IEA INTERNATIONAL ENERGY AGENCY

National Survey Report of PV Power Applications in Switzerland 2014

PVPS

PHOTOVOLTAIC POWER SYSTEMS PROGRAMME

Prepared by

Pius Hüsser, Nova Energie GmbH, Aarau

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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 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

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 2014. 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 2014 statistics if the PV modules were installed and connected to the grid between 1 January and 31 December 2014, although commissioning may have taken place at a later date**.

1.1 Applications for Photovoltaics

The PV market in Switzerland is still relatively strong, albeit a small reduction in installed capacity from 320 MW in 2013 to 305 MW in 2014.

This has been caused by an almost 20% decrease y/y of the feed in tariff scheme. However, with the introduction of direct subsidies for systems smaller than 30kWp (DC) starting in April 2014, the market for this segment increased substantially. This was also due to the fact that there is no waiting list and no cap for direct subsidies, while for the feed in tariff scheme for system sizes > 30 kWp the waiting list grew even faster. Another driver for the PV market was also set into force: Self consumption is explicitly allowed by law, also starting in 2014, independent of the size of the installation.

This will also help in the future, especially for residential and SME systems.

1.2 Total photovoltaic power installed

In 2014 305 MW (DC) have been installed in Switzerland. This is 5% less compared to the previous year but still on a remarkably high level of almost 40 W per capita.

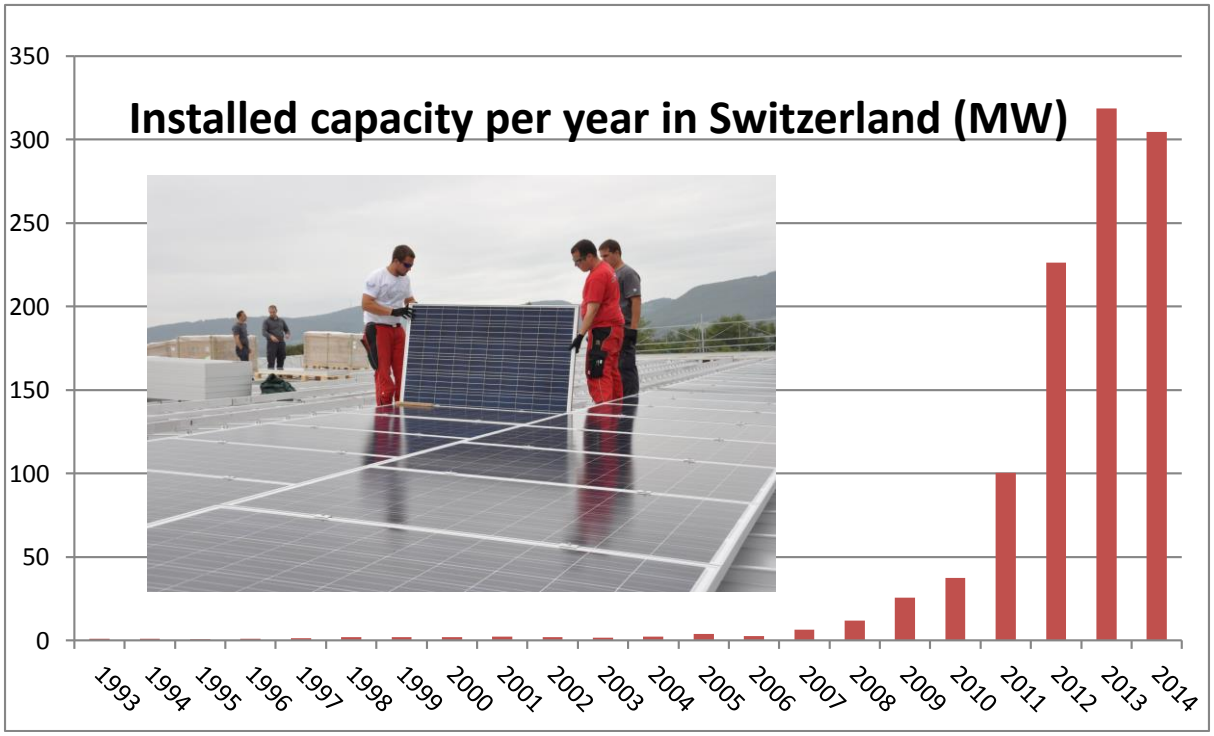

Table 1: PV power installed during calendar year 2014

AC			MW installed in 2014(mandatory)	AC or DC
Grid-connected	BAPV	Approx. 76%*	304.5	DC
	BIPV	Approx. 24%*		
	Ground-mounted	Less than 0,2%*		
Off-grid	Residential		0,5	DC
	Other			
	Hybrid systems			
Total			**305**	

*Best estimate based on FiT registered installations until 2014

BIPV may have a market share of above 20%, due to a premium feed in tariff for these types of installations. Ground mounted systems are almost non-existent, besides some very small plants in the residential areas.

Table 2: Data collection process:

Data are collected in DC	
• The data collection process is done by Swissolar on behalf of the Swiss government. • It is based on a questionnaire sent to all importers, installers and manufacturers. It is estimated, that about 85% of the market is covered with this survey. • To validate the data, there is a compulsory registration for systems above 30 kVA since the beginning of 2013 (Guarantees of origin and electricity labelling). Unfortunately, not all PV systems have been registered up to now. • The report has been published by the Swiss Federal Office of Energy in June 2015 and also serves as a base for the annual renewable energy statistics.	 Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation UVEK Bundesamt für Energie BFE Juni 2015 Markterhebung Sonnenenergie 2014 Teilstatistik der Schweizerischen Statistik der erneuerbaren Energien Ausgearbeitet durch SWISSOLAR Schweizerischer Fachverband für Sonnenenergie

Link to the Swiss Federal Office of Energy www.bfe.admin.ch Electricity Statistics 2014 (DE/FR): http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_903543026.pdf Overall Energy Statistics 2014: http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_208577679.pdf	
The quality and accuracy of the data is expected to be around +- 10%.	

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

MW-GW for capacities and GWh-TWh for energy	2014 Numbers	2013 Numbers
Total power generation capacities (all technologies)	Approx. *19,1 GW*	Approx. 18,7 GW
Total power generation capacities (renewables including hydropower)	Approx. 15,1 MW	Approx. 14,7 GW
Total electricity demand (= consumption)	57,5 TWh	59,3 TWh
New power generation capacities installed during the year (all technologies)	Approx. *0,4 GW RES* *a very few Co-Generation plants*	0,4 GW
New power generation capacities installed during the year (renewables including hydropower)	Approx. *0,4 GW*	0,4 GW
Total PV electricity production in GWh-TWh	Approx. 850 GWh	544 GWh
Total PV electricity production as a % of total electricity consumption	1,5%	0.9 %

Table 4: Other information

	2014 Numbers
Number of PV systems in operation in Switzerland	**Approx. 40 000** **Split in market segments see below**
Capacity of decommissioned PV systems during the year in MW	0
Total capacity connected to the low voltage distribution grid in MW	Approx. 95% Normally up to 1 MVA can be connected to the low voltage grid
Total capacity connected to the medium voltage distribution grid in MW	Approx. 5%
Total capacity connected to the high voltage transmission grid in MW	0%

Table 4a: PV systems - market segmentation (numbers)*

Type of system	2014 Newly added	2014 Cumulated
single family homes:	**5 136**	**21 706**
apartment buildings:	**817**	**3 332**
Industrial buildings	**768**	**6 253**
Farm houses	**987**	**5 297**
Commercial buildings	**168**	**633**
Municipal & state owned buildings	**280**	**2 225**
Traffic infrastructure and buildings	**23**	**83**
others:	**2**	**227**
Total:	**8 181**	**39 946**

*Market Survey Solar Power 2014, June 2015, Swiss Federal Office of Energy

Table 5: The cumulative installed PV power

	Cumulative installed capacity as of 31 December 2014 (kW)																						
Sub-market	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Stand-alone domestic	1 540	1 675	1 780	1 940	2 030	2 140	2 210	2 300*	2 390*	2 480*	2 570*	2 740*	2 810*	2 930*	3 050*	3 200*	3 800	4 000	4 100	4 200	4 MW	4 MW	4 MW
Stand-alone non-domestic	70	100	112	143	162	184	190	200*	210*	220*	230*	260*	290*	320*	350*	400*							
Grid-connected distributed	2200	2900	3 600	4 050	4 850	5 950	7 630	9 420	11 220	13 340	15 140	16 440	18 440	21 240	23 740	30 040	41 540	67 040	104 140	206 700	433 MW	752MW	1 057 MW
Grid-connected centralised	900	1 100	1 200	1 350	1 350	1 450	1 470	1 480	1 480	1 560	1 560	1 560	1 560	2 560	2 560	2 560	2 560	2 560	2 560				
TOTAL (kW)	4 710	5 775	6 692	7 483	8 392	9 724	11 500	13 400	15 300	17 600	19 500	21 000	23 100	27 050	29 700	36 200	47 900	73 600	110 900	211 100	437 MW	756 MW	1 061 MW

- Swiss PV market decreased by 5% in 2014 to about 305 MW newly installed capacity (37 W/capita). This was due to another reduction of Feed in Tariffs (FiT) by approx. 20% during 2014. However, thanks to this reduction, the Swiss Federal Office of Energy could increase the yearly cap for PV to > 100 MWp.
- A new market was created by a federal direct subsidy scheme for system sizes below 30 kW (DC). Since there is no cap for the time being, there was a run from those waiting for positive notification for the FiT scheme to switch to the direct subsidy scheme, rather than wait for another 3-6 years for the FiT.
- Besides the (capped) national FiT scheme, there are still many regional, local and utility support schemes either with direct subsidies or FiTs equal to or below those of the federal level.

2 COMPETITIVENESS OF PV ELECTRICITY

2.1 Module prices

Table 6: Typical module prices for a number of years

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Standard module price for small systems in the range of 3 to 10 kWp	4.30	4.80	5.20	5.00	5.00	3.80	3.60	2.50	1.30*	1.00*	0.95**
Best price, large systems (> 100 kWp)	4.10	4.60	5.00	4.80	4.80	3.30	2.20	1.30	0.85*	0.80*	0.57**

*Source: Large Scale Photovoltaic Plants in Switzerland, Sector Structure and Price Development

Ernst Basler + Partner AG, May 2014

** Estimation based on several offerings for small and large systems in 2014

2.2 System prices

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	Holiday houses, traffic control and many other applications	6.00 to 15.00
OFF-GRID >1 kW	Alpine huts, alpine dairies Maximum size for large alpine huts in the range of 10 to 20 kW	4.00 to 12.00
Grid-connected Rooftop up to 10 kW (residential)	Roof mounted (attached)	2.50 to 4.50*
Grid-connected Rooftop from 10 to 250 kW (commercial)	Roof mounted (BIPV)	2.00 to 3.00*
Grid-connected Rooftop above 250kW (industrial)	Industry or public buildings (attached)	1.90*
Grid-connected Ground-mounted above 1 MW	No market in Switzerland	n/a
Hybrid systems	Hybrid system with hybrid modules (PV and solar thermal).	n/a (Pilot stage)

* Estimation based on several offerings for small and large systems in 2014

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

YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
10-20 kW	13.00	13.00	12.50	11.80	11.00	10.40	10.20	10.10	9.90	9.40	9.20	8.40	7.50	8.5	9.00	9.10	8.70	7.25	6.50	4.5	3.50	3.25	2.50 - 3.50
3-4 kW	13.40	13.30	13.20	12.80	12.60	12.30	12.30	11.90	12.50	12.20	11.00	9.25	9.10	10.00	10.0	9.65	9.80	8.80	7.00	6.50	5.00	4.50	4.00 - 5.00

The standard size for single family houses, for many years in the range of 2 to 4 kW, increased considerably in the last few years to a range of 5 to 10 kW. The specific costs for systems of 3 kW or less thus remained comparatively high due to fixed costs, such as administration (grid connection), security issues while working on a roof, etc.

2.3 Cost breakdown of PV installations (optional)

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	0.95	0.70	1.20
Inverter	0.30 - 0.50		
Other (racking, wiring…)	0.20 – 0.60		
Soft costs			
Installation	0.50 – 1.00		
Customer Acquisition	5% to 10% of overall costs		
Profit	5% to 10% of overall costs		
Other (permitting, contracting, financing…)	n/a (very small)		
Subtotal Hardware	1.50	2.00	2.50
Subtotal Soft costs	0.70	1.00	1.50
Total	2.20	3.00	4.00

These numbers are a rough estimate of the cost breakdown. Since installers make different calculations, some try to obtain a high margin on modules and inverters but offer the installation work for a very low price and vice versa.

2.3.2 Utility-scale PV systems > 1 MW

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

Cost Category	Average (Percentage of overall costs, 2013/2014)
Hardware	
Module	46
Inverter	10
Other (racking, wiring, etc.)	15
Soft cost	
Installation Labor	21
Customer acquisition, Profit, Other	8
Subtotal Hardware	56
Subtotal - Soft cost	44
Total Installed Cost	100

*Source: Large Scale Photovoltaic Plants in Switzerland, Sector Structure and Price Development

Ernst Basler + Partner AG, May 2014

2.4 Financial Parameters and programs

Table 11: PV financing scheme

Type of system	Average Cost of capital (Interest rate)
Residential systems are mainly financed by increasing the mortgage	1% - 2.0 %
PV on commercial buildings owned and operated by the building owners also obtain low interest mortgages	1% - 3.0 %
Third party investors on rented roofs have to pay higher interest rates, depending also on the bankability of the project and the credibility of the investor	2% - 6%

2.5 Additional Country information

Table 12: Country information

	2014	2013	2012
Retail Electricity Prices for household, commercial company and industrial company Swiss Average	n/a	0.1685/kWh	0.1670/kWh
Average consumption per capita (kWh/a)	Approx. 7 055	7 333	7 375
Population (average)	Approx. 8,15 Mio	8,089 Mio	7,997 Mio
Country size (km^2)	41 285 km2		
Average PV yield in kWh/kWp	995	975	950
Name and market share of major electric utilities.	Approx. 700 utilities, mostly DSOs, from very small (< 100 customers) to municipality owned utilities, such as ewz (City of Zurich) with their own hydro production and serving > 200 000 customers.		

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

Table 13: PV support measures (summary table)

	On-going measures	Measures that commenced during 2014
Feed-in tariffs (gross & net) on the federal level	Yes, but with cap, huge waiting list	Self-consumption
Capital subsidies for equipment or total cost		Since April 1st 2014, No cap Max 30kWp DC
Green electricity schemes	Some utilities	
PV-specific green electricity schemes	A lot of the DSOs offer green electricity schemes including a share of PV	
Renewable portfolio standards (RPS)		
PV requirement in RPS		
Investment funds for PV		
Income tax credits	Yes, especially for residential systems	
Prosumers' incentives (self-consumption, net-metering, net-billing…)		Self-consumption since 1.1.2014
Commercial bank activities e.g. green mortgages promoting PV	some	
Activities of electricity utility businesses	Some utilities engage in installation and distribution of PV	
Sustainable building requirements	Green Building Codes require PV	

3.2 Direct Support measures

3.2.1 Support measures exiting in 2014

3.2.1.1 Description of support measures excluding prosumers, BIPV, and rural electrification

In April 2014 a new direct subsidy scheme on a federal level has been introduced. Systems eligible for subsidies range from 2 to 30 kWp DC. There is no waiting list and the procedure is very simple for application and registration.

The FiT scheme for all renewables still has strong support from the Swiss parliament and administration. Although there is a cap, it has a strong influence on the PV market.
A lot of installations are built in hopes that within a couple of years they will profit from the FiT scheme.

3.2.1.2 Prosumers' development measures

Self-consumption is allowed for all installations since January 2014. Together with the new direct subsidy scheme and tax incentives, small installations on residential or commercial buildings can be profitable if the share of self-consumption is moderately high.

3.2.1.3 BIPV development measures

The FiT scheme has an extra category for BIPV systems with a tariff slightly higher than for "normal" roof mounted systems (BAPV).

3.2.1.4 Rural electrification measures

There are more or less no rural, inhabited areas which are not connected to the grid.

3.2.1.5 Other measures including decentralized storage and demand response measures

Some utilities have started deploying smart meters at the customer's site. This is a prerequisite for local storage management and demand site management.

3.2.2 Support measures phased out in 2014

Since 2014, systems below 10 kWp can't apply for the Fit scheme anymore. Instead, they receive direct subsidies and the possibility of self-consumption.

3.2.3 New support measures implemented in 2014

The officially legalized self-consumption since the beginning of 2014 is considered as a very strong driver for PV installations in the future.

3.2.4 Measures currently discussed but not implemented yet

The Swiss parliament is discussing the support schemes (FiT and direct subsidies) for renewable electricity and energy efficiency. The levy per kWh shall be increased from a maximum of 1,5 CHFcents per kWh to 2,3 CHFcents per kWh.

3.2.5 Financing and cost of support measures

The main support schemes for PV are financed by a levy per kWh on consumed electricity. There is only an exemption for very large consumers (industry).

Some cantons finance their support schemes through taxes, partly also from a federal CO2-tax programme where all the cantons obtain a certain share of the CO2-levy.

3.3 Indirect policy issues

A new building code for new buildings which requires that a certain amount of electricity must be produced on-site is in preparation for the coming years. Since PV is the most suitable technology to fulfil this requirement, this building code will become a very strong driver for PV.

4 HIGHLIGHTS OF R&D

4.1 Highlights of R&D

Excerpt from the IEA PVPS Annual Report 2014, see also www.iea-pvps.org

In 2014, more than 70 projects, supported by various national and regional government agencies, the European Commission and the private sector, were conducted in the different areas of the photovoltaic energy system. Innovative solutions, cost reduction, increased efficiency and reliability, industrial viability and transfer as well as adequate market orientation are the main objectives of the technical R&D. For solar cells, the previous strong focus on thin film solar cells is diversifying with projects in a wider variety of materials Public budgets for market stimulation, demonstration / field test programmes and R&D. For solar cells, the previous strong focus on thin film solar cells is diversifying with projects in a wider variety of materials (crystalline silicon, amorphous and microcrystalline silicon, compound semiconductors, dye-sensitised, perovskite and organic solar cells).

Work at the Swiss Federal Institute of Technology (EPFL) in Neuchâtel continued on thin film micromorphous solar cells and increased on advanced structures for high-efficiency crystalline silicon solar cells. Further progress is being achieved in the area of high-efficiency heterojunction silicon solar cells, reaching efficiencies up to 22,4 %. On the more fundamental R&D side, a new project on high-efficiency tandem configurations involving perovskite solar cells started in 2014. At the other end, industry co-operation was extended with various companies. The CSEM (Centre Suisse d'électronique et microtechnique), a close partner of the PV-Lab at EPFL, further developed its new photovoltaic technology centre in Neuchâtel. The mission of this PV technologies to the industry by an increased collaboration and a dedicated infrastructure.

Table 14: Public budgets for R&D, demonstration/field test programmes and market incentives.

	R & D	Demo/Field test
National/federal	n/a	FiT 104 Mio CHF
State/regional	n/	Approx. >5 Mio CHF market incentives
Total	>110 Mio CHF	

5 INDUSTRY

5.1 Production of feedstocks, ingots and wafers

There is no longer any feedstock, ingots and wafer production in Switzerland.

Swiss Wafers went bankrupt in mid-2013.

Table 15: Production information for the year for silicon feedstock, ingot and wafer producers

Manufacturers (or total national production)	Process & technology	Total Production	Product destination (if known)	Price (if known)
None	Silicon feedstock	tonnes		

5.2 Production of photovoltaic cells and modules (including TF and CPV)

Table 16: Production and production capacity information for 2014

Cell/Module manufacturer (or total national production)	Technology (sc-Si, mc-Si, a-Si, CdTe)	Total Production (MW)		Maximum production capacity (MW/yr)	
		Cell	Module	Cell	Module
Wafer-based PV manufactures					
Sunage	sc-Si, mc-Si	-	25	-	na
Meyer Burger	sc-Si, mc-Si	-	10	-	na
Megasol	sc-Si, mc-Si	-	3	-	na
Others	Na		2	-	na
TOTALS		**-**	**40**	**-**	**na**

a) There is no cell production in Switzerland, except for pilot lines for new technologies such as SmartWire Connection Technologie SWCT (Meyer Burger) or CIGS (Flisom).

b) Except for Sunage (19 MW export), there is only a marginal export of Swiss modules to other countries.

c) Swiss manufacturers are specialized in BIPV products. This is supported by enhanced support schemes for BIPV installations. Besides this, there is also a pilot production of hybrid collectors (PV and solar thermal).

Picture 1 Hybrid collector Meyer Burger

5.3 Manufacturers and suppliers of other components

Switzerland has a strong industry for BOS-components. Among them are the following companies:

Inverters:
Studer electronics manufactures inverters for stand-alone and storage solutions.

Sputnik Engineering was one of the world's leading manufacturers of inverters for grid connection applications. **They went into bankruptcy in November 2014.**

Junction Boxes/connectors:
Multi Contact AG is the leading manufacturer of junction boxes, cables and connectors. They claim to have a market share of 50% with module connectors.

Cables:
Huber & Suhner has a variety of dedicated PV cables for more than 20 years.

Supporting structures:
montavent offers mounting systems for profiled metal and corrugated roofs.
ALUSTAND has mounting structures for tilted and flat roofs.

Storage batteries:
Leclanché develops and produces energy storage systems with large format lithium-ion cells, amongst other products.

6 PV IN THE ECONOMY

6.1 Labour places

Table 17: Estimated PV-related labour places in 2014

Research and development (not including companies)	200
Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D	4300*
Distributors of PV products	
System and installation companies	
Electricity utility businesses and government	300
Other	1000*
Total	5800

*Based on the value of business in table 18

6.2 Business value

2014 the business value of PV installations exceeded the business value of the equipment & components manufacturers considerably.

Table 18: Business value of PV

Sub-market	**Capacity installed *in 2014* (MW)**	**Price per W(CHF)** *(from table 7)*	**Value (MIO CHF)**	**Totals (MIO CHF)**
Grid-connected	**305**	**2.10**	*640*	*640*
Export of PV products (Inverters, manufacturing equipment etc.)				*414*
Change in stocks held				*0*
Import of PV products (Modules, Inverters etc.)				*230*
Business value of PV				***824***

7 INTEREST FROM ELECTRICITY STAKEHOLDERS

7.1 Structure of the electricity system

About 700 utilities operate in Switzerland. Most of them serve only one village or town (DSO, Distribution System Operators) and are mostly publicly owned or organized as a cooperative of the customers.

For PV, there is only one regulation on the national level which defines how much a utility has to pay for solar electricity as a minimum. A lot of utilities pay a premium which is normally below the national FiT but still helps their local producer to cover at least a part of the production costs.

7.2 Interest from electricity utility businesses

Many DSOs start to develop new support schemes for prosumers within their servicing area.

Besides this, they begin to build their own PV installations in order to sell the solar production within the national grid scheme; but also more and more for specific electricity products with a high share of PV, besides other renewables.

Within the FiT scheme, utilities take a considerable share of the FiT revenues from PV production.

Since 2014 some (bigger) utilities have large stakes in installer companies or are even taking them over.

7.3 Interest from municipalities and local governments

There is great interest by municipalities in Switzerland. For new buildings, such as schools, it becomes a quasi-standard to build a PV system on the roof.

Besides this, municipalities are purchasing increasingly solar electricity within the framework of switching to 100% renewable electricity for community needs.

Some towns were the first to have a so called “Solarkataster,” a web-based map where house owners could check how much PV could be installed on their roof and how much electricity production can be expected.

8 STANDARDS AND CODES

The main regulations for electrical installations has been revised and set into force, as of the beginning of 2015.

PV is included in this regulation ((NIN) Low Voltage Installations Norm).

9 HIGHLIGHTS AND PROSPECTS

In 2014, Swiss PV installations reached more than 1 GW. Thus, it is expected that PV is going to be the second largest source of renewable energy in 2015 in Switzerland (after hydro power which has a share of about 56%).

The future looks very bright since PV is considered to reach a quite remarkable share of possibly over 20% of the electricity demand.

The Swiss professional solar association (Swissolar) expects to reach a market share of more than 5% until 2020.

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 CHF

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