No	No	No	No	No	No
Net-billing	No	No	No	No	No	No
Commercial bank activities e.g. green mortgages promoting PV	No	No	No	No	No	No
Activities of electricity utility businesses	No	No	No	No	No	No
Sustainable building requirements	Yes	Yes	Yes	Yes	Yes	Yes
BIPV incentives	Yes	Yes	Yes	Yes	Yes	Yes
Other (specify)	No	No	No	No	No	No

3.2 Self-consumption measures

PV self-consumption	1	Right to self-consume	Self-consumption is legally permitted
	2	Revenues from self-consumed PV	None
	3	Charges to finance Transmission & Distribution grids	None
Excess PV electricity	4	Revenues from excess PV electricity injected into the grid	Payment through traditional support schemes such as feed-in tariff (FiT) or green certificates (GC): PV electricity gets a value defined by regulation.
	5	Maximum timeframe for compensation of fluxes	None
	6	Geographical compensation	None

Other characteristics	7	Regulatory scheme duration	13 years
	8	Third party ownership accepted	
	9	Grid codes and/or additional taxes/fees impacting the revenues of the prosumer	self-consumption fee)
	10	Regulations on enablers of self-consumption (storage, DSM…)	storage bonus, demand side management
	11	PV system size limitations	None
	12	Electricity system limitations	Distributors's License
	13	Additional features	Self consummation tax

3.3 Tenders, auctions & similar schemes

3.4 Direct Support measures

3.5 Financing and cost of support measures

Until today public support schemes for PV in Austria have shown some discontinuity. 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, especially for PV systems above 5 kWp, generally addresses only a small amount of the huge number of prospective buyers of PV systems in Austria. Because of the fact that no public body finances the feed-in tariff system, all electricity consumers have to come up with coverage.

Austria has mainly three levels of supporting PV systems:

Systems up to 5 kWp are supported by the also limited sources of the governmental Austrian Climate and Energy Fund, which provided a limited incentive in form of a non-refundable rebate for new installations for private households up to 5 kWp. This support scheme provides additional financial benefits to building integrated systems (BIPV). This public initiative launched once a year, 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 kWp installation was reduced significantly according to the lower PV prices. 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. In 2013 36 MEUR were provided. In 2013 the investment subsidy of 800 EUR/kWp was reduced to 300 EUR/ kWp or to 400 kWp for Building integrated PV systems. For the first time more money was available in 2013, that was required from buyers of PV systems. In 2013 PV systems with a total capacity of 67,867 kWp have been installed under this funding scheme, more than ever before. In 2014 the budget has been reduced to 26.8 MEUR. Also the investment subsidy was reduced to 275 EUR/kWp or to 375 EUR/kWp for Building integrated PV systems. In 2014 PV systems with a total capacity of 46,197 kWp have been installed under this funding scheme.

In 2015 the budget has been reduced to 17 MEUR. The investment subsidy was 275 EUR/kWp and 375 EUR/kWp for Building integrated PV systems. In 2015 PV systems with a total capacity of 63,974

kWp have been installed under this funding scheme. In 2016, the budget was reduced to 8,5MEUR. The investment subsidy was 275 EUR/kWp and 375 EUR/kWp for Building integrated PV systems. In 2016 PV systems with a total capacity of 74,882 kWp have been installed under this funding scheme.

For PV systems above 5 kWp a 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 power plants) 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 2015 Feed-in Decree tariffs ranged from 8.24 Cent/kWh for systems above 5 to 200 kWp installed on buildings or noise protections walls. In addition to the feed-in Tariff a unique investment subsidy of max. 200 EUR/kWp is granted for systems installed on buildings or noise protection walls. From 2015 on, systems on open landscape and systems > 200kWp are no more supported.
In 2015 the governmental Austrian Climate and Energy Fund supported PV systems for the Agriculture and Forestry between 5kW to 30kW. For 2016 the budget has been 6.6 MEUR.

Table 7: Feed-in tariffs from 2009 to 2016 according to the Feed-in Decree

	2009 (Cent / kWh)	2010 (Cent / kWh)	2011 (Cent / kWh)	2012 (Cent / kWh)	2013 (Cent / kWh)	2014 (Cent / kWh)	2015 (Cent / kWh)	2016 (Cent / kWh)
up to 5 kWpeak	45.98	-	-	-	-			
above 5 kWpeak up to 10 (20) kWpeak	39.98	35 – 38	35 – 38	23 – 27.6				
above 10 (20) kWpeak	29.98	25 – 33	25 – 33	19 – 25				
above 5 kWpeak up to 500 kWpeak					16.59 – 18.12			
above 5 kWpeak up to 350 kWpeak						10.00 (open landscape)- 12.50 (PV on buildings)		
above 5 kWpeak up to 200 kWpeak							11.50 - 18.00 No support for PV on open landscape	8.24 No support for PV on open landscape

The total amount of feed-in tariffs paid for PV in 2016 was approximately 122.9 MEUR (2015: 109.3 MEUR), which represents a 14.6 % increase compared to the previous year. The average feed-in tariff paid for PV in 2016 was 24.56 Eurocent/kWh which represents a 1.9 % reduction compared to the previous year (2015: 25.03 Eurocent /kWh).

In addition to the federal incentives almost all provinces continued running their regional support in form of rebates on the costs of the PV system (investment subsidies) in 2015. Salzburg, Styria and Vienna offer such a separate support scheme for PV. Other provinces (Carinthia, Lower Austria, Upper Austria, Burgenland, Styria and Salzburg) offer additional funding by the "Wohnbauförderung" (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.

3.6 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 20/20/20 climate and energy targets, set in 2007 by the European Union, have strong influence on Austria. Austria's targets are a total share of the national energy consumption produced from renewable resources to 34 %, a reduction in greenhouse gas emissions of 16 % below 2005 levels emissions in non-ETS sectors and an increase in energy efficiency by 20 % by 2020 as opposed to a business-as-usual scenario.

In the city of Vienna, the local building code foresees the need to install 1 kWp of PV per 100 m² gross floor area at all new industrial and commercial buildings.

In Austria the tax on new cars depends on CO_2 pollution-categories.

The Austrian Development Agency (ADA) has co-financed the Caribbean Renewable Energy Development Programme (CREDP) since 2009 and has directly financed investment projects such as the photovoltaic (PV) system at Guyana Energy Agency's (GEA), the PV system at Comision Nacional de Energia in the Dominican Republic, PV-lab Equipment for the Technical Community College in Saint Vincent and the Grenadines, as well as currently on-going projects such as solar water heating at St. Jude's hospital in St. Lucia, PV-LED street lighting in Saint Vincent and the Grenadines, PV system for Government Offices in Antigua and PV-lab equipment for T. A. Marryshow Community College in Granada.
The Austrian Development Cooperation (ADC) supported the establishment of ECREEE since its beginning with the creation of a secretariat in Cape Verde and a network of National Focal Institutions in all 15 ECOWAS member states. ADC will continue to support ECREEE with a core funding to its Business Plan 2011-2016 and the secondment of a technical assistant to ECREEE's secretariat in Cape Verde.

4 PV IN THE ECONOMY

4.1 Labour places

In total it can be estimated that at the end of 2016 approximately 2,822 full-time jobs (2015: 2,936 jobs) were directly linked to PV R&D, manufacturing and installation in Austria. In the various sectors the following figures (Table 17) represent an estimation of existing work places, based on information from the manufacturing companies and R&D institutions.

Table 17: Estimated PV-related labour places in 2015

Research and development (not including companies)	601
Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D	
Distributors of PV products	
System and installation companies	2221
Electricity utility businesses and government	N/A
Other	N/A
Total	2,822

4.2 Business value

In 2016 about 155 MWp (2015: 152 MWp) of PV systems were installed in Austria, which led to a cumulated total installed capacity of 1,096 MWp. As a consequence the sum of produced renewable electricity by PV plants in operation amounted to 1,096 GWh in 2016.The average specific price of a grid-connected 5 kWp photovoltaic plant in Austria decreased from 1,658 EUR/kWp to 1,645 EUR/kWp. This observation confirms a high economic learning rate, which is highly correlated to the strongly increasing world market. Based on this average turnkey price for on-grid connected systems, the estimated value of the national installation market increased to about 256 MEUR

(2015: 252 MEUR). Table 18 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 18: Value of PV business

Sub-market	**Capacity installed *in 2016* (MW)**	**Price per W** *(from table 7)*	**Value**	**Totals**
Off-grid domestic	*X*	*Y*	*a = X x Y x 1 000 000*	
Off-grid non-domestic	0.952	*~ 5.00 EUR/W*	*b*	*4,760,000.00 EUR*
Grid-connected distributed	154.802	1.645 *EUR/W*	*c*	*254,649,300.0 EUR*
Grid-connected centralized			*d*	
				a+b+c+d
Export of PV products				*N/A*
Change in stocks held				*N/A*
Import of PV products				*N/A*
Value of PV business				***255,125,300***

If possible, please provide some brief comment on the industry value chain in your country or provide references to articles, reports dealing with this topic.

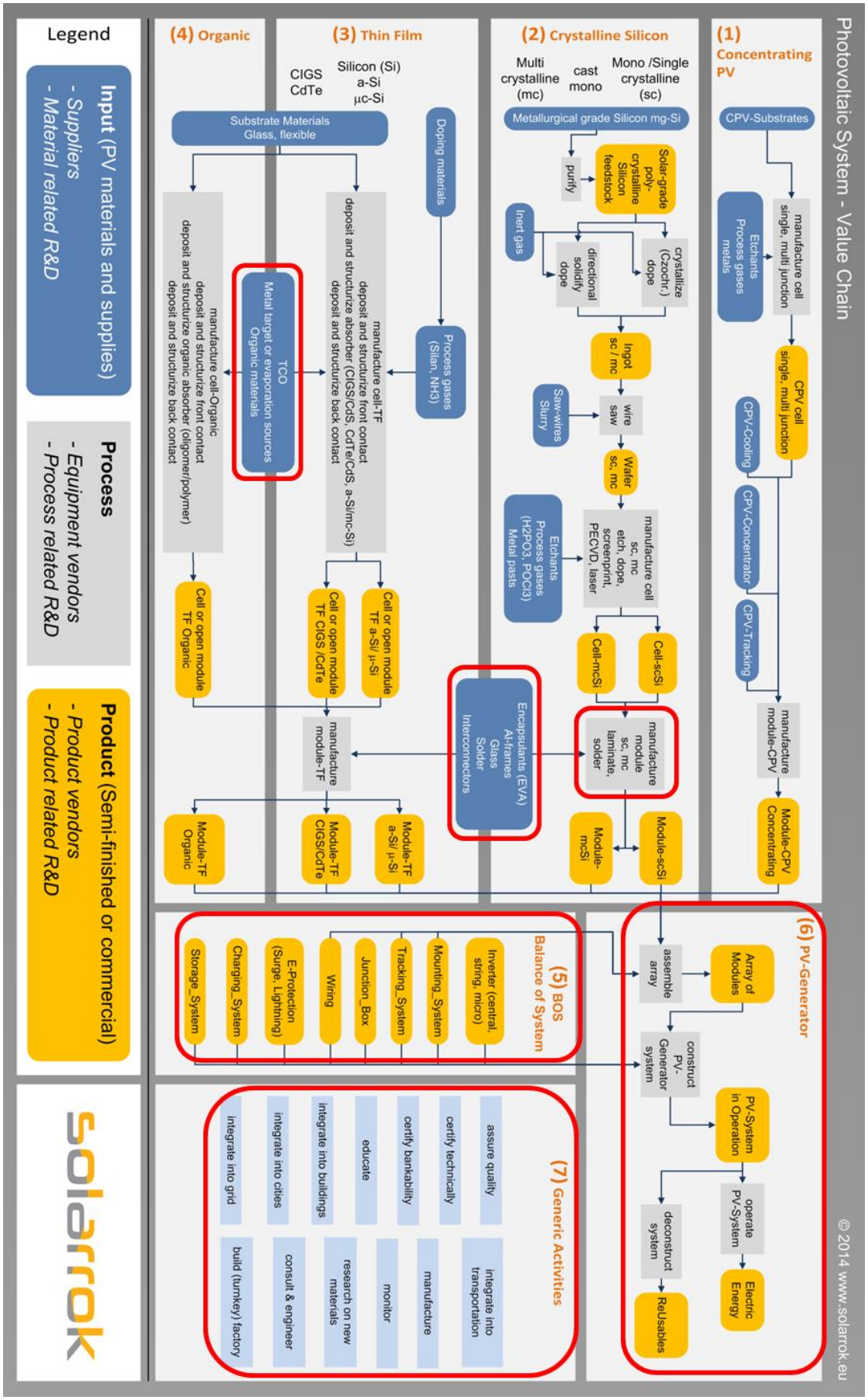
In 2016 about 36.4 % of the Austrian PV module production was exported, compared to almost 50.5 % in 2015. The export ratio of the Austrian inverter production (91 %) remains high, also the production volumes increases in 2016 from 1,350 MWp to 1,415 MWp. Due to the variety of PV related products manufactured by Austrian industry, no reliable estimation can be provided for the import/export and business value of these products.

Industry value chain:

The following PV value chain gives an overview of the PV industry in Austria (Figure 2). All inputs, products and processes produced or operated by Austrian companies are marked with a red border. Austrian producers can be found in the following areas:

- encapsulants (EVA), all-frames, glass, solders, interconnectors
  e.g. Isovoltaic AG, Ulbrich of Austria, Lisec Austria GmbH
- TCO, metal targets and evaporation sources, organic materials
  e. g. Plansee High Performance Materials
- manufacture module sc, mc, laminate, solder
  e. g. Energetica Energietechnik GmbH, Ertex Solartechnik GmbH, Kioto-Photovoltaic, PV Products GmbH, PVT-Austria, SED Produktions GesmbH, Sunplugged GmbH, MGT-esys
- Balance of system
  e. g. Fronius International, Welser Profile, LEBAU Partnernetzwerk & Bau GmbH, Phoenix Contact, Gebauer & Griller Kabelwerke Gesellschaft m.b.H.

Figure 1: PV value chain for Austria; Data source: SOLARROK 2014



5 INTEREST FROM ELECTRICITY STAKEHOLDERS

5.1 Structure of the electricity system

Short description of the electricity industry landscape

Since the fully liberalization in 2001 the Austrian electricity market operates within a framework that consists of the relevant legislation at EU (Electricity Directive 2009/72/EC), Austrian (Electricity Act – ELWOG Elektrizitätswirtschafts- und organisationsgesetz) and provincial level (e.g. the Vienna Electricity Act - Wiener Elektrizitätswirtschaftsgesetz).

During the course of the liberalization, a number of great technical and organisational changes resulted for market participants. First of all, the operation of the grids was separated from competitive activities, such as generation, wholesale and retail, which means an unbundling of the vertically integrated electricity utilities in Austria.

Furthermore so-called balance groups were introduced to enable consumers, generators, suppliers and wholesalers to trade or conclude deals with each other. Whoever takes electricity off the grid, feeds in or trades must be member of a balance group.

The E-Control is the politically and financially independent regulator of the Austrian Electricity market. The main tasks are to strengthen competition and ensure that this does not compromise security of supply and sustainability.

At the end of 2014 about 140 distribution system operators (DSO) existed in Austria. These distribution system operators are responsible for secure grid operation, for metering and for handling and processing grid user.

5.2 Interest from electricity utility businesses

In 2014 and 2015 some Austrian DSOs announced that PV has reached a critical penetration in some network segments. This question of PV grid integration becomes an important national enabler for Smart Grids in Austria.
As already mentioned, some electricity utilities started public participation models for PV.

5.3 Interest from municipalities and local governments

From 2014 almost all provinces offered support in form of investment subsidies in addition to the federal incentives. Salzburg, Styria, Tyrol and Vienna offer a separate support scheme for PV. Other (Burgenland, Carinthia, Lower Austria, Upper Austria, Styria and Salzburg) offers additional funding by the subsidized housing scheme. Only in Vorarlberg and Lower Austria no regional support was available in 2015. Since 2014 decentralized electricity storages in combination with PV systems are supported in some provinces.

6 HIGHLIGHTS AND PROSPECTS

Highlights:

In 2016, off-grid and grid connected PV systems with a total PV power of 154.80 MWp have been installed, which led to a cumulated total installed capacity of 1,096.1 MWp at the end of 2016. In 2016 1.88 % of the total electricity consumption in Austria was provided by photovoltaic (2015: 1.6%). This is an important step towards the target of the Austrian Photovoltaic Association, who 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.

For the second year in a row the home market became more important for Austrian module manufacturer than the export market. Nevertheless the international PV market will remain the basis for growth and will help to strengthen the position of Austria as an important supplier of components for PV systems.

The annual National Photovoltaic Conference 2016 (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 300 experts participating. This conference is established as The annual come together of the Austrian PV stakeholders.

Prospects:

Austrian photovoltaic R&D is conducted in thin layer technology, grid integration and building integration. Especially the development of building integrated photovoltaic elements is of high importance and can represent a very attractive market segment for future development of the Austrian photovoltaic industry. High added value seems to be achievable in this market branch. In this context the OFI together with 8 partners started the project PV@Fassade - Fassadenelement mit PV-aktiven Schichten“ in spring 2014. Another national project named “Shape-PV – The shape of BIPV to come: Concept” aims to perform a screening of the existing technical solutions for the energy balance of buildings in Austria. Moreover, it covers building engineering aspects, structural physics, and legal frameworks for each architectural period, and highlights obstacles or barriers. A screening of an energy efficiency analysis is performed considering regional aspects and the specific Austrian situation. The concept comprises technical as well as economic issues in a number of analyses and expert evaluations (adaptation of architectural and technical requirements, PV system aspects). These projects, sponsored by the Austrian Climate and Energy Fund, are dealing with the integration of PV in facades. In international context Austria is participating in the “Dem4BiPV” project. “Dem4BiPV“ is based on the principle of European cooperation through which innovative educational material utilizing ICTs will emerge on the topic of BIPV, which is of crucial importance for the future development and penetration of the PV market in Europe with a potential significant contribution in meeting Europe’s energy challenges. Education and training are crucial for both economic and social progress, and aligning skills with labour market needs plays a key role in this.

Austria is participating in IEA PVPS Task 15 BIPV and is member of the expert pool BIPV at the EU PV Technology platform. The national technology platform Photovoltaics, is also strong focused on BIPV. To strengthen the competitiveness and expand the value creation for the Austrian market the Technology Platform Photovoltaic (TPPV) was founded in 2009 by companies involved in the PV production of PV components.

Furthermore, due to the increased deployment of PV-systems, the question of PV grid integration becomes an important national enabler for Smart Grids.

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°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.

CPV: Concentrating PV

Hybrid system: A system combining PV generation with another generation source, such as diesel, hydro, wind.

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 the additional transport costs of installing a telecommunication system 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, electricity utility businesses 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.

PV support measures:

Feed-in tariff	an explicit monetary reward is provided for producing PV electricity; paid (usually by the electricity utility business) at a rate per kWh that may be higher or lower 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 business, usually at a premium price
PV-specific green electricity schemes	allows customers to purchase green electricity based on PV electricity from the electricity utility business, usually at a premium price
Renewable portfolio standards (RPS)	a mandated requirement that the electricity utility business (often the electricity retailer) source a portion of their electricity supplies from renewable energies
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

Compensation schemes (self-consumption, net-metering, net-billing…)	These schemes allow consumers to reduce their electricity bill thanks to PV production valuation. The schemes must be detailed in order to better understand if we are facing self-consumption schemes (electricity consumed in real-time is not accounted and not invoiced) or net-billing schemes (the electricity taken from the grid and the electricity fed into the grid are tracked separately, and the electricity account is reconciled over a billing cycle). The compensation for both the electricity self-consumed and injected into the grid should be detailed. Net-metering schemes are specific since they allows PV customers to incur a zero charge when their electricity consumption is exactly balanced by their PV generation, while being charged the applicable retail tariff when their consumption exceeds generation and receiving some remuneration for excess electricity exported to the grid
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
Activities of electricity utility businesses	includes 'green power' schemes allowing customers to purchase green electricity, operation of large-scale (utility-scale) 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