Technology Collaboration Programme
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International Energy Agency
Photovoltaic Power Systems Programme

Task 1 Strategic PV Analysis and Outreach

PVPS

National Survey Report of PV Power Applications in Italy

2019

GSE Gestore Servizi Energetici
RSE Ricerca Sistema Energetico
ENEA
ELETTRICITÀ FUTURA imprese elettriche italiane

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 Technology Collaboration Programme (TCP) was created with a belief that the future of energy security and sustainability starts with global collaboration. The programme is made up of 6.000 experts across government, academia, and industry dedicated to advancing common research and the application of specific energy technologies.

The IEA Photovoltaic Power Systems Programme (IEA PVPS) is one of the TCP's 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.

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 Cop- per 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 2019. Information from this document will be used as input to the annual Trends in photovoltaic applications report.

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COVER PICTURE

Gestore dei Servizi Energetici, GSE

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This paper received valuable contributions from several stakeholders of Italian PV market: operators, installers, manufacturers of PV modules and other components, IUAV University of Venice, Nomisma Energia, and others. They all provided data included in this report. Many thanks to all of them.

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 2019 statistics if the PV modules were installed and connected to the grid between 1 January and 31 December 2019, although commissioning may have taken place at a later date.

1.1 Applications for Photovoltaics

Italy in 2019 installed 751 MW compared to a lower 440 MW data of 2018; out of 751 MW installed in 2019, almost all plants are under a net-billing scheme (so-called Scambio Sul Posto, SSP). On-grid installed capacity reached 20.865 MW for 880.090 PV plants installed.

In 2019 around 58.000 PV plants were installed, most of them with a capacity under 20 kW; in 2019, 29% of the installed capacity is of plants over 5 MW. The trend of the previous years of additional 400 MW plants under the net- billing scheme is confirmed, and about 270 MW of PV plants out of 750 MW are not accessing Feed-in Premium/Feed-in Tariff nor other subsides.

Around 97% of PV plants installed are connected to the low voltage distribution grid; the remaining share of 3%, consisting of around 21.000 plants connected to medium voltage grid, is 55,6% of total existing capacity. Only a small number of installations is connected to the high voltage grid and with a capacity of around 1.515 MW, the 7,3% of the total.

Number and capacity are distributed in a rather different way among Italian regions: at the end of 2019, 29,5% of plants installed is concentrated in Lombardy and Veneto, while Apulia has the national record in term of installed capacity with 2.826 MW (13,5% of the cumulative power).

The capacity installed at the end of 2019 results in a national data of 69 kW per km^2 (+ 2 kW compared to 2018) and in a national power per capita of 346 W per inhabitant, (+12 W compared to 2018). PV plants commissioned in 2019 have an average capacity of 12,9 kW, the highest figure observed since 2013, due to the commissioning of some large plants.

Polycrystalline silicon PV modules are installed on 72,5% of the existing capacity, monocrystalline silicon modules on 21,5% and thin film modules or different materials (which include a-Si, CIS, CdTe on 6%. The thin-film technologies, are used to a higher percentage in south of Italy.

PV electricity production reached 23.689 GWh, with a growth compared to the previous year (+4,6%) mainly due to better irradiation conditions. Out of the 23.689 GWh produced in Italy in 2019, 52% is generated by the industrial sector, 20% by the tertiary sector, 15% by the domestic sector and 13% by the agricultural sector.

Electricity produced by PV and self-consumed amounted to 4.718 GWh in 2019, around 20% of total PV systems production and to 38.6% of the production of self-consumption plants. Almost all the PV plant owners in the domestic sector self-consume (it is a real-time self-consumption). The highest percentage shares of self-consumption are in the tertiary and industrial sectors (taking into account the quota of plants that self-consume).

In 2019 Italian Government approved a new decree supporting renewable energy, for the period 2019-2021, produced from new, repowered and upgraded plants powered by "mature" RES plants: PV (>20kW), onshore wind, hydro and sewage gas for a total capacity of about 8 GW. The mechanism is based on competitive auctions for groups of technologies and registries for smaller plants (up 1 MW of capacity).

1.2 Total photovoltaic power installed

Table 1: Annual PV power installed during calendar year 2019[1] [2]

		Installed PV capacity in 2019 [MW]	AC or DC
PV capacity	Off-grid		DC
	Decentralized[3]	504	DC
	Centralized[4]	254	DC
	Total	**758**[5]	DC

[1] *Source: GSE*

[2] *Blank box stands for not available data*

[3] *Any PV installation which is embedded into a customer's premises (self-consumption)*

[4] *Any PV installation which only injects electricity and is not associated with a consumer (no self-consumption)*

[5] ***The net value of 758 MW indicated in the table is calculated as algebraic sum of 751 MW - decommissioning ± statistic power update***

Table 2: PV power installed during calendar year 2019[1] [2]

			Installed PV capacity [MW]	Installed PV capacity [MW]	AC or DC
Grid-connected	BAPV[3]	Residential	539	229	DC
		Commercial		141	DC
		Industrial		169	DC
	BIPV[4]	Residential			
		Commercial			
		Industrial			
	Utility-scale	Ground-mounted	219	219	DC
		Floating		0	DC
		Agricultural		0	DC
Off-grid		Residential			
		Other			
		Hybrid systems			
Total			**758[5]**		DC

[1] *Source: GSE*

[2] *Blank box stands for not available data*

[3] *Building Applied Photovoltaic*

[4] *Building Integrated Photovoltaic*

[5] The net value of 758 MW indicated in the table is calculated as algebraic sum of 751 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 for statistical data: GSE, RSE.
Link to official statistics	www.gse.it www.terna.it http://www.arera.it

Table 4: The cumulative installed PV power in 4 sub-markets[1] [2] [3]

Year	Off-grid [MW] [4]	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
2001	11,7	1,6	6,7	20
2002	11,7	3,6	6,7	22
2003	11,7	7,6	6,7	26
2004	12,0	12	6,7	30,7
2005	12,3	18,5	6,7	37,5
2006	12,8	30,5	6,7	50
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	1.277,0
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	14,0	7.809,9	11.473,3	19.297,2
2017		8.105,5	11.576,8	19.682,3
2018		8.449,1	11.658,5	20.107,6
2019		8.661,0	12.204,3	20.865,3

[1] *Source: GSE, TERNA*
[2] *Blank box stands for not available data*
[3] *The classification for grid-connected distributed and grid-connected centralized PV plants, applied since 1992, is below or over 200 kW*
[4] *Best estimate*

Table 5: Other PV market information[1][2]

		2019 Numbers [MW]	2019 Numbers [MW]
Number of PV systems in operation in your country	Residential	880.090	721.112
	Commercial		93.719
	Industrial		65.259
Capacity of decomissioned PV systems during the year [MW]	Residential	2,8	0
	Commercial		0
	Industrial		2,8
Capacity of repowered PV systems during the year [MW]	Residential		
	Commercial		
	Industrial		
Total capacity connected to the low voltage distribution grid [MW]	Residential	7.751	3.403
	Commercial		2.271
	Industrial		2.077
Total capacity connected to the medium voltage distribution grid [MW]	Residential	11.599	30
	Commercial		2.293
	Industrial		9.276
Total capacity connected to the high voltage transmission grid [MW]	Residential	1.515	0
	Commercial		46
	Industrial		1.469

[1]*Source: GSE*

[1] *Blank box stands for not available data*

Table 6: PV power and the broader national energy market

	2018	2019
Total power generation capacities [GW]	118,117	119,299
Total renewable power generation capacities (including hydropower) [GW]	54,301	55,495
Total electricity demand (consumption) [TWh]	321,341	319,622
Total energy demand (final consumption) [TWh]	303,443	301,699[1]
New power generation capacities installed [GW]	0,973	1,182
New renewable power generation capacities (including hydropower) [GW]	1,042	1,194
Estimated total PV electricity production (including self-consumption) [TWh]	22,654	23,689
Total PV electricity production as a % of total electricity consumption	7,47%	7,85%

[1]*GSE estimate based on Terna data*

1.3 Key enablers of PV development

Table 7: Information on key enablers[1]

	Description	Annual Volume	Total Volume	Source
Storage systems		10.433	25.767	www.gse.it
Residential Heat Pumps			6.500.000[2]	
Electric cars		10.618	22.728	www.aci.it
Electric buses and trucks		1.024	5.243	www.aci.it

[1] *Blank box stands for not available data*

[2] *GSE estimation*

2 COMPETITIVENESS OF PV ELECTRICITY

2.1 Module prices

Table 8: Typical module prices for a number of years [€/W][1] [2]

Year	Lowest price of a standard module crystalline silicon	Highest price of a standard module crystalline silicon	Typical price of a standard module crystalline silicon
2009	2,30		2,50
2010	1,50		1,70
2011	1,20		1,50
2012	0,70		0,80
2013	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
2019	0,18	0,45	0,29

[1] *Blank box stands for not available data*

[2] *GSE specific survey*

2.2 System prices

Table 9: Turnkey PV system prices of different typical PV systems(1)

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.	0,95 - 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.	0,50 - 0,70

[1]*GSE specific survey*

Table 10: National trends in system prices for different applications [€/W](1) (2)

Year	Residential BAPV Grid-connected, roof-mounted, distributed 5-10 kW	Small commercial BAPV Grid-connected, roof-mounted, distributed 10-100 kW	Large commercial BAPV Grid-connected, roof-mounted, distributed 100-250 kW	Small centralized PV Grid-connected, ground-mounted, centralized 10-20 MW
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
2019	1,34	1,15	1,00	0,63

[1] *Blank box stands for not available data*

[2] *GSE specific survey*

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[1]

Cost category	Average [€/W]	Low [€/W]	High [€/W]
Hardware			
Module	0,39	0,34	0,45
Inverter	0,14	0,13	0,16
Mounting material	0,27	0,22	0,32
Other electronics (cables, etc.)			
Subtotal Hardware	0,80	0,69	0,93
Soft costs			
Planning[2]			
Installation work	0,09	0,07	0,10
Shipping and travel expenses to customer	0,03	0,02	0,03
Permits and commissioning[3]	0,10	0,08	0,11
Project margin	0,32	0,26	0,37
Subtotal Soft costs	0,54	0,43	0,61
Total (excluding VAT)	1,34	1,12	1,54
Average VAT	10%	10%	10%
Total (including VAT)	1,474	1,232	1,694

[1] *GSE specific survey*

[2] *Planning cost are included in the other soft costs*

[3] *Including financing*

Table 12: Cost breakdown for a grid-connected, ground-mounted, centralized PV systems of >10 MW[1]

Cost category	Average [€/W]	Low [€/W]	High [€/W]
Hardware			
Module	0,20	0,18	0,25
Inverter	0,06	0,05	0,07
Mounting material	0,12	0,11	0,13
Other electronics (cables, etc.)			
Subtotal Hardware	0,38	0,34	0,45
Soft costs			
Planning[2]			
Installation work	0,04	0,03	0,05
Shipping and travel expenses to customer	0,02	0,01	0,02
Permits and commissioning[3]	0,03	0,02	0,04
Project margin	0,16	0,14	0,17
Subtotal Soft costs	0,25	0,20	0,28
Total (excluding VAT)	0,63	0,54	0,73
Average VAT	10%	10%	10%
Total (including VAT)	0,693	0,594	0,803

[1] *GSE specific survey*

[2] *Planning cost are included in the other soft costs*

[3] *Including financing*

2.4 Financial Parameters and specific financing programs

Table 13: PV financing information in 2019(1)

Different market segments	Loan rate [%]
Average rate of loans – residential installations	3,5 – 5,5
Average rate of loans – commercial installations	2,2 – 3,4
Average cost of capital – industrial and ground-mounted installations	1,5 – 2,0

1 GSE specific survey

2.5 Specific investments programs

Table 14: Summary of existing investment schemes(1)

Investment Schemes	Description
Third party ownership (no investment)	The PV plant owner can sell the electricity produced by the plant to a different consumer (systems classified as "Efficient User Systems")
Renting	It is an alternative formula to purchase and leasing which allows, upon payment of a periodic fee, to acquire the plant for a specific period of time, without incurring the expense of the purchase.
Leasing	
Financing through utilities	
Investment in PV plants against free electricity	
Crowd funding (investment in PV plants)	This type of crow funding allows the company to obtain the financing of a commercial initiative by providing company shares in exchange.
Community solar	The Italian Parliament approved a new measure about self-consumption for consumers who act collectively and produce/consume energy from new renewable plants with capacity < 200 kW. The electricity produced is shared using the existing distribution network, through a virtual/distributed energy compensation mechanism (introduced in 2019/2020)
International organization financing	

1 Blank box stands for not available data

2.6 Additional Country information

Table 15: Country information[1]

Retail electricity prices for a household	23,21[2] - 24,76 €cent/kWh			
Retail electricity prices for a commercial company	24,25 - 37,48 €cent/kWh[3]			
Retail electricity prices for an industrial company	10,27 - 18,83 €cent/kWh			
Population at the end of 2019	60.317.000			
Country size [km^2]	301.336			
Average PV yield in [kWh/kW]	1.164			
Name and market share of major electric utilities		Electricity production [%]	Share of grid Subscribers [%]	Number of retail customers [%]
	Enel	17,0		
	Eni	9,1		
	Edison	7,6		
	A2A	6,3		
	EPH	5,2		
	Iren	3,4		
	Sorgenia	2,7		
	ENGIE	2,5		
	ERG	2,1		
	Axpo	2,1		
	Tirreno Power	1,8		
	Saras	1,6		
	Other	38,7		

[1] Blank box stands for not available data

[2]Consumption up to 5.000 kWh per year

[3]Nomisma Energia estimate

3 POLICY FRAMEWORK

Table 16: Summary of PV support measures[1]

Category	Residential		Commercial + Industrial		Centralized	
Measures in 2019	**On-going**	**New**	**On-going**	**New**	**On-going**	**New**
Feed-in tariffs	-	-	-	yes	-	yes
Feed-in premium (above market price)	-	-	-	-	-	-
Capital subsidies[2]	yes	-	yes	-	-	-
Green certificates	-	-	-	-	-	-
Renewable portfolio standards with/without PV requirements[3]						
Income tax credits	yes	-	yes[5]	-	-	-
Self-consumption	yes	-	yes	-	yes	-
Net-metering	-	-	-	-	-	-
Net-billing[4]	yes	-	yes	-	yes	-
Collective self-consumption and virtual net-metering	yes	yes	yes	yes	-	-
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		-	-	-	-	-

[1] *Blank box stands for not available data*

[2] *At a regional level (most of tenders are for buildings of public administration and small and medium-sized enterprises (SME)*

[3] *No obligations for utilities to obtain a minimum percentage of their power from renewable energy sources*

[4] *Up to 500 kW*

[5] *Specific national tax relief*

[6] *Virtual net metering under some condition (paragraph 3.4)*

3.1 National targets for PV

The Italian Ministry of Economic Development has recently issued the Integrated National Energy and Climate Plan, which 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, with a set target of cumulative PV capacity of 50 GW by 2030 and a corresponding 70 TWh/year of electricity production.

3.2 Direct support policies for PV installations

A new decree approved in 2019 aims at supporting, in the period 2019-2021, energy from new, refurbished and upgraded plants from “mature” RES: PV (>20kW), onshore wind, hydro and sewage gas for a total capacity of about 8 GW (of which 7,4 GW new). Competitive auctions (for capacities over 1 MW) for groups of technologies and registries for smaller plants (with a capacity up to 1 MW), with some competitive elements are foreseen.
The support for the plants with a capacity up to 250 kW is a Feed-In Tariff, and over 250 kW a sliding Feed-in Premium, so-called called “two-ways mechanism”: the producer receives an incentive equal to the difference between a reference tariff and the hourly zonal price of energy. There are also additional remuneration: for plants installed on buildings (P≤100 kW), on self-consumed energy (if self-consumption exceeds 40% of yearly net production), and for PV plants replacing asbestos. Only new PV plants, not installed in agricultural areas, can participate to the auctions/registers.

Tax credit (available for small size plants up to 20 kW and for storage devices), together with a net-billing scheme (Scambio Sul Posto, SSP), and a specific national tax relief for medium commercial/industrial installations, are further measures to support PV market.
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.

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). Several Regions called for tenders in 2019.

3.2.1 BIPV development measures

Some of the above-mentioned Regional tenders request the PV plant to be integrated in the building envelope.

3.3 Self-consumption measures

Table 17: Summary of self-consumption regulations for small private PV systems in 2019

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	Net-billing based on energy and services; indirect sale through a dedicated withdrawal(1)
	5	Maximum timeframe for compensation of fluxes	Self-consumption, real time; net-billing, advance payment twice per year
	6	Geographical compensation (virtual self-consumption or metering)	On site. 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. In 2019/2020 a new measure, concerning energy communities, has been introduced about self-consumption for consumers who act collectively and produce/consume energy from new renewable plants with capacity < 200 kW
Other characteristics	7	Regulatory scheme duration	Self-consumption, unlimited; net-billing is yearly renewed
	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 coupled with PV)
	11	PV system size limitations	Self-consumption, none; net-billing, up to 500 kW
	12	Electricity system limitations	None
	13	Additional features	None

[1] *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.

Furthermore, the Italian Parliament approved a new measure about self-consumption for consumers who act collectively and produce/consume energy from new renewable plants with capacity < 200 kW. The electricity produced is shared using the existing distribution network, through a virtual/distributed energy compensation mechanism. The shared energy shall be equal to the minimum, in each hourly period, between the electricity produced and fed into the grid and the electricity withdraw from the group of associated final customers.
RES Self-consumers acting collectively must be in the same building or apartment block. In the energy community, members may be private persons, small and medium-sized enterprises, local or regional public administration authorities. In this configuration the withdrawal points of the consumers and the connection points of the plants must be located on the LV electricity grids, sharing the same transformation substation.
The law provides also for a remuneration tariff for pilot configurations in order to give a premium to real time self-consumption combined with storage unit. These projects can be developed and the plants installed until the implementation of the new EU RES Directive, expected by June 2021.

3.5 Tenders, auctions & similar schemes

See paragraph 3.2.

3.6 Other utility-scale measures including floating and agricultural PV

None.

3.7 Social Policies

In 2007, the municipality of Porto Torres (Sardinia Region), with the collaboration of GSE, introduced the so called "reddito energetico" (energy income) project: the municipality allocated public resources to purchase PV systems, sold on loan to families in energy poverty conditions, to benefit them from PV self-consumption and thus reduce their energy bills. The revenues of the net-billing (Scambio, Sul Posto, SSP) feed a public fund, in order to finance the maintenance of the plants or possibly the purchase of other plants for other families.

After this project, some other municipalities and/or some 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):

- Incentives are granted for 24 years (instead of 20) with a tariff reduction on the remaining period.
- Incentives are granted for 20 years but with a tariff adjustment (a reduction for the first period and an increase for the second one).
- 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 geographical islands, not connected to the mainland electricity grid, with an area greater than 1 km^2, located more than 1 km from the continent and with a resident population of at least 50 people.

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. At the end of 2019, almost 26.000 storage systems were installed for a total nominal capacity of 118 MW.

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.

3.9.4 Curtailment policies

In Italy, RES have priority of access to the grid; 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 Feed-in Tariff / Feed-in Premium 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. The economic resources for the new RES decree will be covered in the same way.

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 2019, the total annual production reached from the interviewed companies is 48,74 MW, having a total production capacity of 909,4 MW/y. The Italian manufactures have reached module efficiency values comparable to the best worldwide producers.

Table 18: PV cell and module production and 2019 production capacity information (1) (2)

Cell/Module manufacturer (or total national production)	Technology (sc-Si, mc-Si, s-Si, CdTe, CIGS)	Total Production [MW]		Maximum production capacity [MW/y]	
		Cell	Module	Cell	Module
Wafer-based Pv manufacturers					
Enel Green Power – 3Sun	Si-HJT	25	25	200	200
Micron - Cappello Group SpA	sc-Si, mc-Si				40
Eclipse Italia s.r.l.	sc-Si, mc-Si				200
EXE s.r.l.	sc-Si, mc-Si		18		75
Meridionale Impianti s.r.l	mc-Si				20
Peimar s.r.l	sc-Si, mc-Si				150
Solbian s.r.l.	sc-Si PERC - Multi wire		0,127		2,4
	sc-Si HJT - Multi wire		0,006		
	mc-Si - Multi wire		0,117		
SPS ISTEM s.r.l.	sc-Si, mc-Si				75
Sunerg Solar s.r.l.	sc-Si, mc-Si				100
Trienergia s.r.l.	sc-Si, mc-Si		2,7		24
Gruppo STG s.r.l. V-energy Green Solutions; Energy Glass	sc-Si, mc-Si		2,785		23
Total		25	48,74	200	909,4

[1] *Blank box stands for not available data*

[2] *RSE specific survey*

In this framework, is noteworthy the development plan launched by Enel Green Power (EGP) called 3SUN 2.0, that allowing 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. In 2019 the heterojunction solar cells produced by Enel Green Power have reached a yield of 24.63%, a result certified by ISFH, the German Institute for Solar Energy Research in Hamelin. However, the goal of EGP is to achieve more than 28% of efficiency in the next years.

Several other Italian manufacturers continue to target specific niche markets, such as architectural integration and mobility application. The SOLBIAN manufacturer targets the production of PV flex modules particularly suited to sailing yachts or electric mobility applications. The Trienergia manufacturer proposes design triangular photovoltaic panels (21 cells) and rectangular panels (42 or 60 cells), designed for triangular roofs. 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 national RES targets for 2030 as well as new policies and energy strategies have pushed the Italian manufacturers to introduce in the market more and more efficient components, with innovative features to the benefit of end-users and the electrical network.

Relevant national PV inverter manufacturer both for small-scale and utility-scale applications, are Elettronica Santerno S.p.A, Elpower s.r.l, Borri S.p.A, Fimer S.p.A, Friem S.p.A., Reverberi Enetec s.r.l, Nidec ASI S.p.A., RPS SpA -Aros Solar Technology, BDF Digital S.p.A., and Siel S.p.A. In the framework of energy storage systems, also for residential applications, relevant national companies are Aton, Fiamm, Reverberi Enetec, SIEL.

Other Italian companies (such as Bitron Electronic, Loccioni Group and also ABB Italia SpA), 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 SpA which exports its technological solutions mainly in Chile, Brazil and India.

5 PV IN THE ECONOMY

5.1 Labour places

Table 19: Estimated PV-related full-time labour places in 2019(1)

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	
Research and development (not including companies)	
Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D	
Total	**5.952**(2)

1 Blank box stands for not available data

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

5.2 Business value

Table 20: Rough estimation of the value of the PV business in 2019 (VAT is excluded)(1)

Sub-market	Capacity installed [MW]	Average price [€/W]	Value [€]
Off-grid			
Grid-connected distributed	211,9	1,25	264.875.000
Grid-connected centralized	545,8	0,74	403.892.000
Value of PV business in 2019			668.767.000

1 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 2022, 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. Enel is a private stock company where the state holds a 26% stake.

Generation, transmission and distribution are separated. Generation is a free activity where the first six groups industrial companies (Enel, Eni, Edison, A2a, EP Produzione and Iren) hold 48.6% of the national gross production while the rest is scattered among several players (Table 15).

Transmission is a regulated activity held by the transmission system operator (TSO) Terna, a stock company with the state holding a 30% stake; distribution is a regulated activity where e-Distribuzione (Enel group) is the first operator with 86% market share, followed by the other three major operators (Unareti, Areti, Ireti) that hold another 8,9%.

Retail activity is free, but with regulated tariffs for the domestic sector (for customers who decided not to switch to the liberalized market) until 2022. The 10 major retail operators hold 69,7% of the market, with Enel holding an overall 36%. Some companies with activities in production, distribution and retail are former municipalities owned by local authorities.

The Energy Authority (Italian Regulatory Authority for Energy, Networks and Environment - ARERA) was created in 1995 and regulates the electricity sector following directives from the Italian Government and the Parliament.

6.2 Interest from electricity utility businesses

Italian electricity utilities are involved in the PV sector and also in the secondary market.

6.3 Interest from municipalities and local governments

All Italian municipalities have PV plants installed; furthermore, 72% of municipalities have PV plants on buildings of Public Administration for a total capacity of 864 MW.
See also 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 private PPA agreement for PV plants.

Italy is working on two European Directives implementation which introduce and promote collective self-consumption and energy communities. The Italian government, with the Legislative Decree 162/2019, decided an earlier adoption of a part of the RED II Directive[1], opening the possibility to start collective self-consumption schemes and energy communities.

7.2 Prospects

The ambitious target of 55% of electricity from RES was set in the Integrated National Energy and Climate Plan presented to the European Commission. PV expected to contribute the most with a capacity of around 51 GW by 2030. A decree for supporting RES was enacted in July 2019 (see paragraph 3.2). Major development of small building systems and energy communities is expected. At the same time, it will also be important to build large plants, promoted by instruments such as contracts for difference and PPAs. The construction of large plants will be favoured by administrative measures, such as the identification of areas of the territory (established by the Regions after having developed a procedure at national level) where the authorization procedure can be further simplified.

[1] *Renewable Energy Directive (Directive 2018/2001 – RED II) European Directive for individual and collective self-consumption. It set out the "Energy Community" and ensured their involvement in the markets.*