

PV & Energy Storage Market Opportunities in Italy: Overview and Future Scenarios

Riccardo Sorichetti – Italia Solare IBESA ITALIAN STORAGE DAY – 28th October 2021

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Italia Solare

Our key data



The only Italian association exclusively dedicated to photovoltaics

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€ 1.5bln/year turnover – 15k jobs

ITALIA SOLARE Industrial Members - Year 2020 data

Italia Solare organization



Italia Solare - Working groups

Regional affairs I.S



AgriPV



Energy Communities



Measures and connections



Finance



Taxation



Green Hydrogen







Legislation and regulation



O&M Revamping / Repowering



International affairs



Research, Development and Community Projects



Storage



Technology development and standards

Ecological transition, who's got the ball?

Decarb, adequacy, security, a political choice.



No storage, no transition.



Storage in Italy today

• Utility oriented applications

- TSO (energy/power intensive)
- DSO (Primary Cabin, feeder MV, Secondary Cabin)

- Users oriented applications (grid oriented)
- Other applications (microgrids, off grid)

- Storage systems coupled with a production plant (RES or traditional)
- Storage system coupled with a consumption plant
- Storage system coupled with a prosumer
- Stand-alone installations (third party operator)



Storage in Italy: Terna

Storage Lab (Power Intensive)

Large Scale (Energy Intensive)



- Around Euro 200 mln invested (Regulatory Asset Base RAB)
- Storage pilot projects Terna spa



Storage in Italy: e-distribuzione

Ventotene island (2016)

- Ventotene is a small island of 1.89 km² in Tyrrhenian sea
- The current fixed population totals 750 people, with a consistent increase in summer time
- 4 diesel generators of 600 kVA each and a MV ring are installed in the island
- The increase of residential PV plants caused stability problems to the grid (frequency, voltage)
- The electrical system is optimized and the diesel consumpotion is reduced thanks to a storage system (Li-Ion 300 kW/600 kWh)



"The current regulation subordinates the use of ESS solutions by DSOs to a verification of the technicaleconomical convenience and to a specific evaluation carried out by the Authority, depending on the specific technical-economical needs." (*Source: e-distribuzione development plan*)



Storage in Italy: "private installations" (1)

Storage systems capacity [MWh] connected (2021)



Storage systems capacity range [kWh]	Number	Storage systems Power [MW]	Storage systems Capacity [MWh]
C≤5 kWh	19.926	62,11	79,44
5 kWh < C ≤ 10 kWh	20.824	101,37	159,29
10 kWh < C ≤ 15 kWh	8.020	51,36	105,34
15 kWh < C ≤ 20 kWh	651	5,66	11,74
20 kWh < C ≤ 25 kWh	319	3,75	7,16
25 kWh < C ≤ 50 kWh	600	8,57	19,01
50 kWh < C ≤ 100 kWh	68	2,42	4,57
100 kWh < C ≤ 500 kWh	29	4,17	6,08
C > 500 kWh	5	12,50	12,36
Totale	50.442	251,91	404,99

N. of storage systems connected (2021)



Storage systems power [MW] connected (2021)



Storage in Italy: "private installations" (2)



Veneto



Storage systems capacity by Region [MWh]



8.232

12

Storage in Italy: "private installations" (3)

Number of storage, power [kW] and capacity [kWh] vs coupled PV plant size



N° Storage Systems Storage Power [MW] Storage Capacity [MWh]



Storage in Italy: RfC Terna (1)



Storage in Italy: RfC Terna (2)

STORAGE REQUESTS FOR CONNECTION DISTRIBUTION



Source: Terna Development Plan (31/12/2020)

Hydro



Storage in Italy: RfC e-distribuzione (1)



Detail of the number of storage systems connected to the Low Voltage grid managed by e-Distribuzione distributed by Region and average power [kW]



Storage in Italy: RfC e-distribuzione (2)



Detail of the number of storage systems commissioned and put in operation in the Low Voltage grid managed by e-Distribuzione in the . last years



Drivers (1)

- Direct financing, tax breaks (deductions, superbonus, etc.)
- Self-consumption and shared energy:
 - User Efficiency Systems "Sistemi Efficienti di Utenza" (SEU, ARERA del. 578/2013 and following modifications)
 - New ways to share energy (jointly acting renewable self-consumers and renewable energy communities, ARERA del. 318/2020)
- Capacity Market: no storage in 2022 bid, only 100MW in 2023 bid.



Power capacity awarded in 2023 bid: about 4 GW (out of which just 0.5 GW already authorized) at 75k€/MW/year



Drivers (2)

• Evolution of CM regulation for 2024/2025 – Storage systems.

A titolo esemplificativo si riporta una stima dei valori che verrebbero applicati alle unità esistenti rilevanti:

TI	derating medi	
EOLICO*	EOLICO	82%
GEOTERMICO	GEOTERMICO	23%
	ASTA IDROELETTRICA	39%
IDRICO	BACINO	39%
IDRICO	FLUENTE	65%
	SERBATOIO	48%
	PURO	50%
PRODUZIONE E POMPAGGIO	SERBATOIO	39%
SOLARE*	SOLARE	89%
	COMBINATO	19%
TERMICO	RINNOVABILE PROGRAMMABILE	30%
TERIMICO	TRADIZIONALE	21%
	TURBOGAS	26%

Preliminary estimation of the range of values of derated power associated to storage systems with different E/P rate

> Tabella 3 - Valori CDP percentuale associata ai sistemi di accumulo (stima preliminare a titolo esemplificativo)

Rapporto E/P accumulo (h)	CDP in percentuale (1-tasso di derating)
1	10-30%
2	30-50%
4	60-80%
≥6	70-90%

Source: Terna CM DTF2



Drivers (3)

• Terna adequacy standard analysis

12.880 MW awarded at 75 k€/MW/year for 15 years sum up approximately 15 bln €

Assuming that half of the resources and quota were reserved to storage systems (and the other half for the substitution of carbon fuelled plants) and an average CONE of 160 k€/MW/year with E/P=4h, we could install 2,800 MW/11,200 MWh (that correspond to an installed power/capacity of 4,000 MW/16,000 MWh, i.e. about 77% of the requests for connection received by Terna at 31/12/2020 and around 2/3 of the total storage capacity showed in the Italian PNIEC

		Storage ele	Pompaggio				
Voci di co	sto	E/P=1h	E/P=4				
Costo di investimento	k€/MW	430	1.783				
Costi fissi annuali	<mark>k€/M</mark> W/anno	2,3	4,8	42			
WACC	[]						
Vita utile impianto	а	[10-15]	[10-15]	[50-55]			
Periodo costruzione	а	1	1	4			
Tasso di derating	[]	73%	30%				
CONE	k€/MW/anno	[168 – 221]	[141 – 186]	[210-213]			

Tabella 10 - Sistemi di accumulo

Tabella 13 - Potenziale di nuova capacità per il periodo di validità dello studio (base: richieste di autorizzazione e trend del PNIEC)

Potenziale nuova capacità (MW)	Potenziale nuova capacità de-rated = CDP (MW)			
ca. 14.400	ca. 12.880			
	ca. 400			
ca. 570	[-]			
0	0			
ca. 12.000	ca. 1.400			
20 ^{ca. 7.000}	ca. 1.200			
	Potenziale nuova capacità (MW) ca. 14.400 ca. 570 0 ca. 12.000			

Source: "Proposta in merito allo standard di adeguatezza del sistema elettrico italiano" (June 2021)

Drivers (4)

• What does Italian electrical system need in terms of adequacy?

Estimation of thermal reserve																													
Stima in 2019			Total	Hourly																									
From [GW]	1	to [GW]		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	241	otal	Cumulated
	3	4	. e	5																1	1		2	1	1			6	8758
	4	5	47	7									1	2	2	1	1	1	3	7	7	6	7	7	2			47	8752
	5	6	117	7								7	7	4	3	1	2	8	9	9	14	15	17	12	6	3		117	8705
	6	7	172	2							6	9	10	9	10	9	8	5	8	15	15	17	18	14	15	3	1	172	8588
	7	8	321	L							11	20	16	20	17	9	9	19	26	29	30	31	28	27	17	10	2	321	8416
	8	9	340)						4	17	19	24	19	15	17	22	19	19	23	24	23	25	24	23	19	4	340	8095
	9	10	426	53						10	23	28	28	22	32	22	15	23	28	25	25	26	32	33	22	17	12	426	7755
	10	11	. 446	55	1				2	11	25	30	30	34	18	25	28	27	19	23	23	24	24	29	30	21	17	446	7329
	11	12	421	L 8	2	1	2	2	8	16	29	21	19	17	26	22	20	17	14	18	25	32	32	26	28	17	19	421	6883
	12	13	456	5 12	9	7	3	6	6	11	24	23	25	23	19	22	20	20	29	21	24	26	25	27	24	30	20	456	6462
	13	14	446	5 17	11	7	9	8	11	28	24	22	20	18	20	19	23	21	14	20	22	22	19	23	27	24	17	446	6006
	14	15	466	5 25	16	11	6	9	12	36	20	18	18	20	20	19	16	19	22	15	20	20	19	24	28	27	26	466	5560
	15	16	517	7 13	20	20	22	16	28	32	26	20	16	19	19	19	22	15	20	26	21	19	23	24	26	24	27	517	5094
	16	17	502	2 23	20	21	19	22	25	26	27	28	25	21	23	20	15	19	13	20	17	15	16	16	27	29	15	502	4577
	17	18	537	24	20	16	21	27	29	31	25	19	22	21	16	18	16	21	30	21	13	14	21	18	21	36	37	537	4075
	18	19	491	L 30	27	22	23	29	35	26	12	8	14	19	22	26	22	18	12	9	14	23	12	14	15	23	36	491	3538
	19	20	498	3 30	28	35	35	31	. 37	26	9	8	8	15	17	16	21	14	18	19	21	12	11	11	17	25	34	498	3047
	20	21	. 488	3 33	28	34	29	35	37	22	13	19	21	19	15	20	17	22	15	13	12	11	12	12	6	17	26	488	2549
	21	22	408	3 44	39	33	34	37	27	16	15	7	5	7	13	16	16	11	10	15	7	6	5	5	10	12	18	408	2061
	22	23	372	2 25	37	31	35	32	31	17	15	10	9	8	8	16	18	13	15	3	7	9	3	5	5	7	13	372	1653
	23	24	335	5 19	27	37	34	40	28	18	12	15	10	7	7	5	11	12	8	9	10	3	2	2	1	4	14	335	1281
	24	25	252	2 16	22	26	26	16	16	8	6	11	12	15	11	11	10	10	8	8	2	1	4	1	3	3	6	252	946
	25	26	210) 19	19	19	24	20	13	9	8	5	5	7	10	7	7	6	5	6	4	3	1	2	2	3	6	210	694
	26	27	197	7 1	18	20	19	17	7	8	9	7	10	7	7	9	8	10	10	6	5	4	4	3	1	4	3	197	484
	27	28	130) 8	8	10	10	8	5	5	3	8	5	4	4	5	9	8	7	2	2	3	2	4	4	1	5	130	287
	28	29	117	79	10	11	11	6	6	4	5	2	3	5	8	9	5	6	2	2			1		3	5	4	117	157
	29	30	22	2 1	2	3	1	2	2				1	2	2	1	3							1	1	1	1	22	40
	30	31	. 8	3	1		1		2	1	1						1		1									8	18 /
	31	32	10)		1	1	2	2			1	1	1	1	1		1								21		10	10
			8758	3																								8758	

Drivers (5)

- Estimation of thermal reserve in 2019 (internal estimation using Terna data)
- Total availability: 35.7÷50 GW:
 - thermal
 28.5÷41.7 GW
 (carbon 3.4÷6.9
 GW)
 - ✓ Hydro 5.5÷9.5GW



Drivers (6)

- Estimation of thermal reserve in 2020 (internal estimation using Terna data)
- Total availability: 36÷47.4 GW:
 - ✓ thermal
 28.1÷39.5 GW
 (carbon 3÷6.8
 GW)
 - ✓ Hydro 6.1÷9.4GW



Drivers (7)

- Estimation of thermal reserve up to Sept.
 2021 (internal estimation using Terna data)
- Total availability: 33÷45.5 GW:
 - ✓ thermal
 26.7÷37.6 GW
 (carbon 2.8÷6.1
 GW)
 - ✓ Hydro 5.3÷9.5GW



Electrical Market today (1)

- Electrical market reform (dco 322/2019):
 - elimination of National Unique Price (PUN) and floor at 0 €/MWh, contracting in contiunuous in MI, binomial remuneration (capacity/energy) of a number of services, etc.

• Pilot projects according to ARERA **Deliberation 300/2017**:

- UVAM: besides energy based activities in the Balancing Market, possibility to get a fixed remuneration by means of monthly bids.
- □ UPR: deliberation 383/2018, relevant UP not yet qualified and not UVA, from 01/09/2018, just 1 hydro plant qualified from 01/04/2019 with about 895 MWh supplied ramping up until 31/03/2020.
- UPI: supply of primary frequency regulation by means of storage systems integrated to relevant UP (deliberation 402/2018). 4 storage systems qualified (2 Dispatching Unit, thermal) per 33.4 MW over a total contingent of 30 MW.
- Just some thoughts looking at the situation in Germany remuneration of Frequency Containment Reserve):

Technologie	FCR	aFRR+	aFRR-	mFRR+	mFRR-
Nuclear	0,35	0,37	0,37	1,94	1,94
Lignite	0,62	1,23	1,23	4,54	4,58
Hard coal	0,62	1,27	1,27	3,78	3,68
Gas	0,28	3,14	3,16	7,80	7,56
Oil	-	0,29	0,03	1,54	0,15
Biogas/-mass	0,04	1,84	2,32	2,26	3, 1 6
Water	4,37	14,61	14,69	14,20	14,46
Battery storage	0,45	0,06	0,06	-	-
Demand/DSM	0,12	0,51	0,64	0,67	0,71
Wind	-	-	-	-	0,19
Others	-	-		-	0,01
Summe	6,85	23,33	23,78	36,71	36,44



 Table 1:
 Overview on prequalified capacity (in GW) for each printary energy source/balancing

Electrical Market today (2)

- Pilot projects according to ARERA **Deliberation 300/2017**:
 - Frequency secondary regulation (or frequency/power regulation): pilot project with explicit admission for limited capacity sources.
 - Ultra-rapid frequency regulation (fast reserve unit or FRU): 249.9 MW have been assigned on 10th December 2020 versus 1.3 GW qualified (117 units, 53 operators), to be available 1,000 hours/year for 5 years (2023 2027).

Areas	Assigned power [MW]	Weighted average price [€/MW/year]
CENTRE NORTH	118,2	23418
CENTRE SOUTH	101,7	27279
SARDINIA	30	61016
Total	249,9	



Future scenarios and IS proposals

- Pilot projects for the provision of local ancillary services, ARERA deliberation 352/2021.
- Scheme of Legislative Decree for the fulfilment of EU Directive 2018/2001 (art. 6):
 - Small size PV plant coupled with storage systems should be incentivized with premium tariffs, two way CfD mechanism does not allow repaying the storage system and does not help the system.
- Scheme of Legislative Decree for the fulfilment of EU Directive 2019/944 (art. 18):
 - Operators active in the whole value chain.
 - Doubts on TSO intervention in case of market failure.
- Energy Communities
 - Current configuration with energy withdrawal managed as negative injection does not support the presence of storage systems.



EV and services to the grid

In CEI Annex "X" communication mode between the Recharge Infrastructure Controller (CIR) and BSP, DSO and second generation 2G smart meter, while nothing is said about the interface between CIR and Charging Station Controller (CSC).

The CIR allows to:

- Optimize power delivered to EV depending on absorption of the other user charges and local production;
- Keep available modulation resources so that a BSP could offer, in aggregate, flexibility on MSD;
- Keep available modulation resources for the DSO;
- Give contribution to electrical system security providing grid services in under-frequency conditions.





ITALIA SOLARE | Associazione di Promozione Sociale

Via Passerini 2, 20900 Monza (MB) – Italy www.italiasolare.eu | info@italiasolare.eu Twitter: @italia_solare

