National Survey Report of PV Power Applications in ITALY 2013

PVPS

PHOTOVOLTAIC POWER SYSTEMS PROGRAMME

Prepared by

Salvatore Castello (ENEA), Francesca Tilli (GSE), Salvatore Guastella (RSE)

IEA PVPS TASK 1

National Survey Report of PV Power Applications in ITALY - 2013

30 June 2014

AUTHORS

Mrs. Francesca Tilli francesca.tilli@gse.it

She works at GSE (Gestore dei Servizi Energetici, www.gse.it), the state-owned company which promotes and supports renewable energy sources (RES) in Italy. In particular, GSE fosters sustainable development by providing support for renewable electricity (RES-E) generation and by taking actions to build awareness of environmentally-efficient energy uses.

She is member of IEA PVPS Task1 and Task13.

Mr. Salvatore Castello salvatore.castello@enea.it

He works at ENEA (Agenzia nazionale per le nuove tecnologie l'energia e lo sviluppo economico sostenibile, www.enea.it) the Italian Agency for New Technology, Energy and the Environment.

He is member of IEA PVPS ExCo and Task1.

Mr. Salvatore Guastella salvatore.guastella@rse-web.it

He works at RSE (Ricerca sul settore energetico, www.-rse-web.it) a joint stock company (the unique shareholder is GSE), which develops research in electro-energy, with particular focus to the strategic national projects of general public interest, financed by the Italian Electricity System Research Fund (Fondo per la Ricerca di Sistema) of the Italian Economic Development Ministry.

He is member of IEA PVPS ExCo and Task1.

TABLE OF CONTENTS

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 24 participating countries are Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), China (CHN), Denmark (DNK), France (FRA), Germany (DEU), Israel (ISR), Italy (ITA), Japan (JPN), Korea (KOR), Malaysia (MYS), Mexico (MEX), the Netherlands (NLD), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), Thailand (THA), Turkey (TUR), the United Kingdom (GBR) and the United States of America (USA). The European Commission (EC), the European Photovoltaic Industry Association (EPIA), the US Solar Electric Power Association (SEPA), the US Solar Energy Industries Association (SEIA) and the Copper Alliance are also members.

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 2013. 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 2013 statistics if the PV modules were installed and connected to the grid between 1 January and 31 December 2013, although commissioning may have taken place at a later date**.

1.1 Applications for Photovoltaics

The "Conto Energia" Programme has represented, since 2005, the sustained approach to the stimulation of the Italian photovoltaic market. The Programme has been articulated in five phases and the last one has been officially concluded in June 2013, when the annual budget limit for incentive tariffs of 6.700 M€ per year has been reached.

The overall Programme "Conto Energia" resulted in the installation of grid-connected photovoltaic plants for 17.628 MWp, while its most significant sectors of PV applications regards:

- BIPV 2.570 MW
- BAPV 6.556 MW
- PV (other, on ground) 8.475 MW
- CPV 27 MW

Moreover, during the year 2013 additional 430 MW PV plants have been installed without the Conto Energia tariffs, while further 790 MW already admitted to the Conto Energia incentive could be installed and put in operation by May 2014.

As far as the off-grid application sector, it remains marginal continuing to grow slowly without incentives. It is represented primarily by the non-domestic applications that reached in 2013 about 12 MW, due to the domestic applications (mainly built in the 80s) resulted almost completely decommissioned

1.2 Total photovoltaic power installed

Data of grid connected PV plants realised in the framework of the Conto Energia programme have been obtained by means of official publication of the Manager of Energy Services (GSE), which manages the "Conto Energia" Programme. Such data are collected through plant data sheet provided to GSE by each owner in order to be eligible for the incentive tariff. These data have been controlled by GSE during documentary and on-field verifications.

The data of plants installed outside of the "Conto Energia" programme have been collected among PV operators.

At the end of the year 2013, **590.500 PV plants**, corresponding to a **cumulative installed PV power of 18.070 MW**, have been cumulatively installed in Italy, with an **increase of around 10 %** as respect to the previous year.

The PV power installed in Italy during the year 2013 is subdivided as shown in table 1.

Table 1: PV power installed during calendar year 2013

			MW installed in 2013 (mandatory)	MW installed in 2013 (optional)	AC or DC
Grid-connected	BAPV (1)	Residential	598,20		
		Commercial			DC
		Industrial			
	BIPV (2) (if a specific legislation exists)	Residential	241,50		
		Commercial			DC
		Industrial			
	Ground-mounted	cSi and TF	779,00	763,0	DC
		CPV		16,0	DC
	on-grid distributed	(<=200 kW)		920,51	DC
	on-grid centralised	(> 200 kW)		698,19	DC
Off-grid		Residential Other Hybrid systems	1,00		DC
		Total	1.619,70		DC

(1) BAPV (Building-Applied PhotoVoltaics) refers to PV installations that are a retrofit - integrated into the building after its construction.

(2) BIPV (Building-Integrated PhotoVoltaics) refers to PV materials that are used to replace conventional building materials such as the roof, skylights, or facades.

Table 2: Data collection process:

If data are reported in AC, please mention a conversion coefficient to estimate DC installations.	The data refer to the sum of PV module nominal power
Is the collection process done by an official body or a private company/Association?	Public bodies: GSE and Terna
Link to official statistics (if this exists)	*www.gse.it* *www.terna.it*
Additional comments on market and data collection, especially the estimated accuracy of data.	The following data collected by authors also through direct interviews of Italian PV operators: 1. module and cell production data (obtained from the industrial operators and national publications): uncertainty around 15% 2. prices of PV systems and components (declared by the installers of the plant after plant construction) Uncertainty of data is around 10% 3. quantity of imported modules and inverter installed in 2013 (obtained from the industrial operators): uncertainty is 15%, 4. PV plant numbers and power (data of "Conto energia" plants supplied by GSE, data of other plants collected among PV operators): uncertainty is 2%.

Table 3: PV power and the broader national energy market

MW-GW for capacities and GWh-TWh for energy	2013 numbers	2012 numbers
Total power generation capacities (all technologies)	126.400 MW	125.000 MW
Total power generation capacities (renewables including hydropower)	49.500MW	47.050 MW
Total electricity demand (= consumption)	317.144 MWh	328.220 MWh
New power generation capacities installed during the year (all technologies)	- 1.610 MW	
New power generation capacities installed during the year (renewables including hydropower)	2.200 MW	
Total PV electricity production in GWh-TWh	21.600 MWh	18.631 MWh
Total PV electricity production as a % of total electricity consumption	7 %	5,6 %

Table 4: Other informations

	2013 Numbers (optional)
Number of PV systems in operation in your country (a split per market segment is interesting)	590.500 total only “Conto Energia” PV plants : 577.509 up to 200 kW 12.991 greater than 200 kW
Capacity of decommissioned PV systems during the year in MW	0
Total capacity connected to the low voltage distribution grid in MW	N/A
Total capacity connected to the medium voltage distribution grid in MW	N/A
Total capacity connected to the high voltage transmission grid in MW	N/A

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

1992 - 2004													
Sub-market	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Stand-alone domestic	3.950	4.350	4.700	4.830	4.962	5.052	5.210	5.220	5.240	5.300	5.300	5.300	5.300
Stand-alone non-domestic	3.750	4.150	4.650	4.780	4.792	4.814	5.100	5.640	5.890	6.350	6.365	6.400	6.700
Grid-connected distributed <=200 kW	100	100	150	335	404	677	780	905	1.155	1.635	3.620	7.600	12.000
Grid-connected centralized >200 kW	680	3.480	4.590	5.850	5.850	6.166	6.590	6.715	6.715	6.715	6.715	6.700	6.700
TOTAL (MW)	80.480	12.080	14.090	15.795	16.008	16.709	17.680	18.480	19.000	20.000	22.000	26.000	30.700

2005 - 2013									
Sub-market	2005	2006	2007	2008	2009	2010	2011	2012	2013
Stand-alone domestic	5.300	5.300	5.400	5.400	5.000	4.000	-	-	-
Stand-alone non-domestic	7.000	7.500	7.700	7.900	8.000	9.000	10.000	11.000	12.000
Grid-connected distributed <=200 kW	18.500	30.500	83.900	295.000	656.800	1.532.600	4.208.700	6.040.300	6.960.810
Grid-connected centralized >200 kW	6.700	6.700	23.200	150.000	511.500	1.956.710	8.584.210	10.399.000	11.097.190
TOTAL (MW)	37.500	50.000	120.200	458.300	1.181.300	3.502.310	12.802.910	16.450.300	18.070.000

2 COMPETITIVENESS OF PV ELECTRICITY

2.1 Module prices

In Table 6 are shown the module prices (excluding VAT/TVA/sales tax) and the best prices achieved. In particular, the typical prices derive from an average of price during the year. The best price are the lowest ones and regard import products at the end of 2013 (for Crystalline silicon modules from China).

Table 6: Typical module prices for a number of years

Year	1992		2009	2010	2011	2012	2013
Standard module price(s), Euro: Typical			2,2	1,5	1,0	0,7	0,65 (*)
Best price, Euro			1,6	1,2	0,7	0,5	0,50 (**)
PV module price for concentration (if relevant)							

(*) Crystalline silicon modules

(**) Imported crystalline silicon modules

2.2 System prices

Table 7 gives turnkey prices per W (excluding VAT/TVA/sales tax) for the various categories of PV plant installation. Prices do not include recurring charges after installation such as battery replacement or operation and maintenance. Additional costs incurred due to the remoteness of the site or special installation requirements have not been included. The prices reported indicate a range of all known prices.

Additional information regarding national trends in the turnkey prices of selected applications is reported in Table 8.

Table 7: Turnkey Prices of Typical Applications

Category/Size	Typical applications and brief details	Euro per W
OFF-GRID Up to 1 kW	Street light	3 - 5
OFF-GRID >1 kW		
Grid-connected Rooftop up to 10 kW (residential)	3-5 kW roof-mounted system	2,0 – 2,4
Grid-connected Rooftop from 10 to 250 kW (commercial)	100 kW on commercial building	1,2 - 2,0
Grid-connected Rooftop above 250kW (industrial)		
Grid-connected Ground-mounted above 1 MW	1 MW on ground	1 – 1,4
Other category existing in your country (hybrid diesel-PV, hybrid with battery…)		

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

Price/Wp	1992			2011	2012	2013
Residential PV systems < 10 KW				3,2	2,4	2,2
Commercial and industrial				2.75	2	1,6
Ground-mounted				2,25	1,3	1,2

2.3 Financial Parameters and programs (leasing…)

A brief description of a PV financing scheme currently operating in Italy is given in in Table 9.

Table 9: PV financing scheme

Average Cost of capital	TAN 6.75%
Specific PV financing scheme for Residential or commercial application up to 20 kW	The amounts paid range from a low of 5,000 to a maximum of € 70,000, for the coverage of the total cost of purchase and installation, including VAT. The rate is fixed type (TAN 6.75%) and the duration of the loan ranges from 36 months to 180 month.

2.4 Additional Country information

Table 10: Country information

Retail Electricity Prices for an household (range) , VAT included	16 ÷ 20 c€/kWh
Retail Electricity Prices for a commercial company, VAT included (range)	16 ÷ 18 c€/kWh
Retail Electricity Prices for an industrial company, VAT included (range)	13 ÷ 15 c€/kWh *Rel 2014 AEEG*
Population at the end of 2013 (or latest known)	59.685.000
Country size (km^2)	301.336
Average PV yield (according to the current PV development in the country) in kWh/kWp	North 1000 ÷ 1200 kWh / kWp South 1300 ÷ 1500 kWh / kWp
Name and market share of major electric utilities (as regards to electrical energy sold)	Enel 89,9 TWh 35 % Edison 18,7 TWh 7 % Eni 10,4 TWh 4 % Acea 9,9 TWh 4 % Others 128,6 TWh 50 %

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 11: PV support measures (summary table)

	On-going measures	Measures that commenced during 2013
Feed-in tariffs (gross / net?)		
Capital subsidies for equipment or total cost		
Green electricity schemes	2 - 9 c€/kWh	
PV-specific green electricity schemes		
Renewable portfolio standards (RPS)		
PV requirement in RPS		
Investment funds for PV		
Income tax credits	50% of investment cost	
Prosumers' incentives (self-consumption, net-metering, net-billing…)	Up to 200 kW plant size	
Commercial bank activities e.g. green mortgages promoting PV		
Activities of electricity utility businesses		
Sustainable building requirements		

3.2 Direct Support measures

3.2.1 Support measures exiting in 2013

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

None

3.2.1.2 Prosumers' development measures

Self-consumption is allowed in Italy. However, during 2013 have been developed clear rules for the sale, exchange and self-consumption of the produced electricity. In this contest, the Italian Authority for electricity and gas has updated the rules for exchanging energy with the grid for relatively small plants up to 200 kW. Moreover a consultation concerning the regulation of connection services, measurement, transmission, distribution, dispatching and sale aspects has been undergone in the

case of private grid both of single user and with more consumption units and industrial production unit of electrical energy functional for the production process.

In addition has yet to resolve the burden-sharing of the electrical system.

3.2.1.3 BIPV development measures

The "Conto energia" Programme has foreseen special tariffs for BIPV systems with innovative features.

3.2.1.4 Rural electrification measures

None

3.2.1.5 Other measures including decentralized storage and demand response measures

None

3.2.2 Support measures phased out in 2013

The "Conto Energia" Programme has been officially concluded in June 2013 when the annual budget limit for incentive tariffs of 6.700 M€ per year has been reached.

3.2.3 New support measures implemented in 2013

In march 2013, the Italian Agenzia delle Entrate (Inland Revenue) has officially expressed on the applicability of deductions of 50% to the installation of photovoltaic plants up to 20 kW for residential applications and for energy self-consumption, up to a spending limit of 96,000 € for each installation.

3.2.4 Measures currently discussed but not implemented yet

The following measures are currently discussed but are not implemented yet:

- simplification of the authorization procedures for PV plant installation
- tax credit for PV plants greater than 20 kW

3.2.5 Financing and cost of support measures

The cost of incentives to Photovoltaics for the year 2013 amounted to 6.700 billion Euros. This figure is fully borne by the Italian users. On average, every Italian user contributes with 112 Euro spending per year. It seems a disproportionate amount but it should be compared to the benefits of PV generation for the Italian electric system (that, according to someone, can entail 9 billion Euro saved costs due to reduced thermal generation).

3.3 Indirect policy issues

3.3.1 International policies affecting the use of PV Power Systems

Not available

3.3.2 The introduction of any favourable environmental regulations

Not available

3.3.3 Policies relating to externalities of conventional energy

Not available

3.3.4 Taxes on pollution (e.g. carbon tax)

Not available

3.3.5 National policies and programmes to promote the use of PV in foreign non-IEA countries

Not available

4 HIGHLIGHTS OF R&D

4.1 Highlights of R&D

Research, development and demonstration activities on photovoltaic devices and systems are conducted in Italy mainly by ENEA (the Italian Agency for New Technology, Energy and the Environment) and RSE (a research company owned by GSE, the Italian publicly-owned company managing the renewable energy source incentives and regulations). Additional contributions have been supplied by some Universities, CNR (the National Council for Scientific Research) and few private Laboratories.

ENEA is the main PV Research organization operating in Italy. Its most significant fields of interest regard: crystalline silicon, Cu2O solar cells, microcrystalline Si devices, micromorph tandem solar cell as well as concentrators technologies.

RSE is carrying out activities in research and development on high efficiency single and triple junction solar cells (InGaP/InGaAs/Ge) for terrestrial and concentrator applications, in the frame of Italian electric system research programme RdS (Ricerca di Sistema) and in the European projects “APOLLON”, “SOPHIA” and “SUN on CLEAN”. Furthermore, RSE is involved in components’ characterization and performance evaluation of PV innovative systems, as well as in research and demonstration activities for electrification of remote communities, again in the frame of the RdS programme.

It is worth mentioning that public and private budget for research and demonstration initiatives, amounting to about 5 M€, remain flat with respect to the previous years and very small with respect to the budget allocated for promoting tariffs.

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

In Italy, the public budgets for market stimulation, demonstration / field test programmes and R&D in Italy was 6.706 M€ (see Table 12).

Table 12: Public budgets for R&D, demonstration/field test programmes and market incentives.

	R & D	Demo/Field test	Market incentives
National/federal	5,8 M€	0,2 M€	6.700 M€
State/regional			
Total	6.706 M€		

5 INDUSTRY

5.1 Production of feedstocks, ingots and wafers (crystalline silicon industry)

During the year 2013 any production of ingots and wafer occurred in Italy

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

Module manufacturing is defined as the industry where the process of the production of PV modules (the encapsulation) is done. A company may also be involved in the production of ingots, wafers or the processing of cells, in addition to fabricating the modules with frames, junction boxes etc. The manufacturing of modules may only be counted to a country if the encapsulation takes place in that country.
During 2013, the number of module manufacturers in Italy had declined, due to the market reduction, and the production of remaining one had decreased (near 400 MW), even if the production capacity remain almost equal to the year 2012 (about 600 MW).
The presence of Italian module manufactures in PV market is confirmed by the present availability of 23 manufacturers offering modules with still valid quality certification (IEC 61215 and IEC 61730).
In the year 2013 there was no production of cell in Italy.

Table 13: Production and production capacity information for 2013

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
TOTALS (Almost 23)	sc-Si, mc-Si, a-Si		**400**		**600**

5.3 Manufacturers and suppliers of other components

In Italy, 8 companies manufacture inverters for on-grid and off-grid applications. The most important of them are Power One Italy (now ABB), Elettronica Santerno, Aros, Siel, Fimer, Answer Drivers, Gefram and Astrid Energy. During 2013, these companies have produced about 4.500 MW of inverter while their production capacity is around 7.000 MW.

As far as the prices of inverter an average value of 140-180 €/kW has been obtained on a sample of large size apparatus. In the case of small size inverter the typical prices range from 280 €/kW to 320 €/kW.

6 PV IN THE ECONOMY

6.1 Labour Places

In table 14 is given an estimate of labour places in the following :

a) Public research and development (not including private companies);

b) Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D;

c) All other, including within electricity companies, installation companies etc.

Table 14: Estimated PV-related labour places in 2013

Research and development (not including companies)	250
Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D	
Distributors of PV products	
System and installation companies	9.000
Electricity utility businesses and government	750
Other	
Total	10.000

6.2 Business value

Table 15 provide an estimate of the value of PV business in Italy during 2013

Table 15: Value of PV business

Sub-market	**Capacity installed *in 2013* (MW)** *(from table 1)*	**Price per W** *(from table 7)*	**Value [Euro]**	**Totals [Euro]**
Off-grid domestic				
Off-grid non-domestic	**1,00**	**4,0**	**4.000.000**	
Grid-connected distributed (<=200kW)	**920,51**	**2,2**	**2.025.122.000**	
Grid-connected centralized (> 200 kW)	**698,19**	**1,2**	**837.828.000**	
				2.866.950.000
Export of PV products *(3 GW inverter)*				**660.000.000**
Change in stocks held				
Import of PV products *(1,0 GW modules + 0,2 GW cells)*				**- 738.000.000**
Value of PV business				**2.788.950.000**

7 INTEREST FROM ELECTRICITY STAKEHOLDERS

7.1 Structure of the electricity system

Short description of the electricity industry landscape - structure – vertically integrated or separate generation, transmission, distribution; - retailers and network businesses – integrated or separate; - ownership – private – public (state owned or municipal) - Electricity industry regulator?	N/A

7.2 Interest from electricity utility businesses

Not Available

7.3 Interest from municipalities and local governments

Not Available

8 STANDARDS AND CODES

At international level, Italy has actively participated to the works on new and revised standards carried out within both IEC and CENELEC working groups. In this contest, the Technical Secretariat of CENELEC TC 82, is managed by the Italian Electrotechnical Committee (CEI).

The standards, published during 2013 by CEI (Italian Electrotechnical Committee), which can affect the development of PV plants in Italy are the following:

- CEI 0-16 Reference technical rules for the connection of active and passive users to the MV and HV electrical grids
- CEI 0-21 Reference technical rules for the connection of active and passive users to the LV electrical grids

In particular, these standards foresee the use of electrical storage in PV plants connected to the grid, although this is not yet regulated by the Italian Authority for Electricity (AEEG) and, as regards the "Conto Energia" PV plants, by GSE.

9 HIGHLIGHTS AND PROSPECTS

Even if the national market stimulation initiative (Conto Energia Programme) has been extinguished in July 2013 restraining the entire PV market, it is expected that in Italy the PV installations will not be stopped, although considerably reduced.

As highlighted by several PV operators, the development of PV in Italy without incentives could happen by initiatives at no cost for the public finances, like as:

- clear rules for the sale of the produced electricity;
- the simplification of the authorization process for PV installations;
- a major focus on self-consumption of produced energy though electric storage;
- fiscal bonus for PV investment costs as well as for the creation of job opportunities in PV activities.

Regarding to the first point, the Italian Authority for electricity and gas (AEEG) has updated the rules for exchanging energy with the grid for relatively small plants up to 200 kW. Moreover a consultation concerning the regulation of connection services, measurement, transmission, distribution, dispatching and sale aspects has been undergone in the case of private grid both of single user and with more consumption units and industrial production unit of electrical energy functional for the production process.

Besides, it is widely recognized that the simplification of the authorization process and specific measures at no cost for the public finances (i.e., tax credit) accompanied by the good solar radiation values, especially in southern region of Italy, will be able to support the achievement of grid parity. In this contest, in march 2013, the Italian Agenzia delle Entrate (Inland Revenue) has officially expressed on the applicability of deductions of 50% to the installation of photovoltaic plants up to 20 kW for residential applications and for energy self-consumption, up to a spending limit of 96,000 € for each installation.

At the same time, it is expected that the barrier to the diffusion of PV plants represented by the electric grid, which is not adequate in some regions of Italy, should be partly removed by the grid managers and partially solved by the recent Italian regulations which require that PV plants have to provide services to the LV and MV grids in order to improve their management.

DEFINITIONS, SYMBOLS AND ABBREVIATIONS

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

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

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

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

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

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.

Prosumer: Consumer having invested in a decentralized source of electricity generation which provides part of his/her electricity needs (EPIA, EEGI 2013)

Currency: The currency unit used throughout this report is Euro.

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