



**Task 1** Strategic PV Analysis and Outreach

# National Survey Report of PV Power Applications in Italy 2018

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PHOTOVOLTAIC POWER SYSTEMS  
TECHNOLOGY COLLABORATION PROGRAMME

# PVPS

## Cover picture:

Source: GSE, Catalogue of Photovoltaic Plants Integrated with Innovative Characteristics



## WHAT IS IEA PVPS TCP

The International Energy Agency (IEA), founded in 1974, is an autonomous body within the framework of the Organization for Economic Cooperation and Development (OECD). The IEA carries out a comprehensive programme of energy cooperation among its 30 member countries and with the participation of the European Commission. The IEA Photovoltaic Power Systems Programme (IEA PVPS) is one of the collaborative research and development agreements (technology collaboration programmes) within the IEA and was established in 1993. The mission of the programme is to *“enhance the international collaborative efforts which facilitate the role of photovoltaic solar energy as a cornerstone in the transition to sustainable energy systems.”*

In order to achieve this, the Programme’s participants have undertaken a variety of joint research projects in PV power systems applications. The overall programme is headed by an Executive Committee, comprised of one delegate from each country or organisation member, which designates distinct ‘Tasks,’ that may be research projects or activity areas. This report has been prepared under Task 1, which deals with market and industry analysis, strategic research and facilitates the exchange and dissemination of information arising from the overall IEA PVPS Programme.

The IEA PVPS participating countries are Australia, Austria, Belgium, Canada, Chile, China, Denmark, Finland, France, Germany, Israel, Italy, Japan, Korea, Malaysia, Mexico, Morocco, the Netherlands, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, and the United States of America. The European Commission, Solar Power Europe, the Smart Electric Power Alliance (SEPA), the Solar Energy Industries Association and the Copper Alliance are also members.

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## WHAT IS IEA PVPS task 1

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 2018. Information from this document will be used as input to the annual Trends in photovoltaic applications report.

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Data for non-IEA PVPS countries are provided by official contacts or experts in the relevant countries. Data are valid at the date of publication and should be considered as estimates in several countries due to the publication date.



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## 1 INSTALLATION DATA

The PV power systems 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 2018 statistics if the PV modules were installed and connected to the grid between 1 January and 31 December 2018, although commissioning may have taken place at a later date.

### 1.1 Applications for Photovoltaics

Italy in 2018 installed 48.225 photovoltaic plants for a new capacity of 440 MW. The cumulative power at the end of the year is 20.108 MW. Plants commissioned in 2018, mostly in the domestic sector, have an average capacity of 8,8 kW. As a matter of fact, at the end of 2018, around 81% of plants installed in Italy are in the residential sector, almost all under the « Scambio Sul Posto » scheme (the so-called SSP is a net-billing mechanism). With more than 9 GW, most of the total installed capacity is in the industrial sector, which plants are between 200 kW and 1 MW.

The analysis of the new installation in 2018 in the different regions outlines that the best performing regions are those with a high population density. Public administration owns 20.039 PV plants for a capacity of 857 MW (4,3% of the installed capacity in Italy). Around 71% of the Italian municipalities have at least one PV plant owned by the public administration.

Around 98% of PV plants installed in Italy are connected to the low voltage distribution grid; the remaining 2%, consisting of around 20.000 plants are connected to medium voltage grid, representing almost 57% of total existing capacity. Only few installations are connected to the high voltage grid, with a capacity of around 1.256 MW, the 6,4% of the total. PV electricity production reached 22.654 TWh (a decrease of 7% compared to the previous year, due mostly to worse irradiation conditions). Electricity produced by PV and self-consumed amounted to 5,1 TWh in 2018, around 23% of total PV systems production, with an increase compared to 2017.

At the end of 2018, the capacity installed results in a national data of 67 kW per km<sup>2</sup> and the figure of national power per capita is equal to 325 W per inhabitant.

### 1.2 Total photovoltaic power installed

**Table 1: Annual PV power installed during calendar year 2018<sup>(1)</sup>**

		Installed PV capacity in 2018 [MW]	AC or DC
<b>PV capacity</b>	Off-grid		
	Decentralized <sup>(2)</sup>	419,8	DC
	Centralized <sup>(3)</sup>	5,5	DC
	<b>Total</b>	<b>425,3<sup>(4)</sup></b>	DC

<sup>1</sup> Blank box stands for not available data

<sup>2</sup> Any PV installation which is embedded into a customer's premises (self-consumption)

<sup>3</sup> Any PV installation which only injects electricity and is not associated with a consumer (no self-consumption)

<sup>4</sup> The net value indicated in the table is equal to 440 MW – decommissioning ± statistic power update

**Table 2: PV power installed during calendar year 2018<sup>(1)</sup>**

			Installed PV capacity in 2018 [MW]	Installed PV capacity in 2018 [MW]	AC or DC
<b>Grid-connected</b>	BAPV <sup>(2)</sup>	Residential	397,0	172,2	DC
		Commercial		96,2	DC
		Industrial		128,5	DC
	BIPV <sup>(3)</sup>	Residential			
		Commercial			
		Industrial			
	Utility-scale	Ground-mounted	28,3	28,3	DC
		Floating		0	DC
		Agricultural		0	DC
	<b>Off-grid</b>	Residential			
Other					
Hybrid systems					
<b>Total</b>			<b>425,3<sup>(4)</sup></b>		DC

<sup>1</sup> Blank box stands for not available data

<sup>2</sup> Building Applied PhotoVoltaic

<sup>3</sup> Building Integrated PhotoVoltaic

<sup>4</sup> The net value indicated in the table is equal to 440 MW – decommissioning ± statistic power update

**Table 3: Data collection process**

If data are reported in AC, please mention a conversion coefficient to estimate DC installations.	Data refer to the sum of PV nominal power
Is the collection process done by an official body or a private company/Association?	Public bodies: GSE, RSE Association: Elettricità Futura
Link to official statistics	<a href="http://www.gse.it">www.gse.it</a> <a href="http://www.terna.it">www.terna.it</a> <a href="http://www.arera.it">www.arera.it</a>

**Table 4: The cumulative installed PV power in 4 sub-markets<sup>(1)(2)</sup>**

Year	Off-grid <sup>(3)</sup> [MW]	Grid-connected distributed [MW]	Grid-connected centralized [MW]	Total [MW]
1992	7,8	0,1	0,7	8,6
1993	8,6	0,1	3,5	12,2
1994	9,4	0,2	4,6	14,2
1995	9,6	0,3	5,9	15,8
1996	9,8	0,4	5,9	16,1
1997	9,9	0,7	6,2	16,8
1998	10,3	0,8	6,6	17,7
1999	10,8	0,9	6,7	18,4
2000	11,1	1,2	6,7	19,0
2001	11,7	1,6	6,7	20,0
2002	11,7	3,6	6,7	22,0
2003	11,7	7,6	6,7	26,0
2004	12,0	12,0	6,7	30,7
2005	12,3	18,5	6,7	37,5
2006	12,8	30,5	6,7	50,0
2007	13,1	68,7	18,3	100,1
2008	13,3	309,1	173,9	496,3
2009	13,0	682,6	581,4	1277,0
2010	13,0	1.544,6	2.047,5	3.605,1
2011	10,0	4.333,3	8.797,7	13.141,0
2012	11,0	6.042,6	10.742,4	16.796,0
2013	12,0	7.010,0	11.175,5	18.197,5
2014	12,0	7.236,4	11.358,0	18.606,4
2015	14,0	7.493,5	11.407,2	18.914,7
2016 <sup>(4)</sup>	14,0	7.809,9	11.473,2	19.297,2
2017		8.105,5	11.576,7	19.682,3
2018		8.449,1	11.658,5	20.107,6

<sup>1</sup> Blank box stands for not available data

<sup>2</sup> The classification for grid-connected distributed and grid-connected centralized PV plants, applied since 1992, is below or over 200 kW

<sup>3</sup> Best estimate

<sup>4</sup> Grid connected data updated with GSE statistics 2018

**Table 5: Other PV market information<sup>(1)</sup>**

	2018 Numbers
Number of PV systems in operation in your country	822.301
Capacity of decommissioned PV systems during the year [MW]	5
Capacity of repowered PV systems during the year [MW]	
Total capacity connected to the low voltage distribution grid [MW]	7.389,0
Total capacity connected to the medium voltage distribution grid [MW]	11.432,2
Total capacity connected to the high voltage transmission grid [MW]	1.286,4

<sup>1</sup> Blank box stands for not available data

**Table 6: PV power and the broader national energy market**

	2017 numbers	2018 numbers
Total power generation capacities [GW]	117,144	118,117
Total renewable power generation capacities (including hydropower) [GW]	53,259	54,301
Total electricity demand (consumption) [TWh]	320,548	321,431
Total energy demand (final consumption) [TWh]	301,881	303,443
New power generation capacities installed in 2018 [GW]	0,063	0,973
New renewable power generation capacities installed in 2018 (including hydropower) [GW]	0,986	1,042
Total PV electricity production (including self-consumed PV electricity) [TWh]	24,378	22,654
Total PV electricity production as a % of total electricity consumption	8,1%	7,5%



### 1.3 Key enablers of PV development

**Table 7: Information on key enablers<sup>(1)</sup>**

	Description	Annual Volume	Total Volume	Source
Decentralized storage systems				
Residential Heat Pumps				
Electric cars		4.943	12.156	<a href="http://www.aci.it">www.aci.it</a>
Electric buses and trucks		648	4.563	<a href="http://www.aci.it">www.aci.it</a>

<sup>1</sup> Blank box stands for not available data

## 2 COMPETITIVENESS OF PV ELECTRICITY

### 2.1 Module prices

**Table 8: Typical module prices for a number of years<sup>(1)</sup>**

Year	Lowest price of a standard module crystalline silicon [€/W]	Highest price of a standard module crystalline silicon [€/W]	Typical price of a standard module crystalline silicon [€/W]
2009 <sup>(2)</sup>	2,30		2,50
2010 <sup>(2)</sup>	1,50		1,70
2011 <sup>(2)</sup>	1,20		1,50
2012 <sup>(2)</sup>	0,70		0,80
2013 <sup>(2)</sup>	0,50		0,60
2014	0,50	0,80	0,55
2015	0,50	0,75	0,55
2016	0,40	0,65	0,48
2017	0,32	0,56	0,40
2018	0,20	0,48	0,35

<sup>1</sup> Blank box stands for not available data

<sup>2</sup> Statistics updated according to GSE analysis data related to database of plants accessing incentive scheme

## 2.2 System prices

**Table 9: Turnkey PV system prices of different typical PV systems**

Category/Size	Typical applications and brief details	Current prices [€/W]
Residential BAPV 5-10 kW	Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected households. Typically roof-mounted systems on villas and single-family homes	1,20 – 1,60
Small commercial BAPV 10-100 kW	Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected commercial buildings, such as public buildings, multi-family houses, agriculture barns, grocery stores etc.	1,15 – 1,25
Large commercial BAPV 100-250 kW	Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected large commercial buildings, such as public buildings, multi-family houses, agriculture barns, grocery stores etc.	1,10 – 1,15
Industrial BAPV >250 kW	Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected industrial buildings, warehouses, etc.	0,80 – 1,00
Small centralized PV 1-20 MW	Grid-connected, ground-mounted, centralized PV systems that work as central power station. The electricity generated in this type of facility is not tied to a specific customer and the purpose is to produce electricity for sale	0,70 – 0,80
Large centralized PV >20 MW	Grid-connected, ground-mounted, centralized PV systems that work as central power station. The electricity generated in this type of facility is not tied to a specific customer and the purpose is to produce electricity for sale	0,55 – 0,70

**Table 10: National trends in system prices for different applications<sup>(1)</sup>**

Year	Residential BAPV Grid-connected, roof-mounted, distributed PV system 5-10 kW [€/W]	Small commercial BAPV Grid-connected, roof-mounted, distributed PV systems 10-100 kW [€/W]	Large commercial BAPV Grid-connected, roof-mounted, distributed PV systems 100- 250 kW [€/W]	Small centralized PV Grid-connected, ground-mounted, centralized PV systems 10-20 MW [€/W]
2011	3,60		2,70	2,80
2012	2,60		1,80	1,70
2013	2,20		1,40	1,20
2014	1,67		1,40	1,03
2015	1,60		1,32	0,96
2016	1,55		1,22	0,88
2017	1,44		1,10	0,80
2018	1,41	1,20	1,08	0,69

<sup>1</sup> Blank box stands for not available data

## 2.3 Cost breakdown of PV installations

**Table 11: Cost breakdown for a grid-connected roof-mounted, distributed residential PV system of 5-10 kW<sup>(1)</sup>**

Cost category	Average [€/W]	Low [€/W]	High [€/W]
<b>Hardware</b>			
Module	0,45	0,42	0,48
Inverter	0,14	0,13	0,16
Mounting material	0,27	0,22	0,32
Other electronics (cables, etc.)			
<b>Subtotal Hardware</b>	<b>0,86</b>	<b>0,77</b>	<b>0,96</b>
<b>Soft costs</b>			
Planning <sup>(2)</sup>			
Installation work	0,09	0,07	0,10
Shipping and travel expenses to customer	0,03	0,02	0,03
Permits and commissioning <sup>(3)</sup>	0,11	0,09	0,12
Project margin	0,32	0,26	0,37
<b>Subtotal Soft costs</b>	<b>0,55</b>	<b>0,44</b>	<b>0,62</b>
<b>Total (excluding VAT)</b>	<b>1,41</b>	<b>1,21</b>	<b>1,58</b>
Average VAT	10%	10%	10%
<b>Total (including VAT)</b>	<b>1,55</b>	<b>1,33</b>	<b>1,74</b>

<sup>1</sup> GSE specific survey

<sup>2</sup> Planning cost are included in the other soft costs

<sup>3</sup> Including financing

**Table 12: Cost breakdown for a grid-connected, ground-mounted, centralized PV systems of >10 MW<sup>(1)</sup>**

Cost category	Average [€/W]	Low [€/W]	High [€/W]
<b>Hardware</b>			
Module	0,26	0,20	0,33
Inverter	0,06	0,05	0,07
Mounting material	0,12	0,11	0,13
Other electronics (cables, etc.)			
<b>Subtotal Hardware</b>	<b>0,44</b>	<b>0,36</b>	<b>0,53</b>
<b>Soft costs</b>			
Planning <sup>(2)</sup>			
Installation work	0,04	0,03	0,05
Shipping and travel expenses to customer	0,02	0,01	0,02
Permits and commissioning <sup>(3)</sup>	0,03	0,02	0,04
Project margin	0,16	0,14	0,17
<b>Subtotal Soft costs</b>	<b>0,25</b>	<b>0,20</b>	<b>0,28</b>
<b>Total (excluding VAT)</b>	<b>0,69</b>	<b>0,56</b>	<b>0,81</b>
Average VAT	10%	10%	10%
<b>Total (including VAT)</b>	<b>0,76</b>	<b>0,62</b>	<b>0,89</b>

<sup>1</sup> GSE specific survey

<sup>2</sup> Planning cost are included in the other soft costs

<sup>3</sup> Including financing

## 2.4 Financial parameters and specific financing programs

**Table 13: PV financing information in 2018<sup>(1)</sup>**

Different market segments	Loan rate [%]
Average rate of loans – residential installations	3,5 – 5,0
Average rate of loans – commercial installations	2,5 – 3,5
Average cost of capital – industrial and ground-mounted installations	1,6 – 2,0

<sup>1</sup> GSE specific survey

## 2.5 Specific investments programs

Not available.

## 2.6 Additional Country information

**Table 14: Country information**

Retail electricity prices for a household	21,14 <sup>(1)</sup> – 22,57 €cent/kWh			
Retail electricity prices for a commercial company	20-26,34 €cent/kWh <sup>(2)</sup>			
Retail electricity prices for an industrial company	8,02- 16,52 €cent/kWh			
Population at the end of 2018	60.359.546			
Country size [km <sup>2</sup> ]	301.336			
Average PV yield in [kWh/kW]	1.141			
Name and market share of major electric utilities <sup>(3)</sup>	Electric utilities	Share % 2018	Electric utilities	Share % 2017
	<i>Enel</i>	19,4	<i>Enel</i>	19,8
	<i>Eni</i>	9,2	<i>Eni</i>	9,3
	<i>Edison</i>	7,0	<i>Edison</i>	7,3
	<i>A2A</i>	6,2	<i>A2A</i>	6,0
	<i>EPH</i>	4,6	<i>EPH</i>	5,3
	<i>Iren</i>	2,9	<i>Iren</i>	3,0
	<i>Engie</i>	2,3	<i>Engie</i>	2,6
	<i>ERG</i>	2,1	<i>ERG</i>	2,0
	<i>Tirreno Power</i>	2,1	<i>Tirreno Power</i>	2,3
	<i>Sorgenia</i>	2,0	<i>Sorgenia</i>	2,1
	<i>Saras</i>	1,6	<i>Saras</i>	1,6
	<i>Axpo Group</i>	1,6	<i>Axpo Group</i>	1,9
	<i>Alperia</i>	1,2	<i>Alperia</i>	1,4
	<i>C.V.A.</i>	0,9	<i>C.V.A.</i>	1,2
<i>Lukoil</i>	1,1	<i>Lukoil</i>	1,1	
<i>Hydro Dolomiti</i>	1,1	<i>Hydro Dolomiti</i>	0,7	
<i>Others</i>	34,2	<i>Others</i>	33,0	

<sup>1</sup> Consumption up to 5.000 kWh per year

<sup>2</sup> Nomisma Energia estimate

<sup>3</sup> Generation share

### 3 POLICY FRAMEWORK

**Table 15: Summary of PV support measures<sup>(1)</sup>**

	On-going measures residential	Measures that commenced during 2018 - residential	On-going measures Commercial + industrial	Measures that commenced during 2018 - commercial + industrial	On-going measures Ground-mounted including floating	Measures that commenced during 2018 - ground mounted including floating
Feed-in tariffs	-	-	-	-	-	-
Feed-in premium (above market price)	-	-	-	-	-	-
Capital subsidies	Yes, at a regional level (most of tenders are for buildings of public administration and small and medium-sized enterprises (SME))				-	-
Green certificates	-	-	-	-	-	-
Renewable portfolio standards (RPS) with/without PV requirements	No obligations for utilities to obtain a minimum percentage of their power from renewable energy sources					
Income tax credits	Yes	-	Yes <sup>(3)</sup>	-		-
Self-consumption	Yes	-	Yes	-	-	-
Net-metering	-	-	-	-	-	
Net-billing <sup>(2)</sup>	Yes	-	Yes	-	Yes	-
Collective self-consumption and virtual net-metering	Yes, under some conditions (paragraph 3.4)	-	Yes, under some conditions (paragraph 3.4)	-	-	-
Commercial bank activities e.g. green mortgages promoting PV	Yes	-	Yes			
Activities of electricity utility businesses	Yes	-	Yes	-	Yes	-
Sustainable building requirements	Yes	-	Yes	-	-	-
BIPV incentives	Not specifically (paragraph 3.2.1)				-	-

<sup>1</sup> Blank box stands for not available data

<sup>2</sup> Up to 500 kW

<sup>3</sup> Specific national tax relief

### **3.1 National targets for PV**

The Italian proposal of the Integrated National Energy and Climate Plan (NECP) foresees a strong increase of RES electricity share in consumption, rising from 34% in 2017 to about 55% by 2030.

The main contribution will be from photovoltaic source, reaching a total capacity of 50 GW by 2030.

### **3.2 Direct support policies for PV installations**

On a national level, tax credit (available for small size plants up to 20 kW and for storage devices), together with a net-billing scheme (so-called Scambio Sul Posto - SSP), and a specific national tax relief for medium commercial/industrial installations, are the measures to support PV market that exist now after the end of the FiT law in 2013.

Italy switched from the net-metering mechanism to a net-billing scheme for systems below 500 kW in 2009, in which electricity fed into the grid is remunerated through an “energy quota” based on electricity market prices and a “service quota” depending on grid services costs (transport, distribution, metering and other extra charges). The net-billing scheme is valid for one year and automatically renewed once granted. Market prices are applied for the electricity injected into the grid as an alternative to SSP. Self-consumption is allowed for all PV system sizes. At the end of 2018, around 80% of plants installed in Italy are under the SSP mechanism.

An important contribution came from regional policies, such as tenders for capital subsidies for PV plants (and other RES and building energy efficiency interventions), mostly dedicated to plants to be installed on public administration buildings and for medium-sized enterprises (SME). Some Regions called for tenders in 2018.

#### **3.2.1 BIPV development measures**

Even if PV is non specifically indicated as a building element, some of the above-mentioned tenders criteria are related to the obligation to install the plan on a building; moreover, these tenders grants subsidies also for building energy efficiency.

### 3.3 Self-consumption measures

**Table 16: Summary of self-consumption regulations for small private PV systems in 2018**

PV self-consumption	1	Right to self-consume	Yes
	2	Revenues from self-consumed PV	Savings on the electricity bill
	3	Charges to finance Transmission, Distribution grids & Renewable Levies	No
Excess PV electricity	4	Revenues from excess PV electricity injected into the grid	SSP, net-billing based on energy and services; indirect sale through a dedicated withdrawal <sup>(1)</sup>
	5	Maximum timeframe for compensation of fluxes	Self-consumption, real time; SSP, advance payment twice per year
	6	Geographical compensation (virtual self-consumption or metering)	On site
Other characteristics	7	Regulatory scheme duration	Unlimited
	8	Third party ownership accepted	Yes, with condition
	9	Grid codes and/or additional taxes/fees impacting the revenues of the prosumer	None
	10	Regulations on enablers of self-consumption (storage, DSM...)	Yes (tax credit for storage)
	11	PV system size limitations	Self-consumption, none; SSP, up to 500 kW
	12	Electricity system limitations	None
	13	Additional features	None

<sup>1</sup> Managed by GSE





### **3.4 Collective self-consumption, community solar and similar measures**

Meter aggregation and virtual net-billing are allowed for some specific cases, i.e., Municipalities of up to 20.000 inhabitants and the Ministry of Defence.

### **3.5 Tenders, auctions & similar schemes**

Market experienced first private PPA agreement for ground PV plants mostly in south of Italy. These are the first test projects of medium (5 -10 MW) and large (30 - 50 MW) with different contractual formulas depending on the subjects involved.

### **3.6 Other utility-scale measures including floating and agricultural PV**

None.

### **3.7 Social policies**

The Municipality of Porto Torres (Sardinia Region) introduced the so called “reddito energetico” (energy income) project, based on a revolving fund, which is used to finance the installation of PV systems for families in energy poverty conditions. The mechanism allows to self-consume the electricity in real time, in order to reduce the cost of the electricity bill, and to finance the revolving fund through revenues of the net-billing (SSP, Scambio, Sul Posto). The first tender took place in 2017.

After this project, some other municipalities and/or other Regions are planning and carrying out similar initiatives.

### **3.8 Retrospective measures applied to PV**

Law 116/2014, implementing Law June 2014, n.91, defines new procedures related to incentives granted to electricity produced by PV plants under all Feed-in schemes (I, II, III, IV and V Conto Energia), among which the so-called “spalmaincentivi”. From January 1, 2015, tariffs (bonuses included, if any) for plants with a capacity over 200 kW are adjusted according to one of the following options (the Responsible Party of the plant can select the option).

1. Incentives are granted for 24 years (instead of 20) with a tariff reduction on the remaining period.
2. Incentives are granted for 20 years but with a tariff adjustment (a reduction for the first period and an increase for the second one).
3. Incentives are granted for 20 years but with a tariff reduction.



### **3.9 Indirect policy issues**

#### **3.9.1 Rural electrification measures**

The Decree of February 14, 2017 grants subsidies to electric RES and thermal plants in small Italian islands not connected to mainland electricity grid.

The mechanism is a feed-in tariff for the electricity fed into the grid that GSE withdraws and sells on the market while paying to the producers a subsidy for 20 years. For self-consumed electricity a feed-in premium is applied.

#### **3.9.2 Support for electricity storage and demand response measures**

Tax deduction for storage coupled with PV plants is foreseen.

#### **3.9.3 Support for electric vehicles (and VIPV)**

Law 145/2018 introduced subsidies for purchasing electric and hybrid vehicles for the years 2019-2021 and tax deduction for purchasing and installation of recharging infrastructures for vehicles powered by electricity. Moreover, white certificates for company car fleets are granted.

#### **3.9.4 Curtailment policies**

In Italy, RES have priority of access to the grid guaranteed; nevertheless, in case of wind energy curtailment a compensation is granted.

### **3.10 Financing and cost of support measures**

The Feed-in Tariff law set the financial cap for PV of 6,7 BEUR in terms of yearly payments.

The cost of the incentives for the FiT/FiP for the years 2005-2013 is covered by a component of the electricity tariff paid by all final electricity consumers; for high energy intensive industry there are reductions or exemptions.

## **4 INDUSTRY**

### **4.1 Production of feedstocks, ingots and wafers (crystalline silicon industry)**

Not available.

### **4.2 Production of photovoltaic cells and modules (including TF and CPV)**

In 2018 the total annual production reached from the interviewed companies is 34,3 MW, having a total production capacity of 892,4 MW/y. Despite the fact that the domestic photovoltaic industry is represented by limited annual production, manufacturers have reached module efficiency values comparable to the best worldwide producers.

A particular case is represented by the 3SUN 2.0 project, a development plan launched by Enel Green Power (EGP), that allow the 3SUN industrial site of Catania (city in South of Italy) to become one of the major worldwide plants that produce the two-sided HJT photovoltaic panel, based on heterojunction technology (the junction of two different types of silicon, amorphous and crystalline) with particularly high performances. The HJT technology production line will be operational from the first quarter of 2019, with a maximum production capacity of 110 MW/year. The maximum production capacity of 250 MW/year is expected to be reached by the end of 2019.

PV module manufacturers with production capacity are listed in the table below.

**Table 17: PV cell and module production and 2018 production capacity information<sup>(1)(2)</sup>**

Cell/Module manufacturer (or total national production)	Technology (sc-Si, mc-Si, a-Si, CdTe, CIGS)	Total Production [MW]		Maximum production capacity [MW/yr]	
		Cell	Module	Cell	Module
Wafer-based PV manufactures					
Enel Green Power – 3Sun	Si-HJT				80
AVProject	sc-Si, mc-Si				50
Azimut	sc-Si, mc-Si		2,7		30
Micron – Cappello Alluminio SpA	sc-Si, mc-Si				40
Eclipse Italia	sc-Si, mc-Si		25		200
Energy Glass - Gruppo STG	sc-Si, mc-Si				3
EXE s.r.l.	sc-Si, mc-Si		5		75
Meridionale Impianti	mc-Si		0,1		20
PEIMAR s.r.l	sc-Si, mc-Si				150
Schlaefer SpA	sc-Si, mc-Si				20
Solbian	sc-Si, mc-Si				2,4
SPS ISTEM	sc-Si, mc-Si				75
Sunerg Solar	sc-Si, mc-Si				100
Trienergia srl	sc-Si, mc-Si		1,5		24
V-energy Green Solutions - Gruppo STG	sc-Si, mc-Si				23
<b>Totals</b>			<b>34,3</b>		<b>892,4</b>

<sup>1</sup> Blank box stands for not available data

<sup>2</sup> RSE specific survey

Several Italian manufacturers are targeting specific niche markets, related to the building integration or the revamping of PV power plants. In this framework, Azimut targets a good part of its production to the BIPV market, offering customized modules or modules with coloured glass for roof integration. The Solbian manufacturer targets almost exclusively off grid applications with customized formats. Trienergia proposes also triangular photovoltaic panels (21 cells) and rectangular panels (42 or 60 cells), designed for triangular roof. Trienergia

manufactures modules only in Metal Wrap Through back contact technology which allows modules to have electrical contacts exclusively on the back.

In the field of CPV (concentrated solar power) Italian operators such as Solergy, Beghelli Bechar, and Sungen, have developed prototypes and systems both, mirror and lens-based, passively or actively cooled.

### **4.3 Manufacturers and suppliers of other components**

The new challenges in the energy sector have been tackled also by the Italian industry which, despite the high market competition, has maintained a qualitatively competitive technological level. The new national RES targets for 2030 as well as new policies have pushed the Italian manufacturers to introduce more efficient components on the market, with innovative features to the benefit of end-users and the electrical network.

Relevant national PV inverter manufacturers both for small-scale and utility-scale applications, are ABB (former Power One), Elettronica Santerno, Elpower, Borri, Fimer, Friem, Reverberi, Nidec ASI, Aros Solar Technology, BDF Digital, and Siel. In the framework of energy storage systems, also for residential applications, relevant national companies are ABB, Aton, Fiamm, Reverberi Enetec, Siel.

Other Italian companies (such as Bitron Electronic, Loccioni Group and also ABB Italia), offers technology solutions that, combined with photovoltaic systems, are able to maximize their energy self-consumption and interact with local automation services or energy management systems.

In the field of supporting structures for PV modules, a relevant Italian company specialized in the development of single-axis trackers for the PV utility-scale applications is Convert Italia which export its technological solutions mainly in Chile, Brazil and India.

Several Italian PV manufacturers are also targeting large size plants, aiming the optimization of performances and the cost reduction of PV electricity production through innovative monitoring solutions and PV components increasingly efficient.

## 5 PV IN THE ECONOMY

### 5.1 Labour places

**Table 18: Estimated PV-related full-time labour places in 2018<sup>(1)</sup>**

Market category	Number of full-time labour places
Research and development (not including companies)	
Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D	
Distributors of PV products	
System and installation companies	
Electricity utility businesses and government	
Other	
<b>Total</b>	<b>5.033<sup>(2)</sup></b>

<sup>1</sup> Blank box stands for not available data

<sup>2</sup> GSE data concerning permanent jobs, in terms of FTE (Full Time Equivalent), directly and indirectly related to O&M activities on existing PV facilities. Figures updated according to availability of new O&M data

### 5.2 Business value

**Table 19: Rough estimation of the value of the PV business in 2018 (VAT is excluded)<sup>(1)</sup>**

Sub-market	Capacity installed in 2018 [MW]	Average price [€/W]	Value [€]
Off-grid			
Grid-connected distributed	343,6	1,30	446.680.000
Grid-connected centralized	81,8	0,80	65.440.000
Value of PV business in 2018			512.120.000

<sup>1</sup> Blank box stands for not available data



## **6 INTEREST FROM ELECTRICITY STAKEHOLDERS**

### **6.1 Structure of the electricity system**

Italian electricity sector went through a deep reform over the last 20 years that changed it from a vertically integrated monopolistic structure to a liberalized market. The process started in 1999 but the complete liberalization was decided only in August 2017 and it is expected to be fully completed in July 2020, when the tariff system will end also in the domestic sector. The former monopolist ENEL still holds relevant market shares in all segments, especially in the domestic sector.

Generation, transmission and distribution are separated. Generation is a free activity where ENEL has a 22% market share while the rest is scattered among several players. Transmission is a regulated activity held by the transmission system operator (TSO) Terna; distribution is a regulated activity where ENEL still holds a 89% market share.

Retail activity is free, but with tariffs until mid 2020, where ENEL holds 70% of the market with a formal separation from the other activities. Enel is a private stock company where the state holds a 26% stake. Terna is a stock company with the state holding a 30% stake. Some companies with activities in production, distribution and retail are former municipalities hold by local authorities.

The energy authority was created in 1995 and is regulating the electricity sector following directives from the Italian Government and the Parliament.

### **6.2 Interest from electricity utility businesses**

Not available.

### **6.3 Interest from municipalities and local governments**

See paragraph 3.7.

## **7 HIGHLIGHTS AND PROSPECTS**

### **7.1 Highlights**

After subsidies period, that allowed almost 18 GW out of 20 GW capacity installed in Italy, marked evolved, on one side, to small residential systems based on self-consumption and net-billing scheme, and on the other side, to a secondary market of managing and acquisition of large plants.

Since 2017, Italy is experiencing also first private PPA agreement for PV plants (see paragraph 3.5).

PV revolving fund is raising a lot of interest in managing projects to address energy poverty (see paragraph 3.7).

### **7.2 Prospects**

The ambitious target of 55% of electricity from RES was confirmed in the Integrated National Energy and Climate Plan presented to the European Commission.

PV expected to contribute the most with a capacity of around 50 GW by 2030, making extremely urgent to take decisions to support the sector.

Concerning this aspect, a decree for supporting RES was discussed in 2018 and enacted in July 2019.

