PV market, business and price developments in Italy

Matteo Giannì

GSE
Gestore
Servizi
Energetici

EU PVSEC 2017 25 - 29 September 2017
33rd European PV Solar Energy Conference and Exhibition
RAI Convention & Exhibition Centre • Amsterdam • The Netherlands

Outlook

- ✓ PV role in electricity generation in Italy
- ✓ Anatomy of PV deployment

  distribution costs incentives impacts

- ✓ New PV trends

  optimize existing plants new plants

GSE

GSE is a state owned company having as mission "…to foster sustainable development by providing support for renewable energy and energy efficiency… "

INCENTIVES AND PROMOTION OF ELECTRICITY FROM RENEWABLE SOURCES

- Qualifying RES plants
- Granting incentives, purchase & resale energy, certification
- On site verification of plants
- Satellite-assisted metering (forecast of energy production)

ENERGY EFFICIENCY, RENEWABLE ENERGY FOR HEATING & COOLING AND TRASPORT

- White Certificates
- High-efficiency CHP
- Heating & Cooling support scheme
- Biofuel
- On site verification of plants

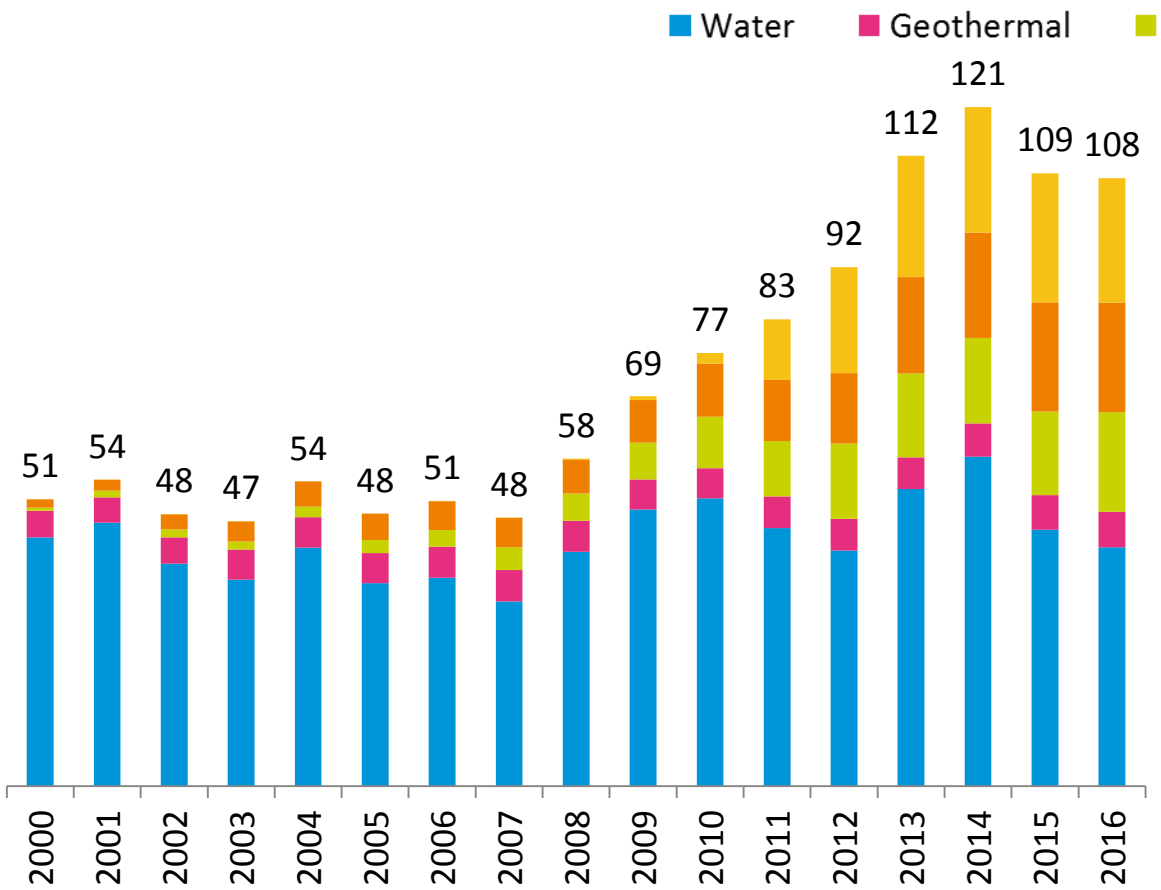
INSTITUTIONAL ACTIVITIES AND OTHER TECHNICAL ENERGY SERVICES

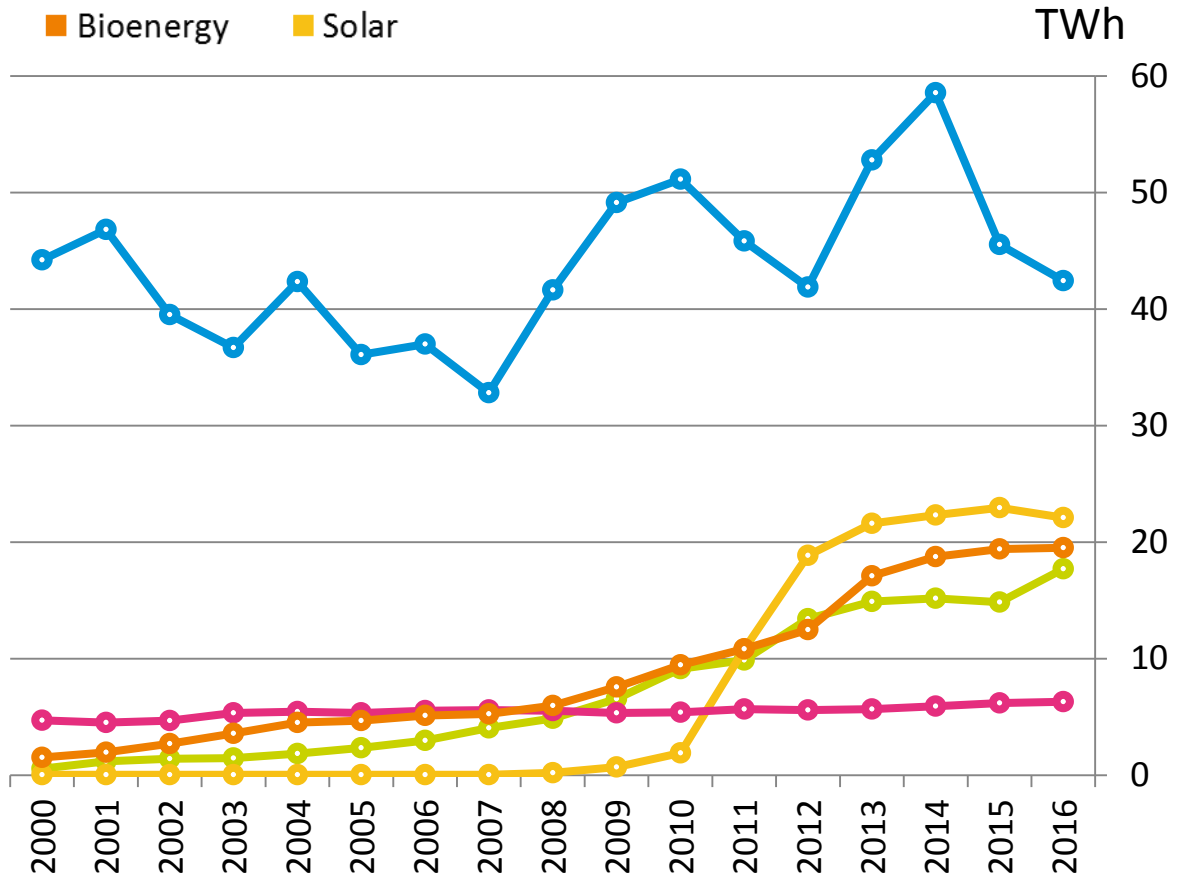
- Monitor European targets on renewables
- Studies and Statistics
- Support to the Public Administration
- ETS auctions to sale the Italian CO2 allowances
- Promotion and communication

Renewable electricity generation in Italy

- Renewable generation **almost doubled** in the last decade
- Renewables covered **37%** of national generation in 2016
- Hydro generation still plays the main role, but other RES showed great increase

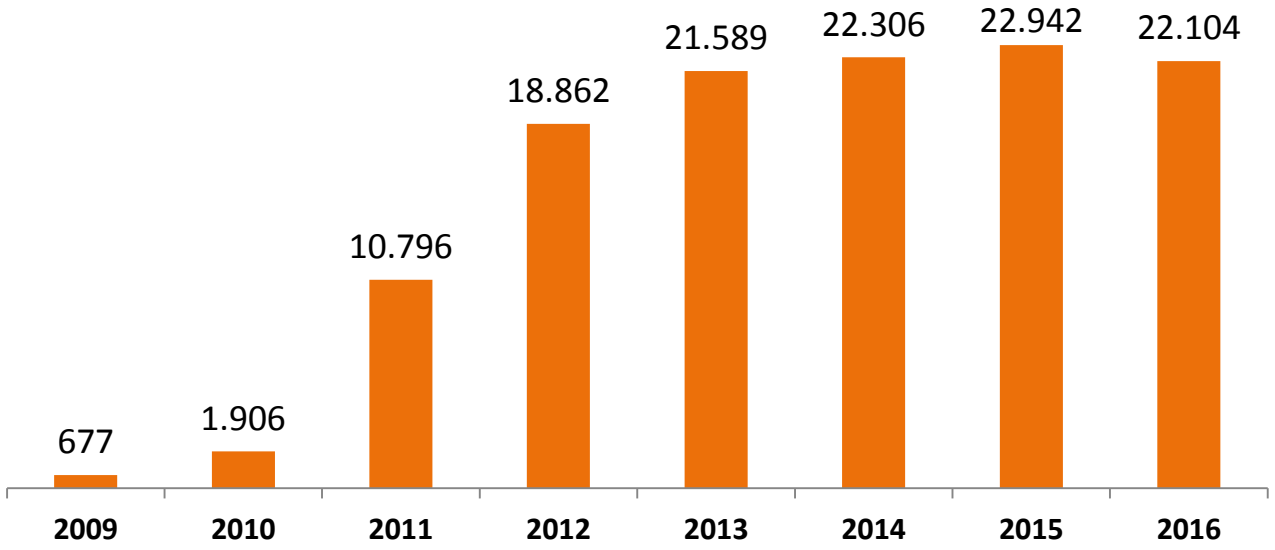
RES gross electricity production (TWh)





PV production in the generation mix

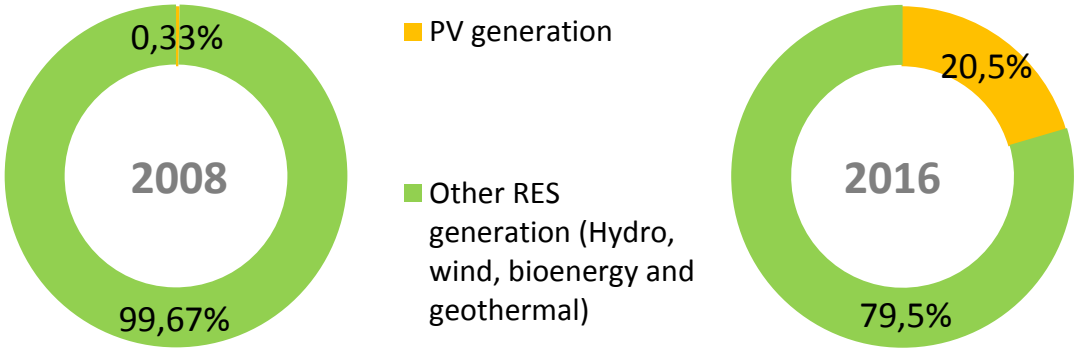
PV generation in Italy (GWh)



- In 2016 electricity generation by PV plants was **22,1 TWh**, lower than the previous year (**-3,6%**), mainly because of the radiation decrease (-3,9%)
- Preliminary elaboration of 2017 data (Gen-Aug) indicate conversely a significant increase with respect to 2016 (7-8%)

	2011	2012	2013	2014	2015	2016
Full load hours	1.326	1.313	1.241	1.211	1.225	1.158

PV share in renewable generation: 2008 vs 2016



- In 2008 PV generation was about **0,3%** of total renewable generation in Italy. In 2016 this share became **20,5%**

PV share in electricity demand

PV share in electricity generation and consumption

	2010	2011	2012	2013	2014	2015	2016
Gross electricity generation (TWh)	302	303	299	290	280	283	290
Natural gas	51%	48%	43%	38%	33%	39%	44%
RES	25%	27%	31%	39%	43%	38%	37%
Hydro	17%	15%	14%	18%	21%	16%	15%
PV	**1%**	**4%**	**6%**	**7%**	**8%**	**8%**	**8%**
Bioenergy	3%	4%	4%	6%	7%	7%	7%
Wind	3%	3%	4%	5%	5%	5%	6%
Geothermal	2%	2%	2%	2%	2%	2%	2%
Gross final consumption (TWh)	343	346	340	330	322	328	325
PV	**1%**	**3%**	**6%**	**7%**	**7%**	**7%**	**7%**
Demand (TWh)	330	335	328	319	311	317	314
PV	**1%**	**3%**	**6%**	**7%**	**7%**	**7%**	**7%**

In 2016 generation from PV plants covered **20%** of **RES generation**, the **7,6%** of **gross generation**, the **7%** of electricity **demand**.

Outlook

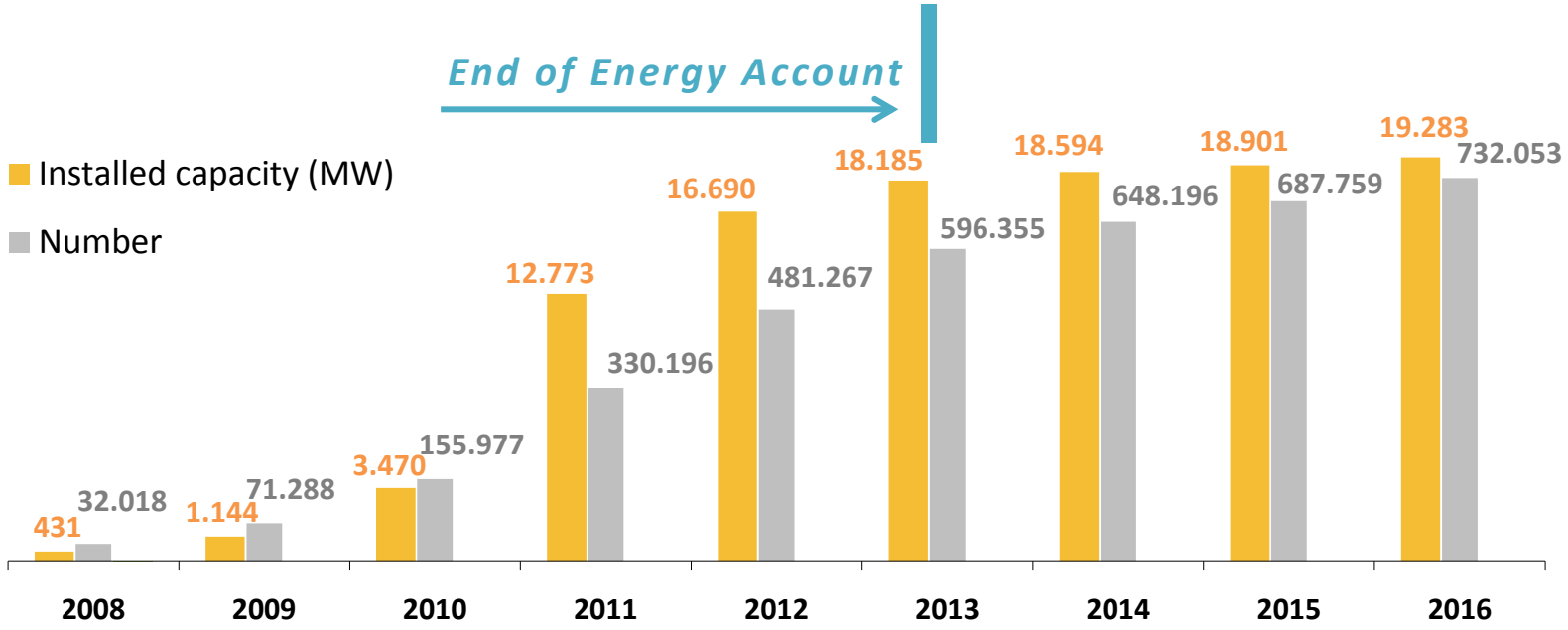
- ✓ PV role in electricity generation in Italy
- ✓ Anatomy of PV deployment

  distribution costs incentives impacts
- ✓ New PV trends

  optimize existing plants new plants

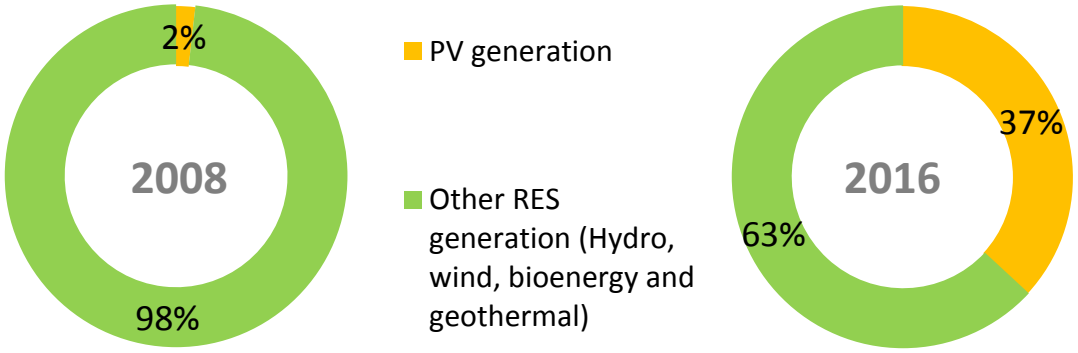
Historical PV development in Italy

Number and capacity of PV plants



- In the past years, the number and capacity of PV plants grew at a very sustained pace.
- More than **550.000 plants** for **17,7 GW** were realized under the Energy Accounts support schemes
- By the end of 2016 more than **730,000 PV plants** were installed, for a total power of **19.3 GW**

PV share in renewable capacity: 2008 vs 2016



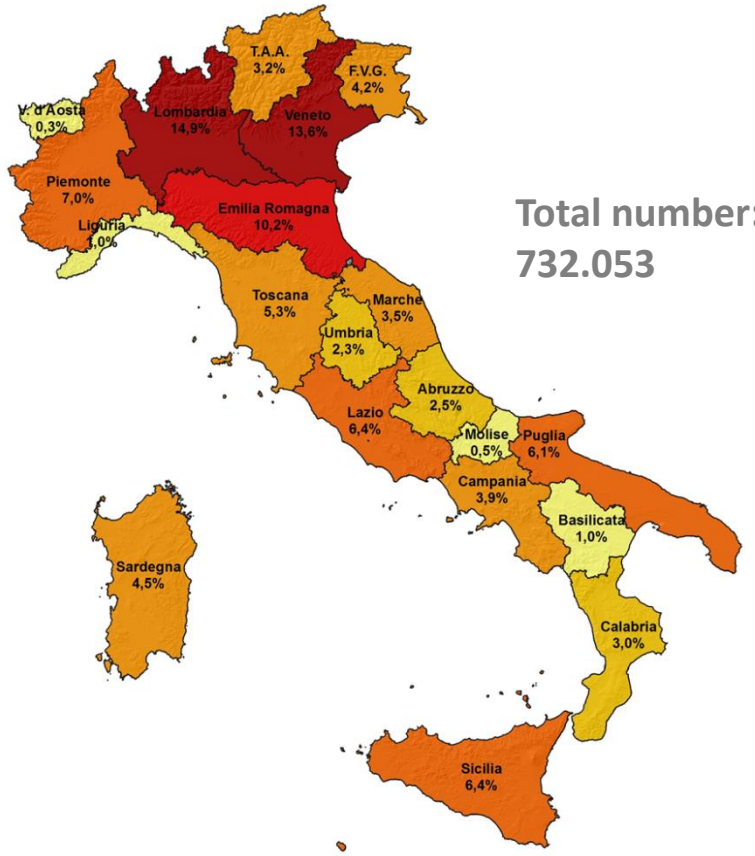
- In 2008 PV capacity was about **2%** of the total renewable capacity installed in Italy. In 2016 this share became **37%**

PV regional distribution in Italy in 2016

Although the difference in solar radiation (≈+20% in South than North), the PV plants are spread all over the country

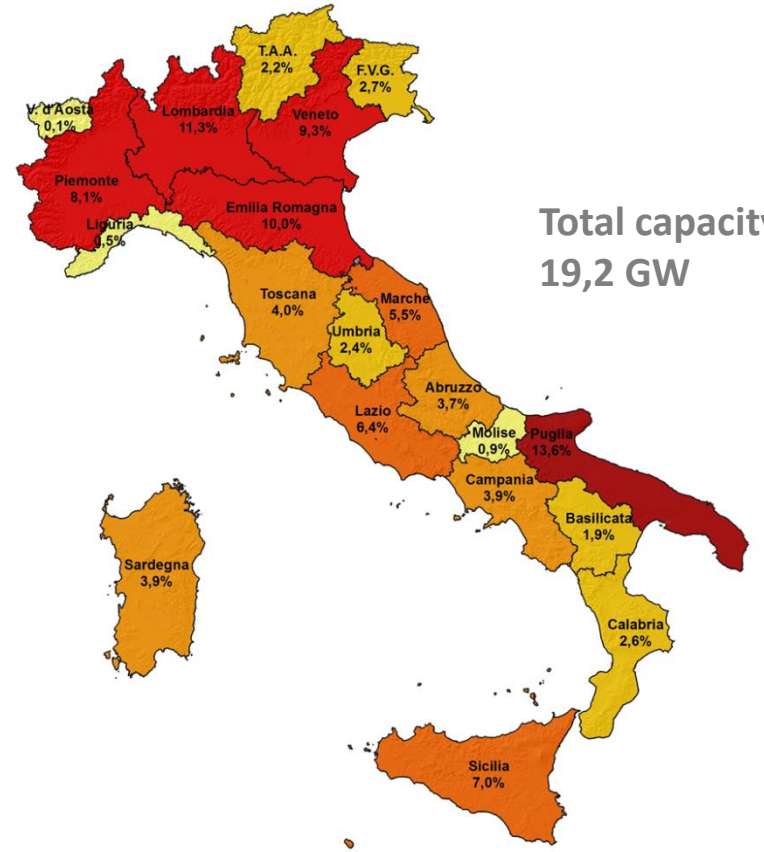
- North: **54%** of installations, **44%** of capacity; average size 21 kW
- Centre: 18% of installations, 18% of capacity; average size 27 kW
- South: 28% of installations, **38%** of capacity; average size 35 kW

PV plants regional distribution



Total number: 732.053

PV capacity regional distribution



Total capacity: 19,2 GW

Breakdown of PV installations by capacity and by sectors

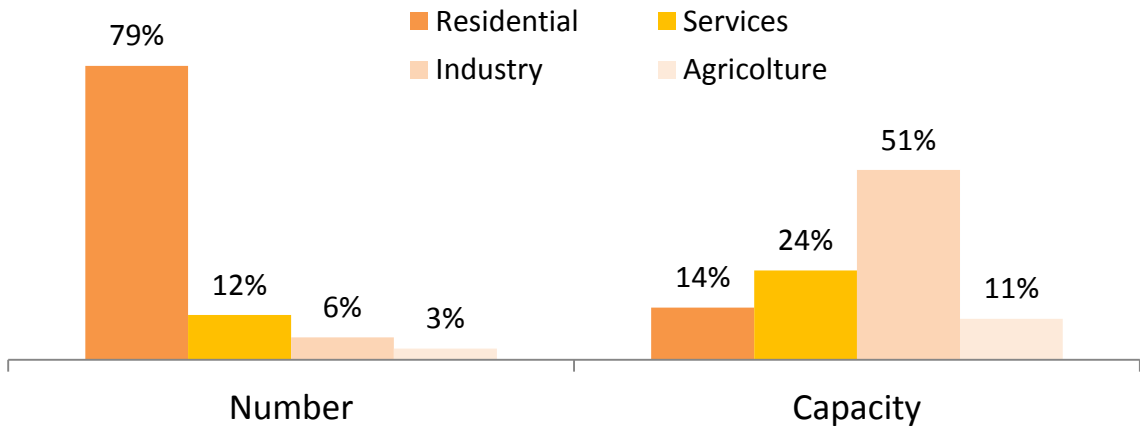
PV by size

- **91% PV plants have size below 20 kW**, with average capacity of 6 KW (668.600 plants, 3,7 GW, 20% of overall capacity)
- **60% PV capacity refers to plants with size above 200 kW** (11.780 plants, 11,4 GW, 1,6% of total number)

2016

Size (kW)	n°	MW
1<=C<=3	245.293	671
3<C<=20	423.307	3.107
20<C<=200	51.673	4.032
200<C<=1.000	10.638	7.297
1.000<C<=5.000	958	2.343
C>5.000	184	1.834
Total	**732.053**	**19.283**

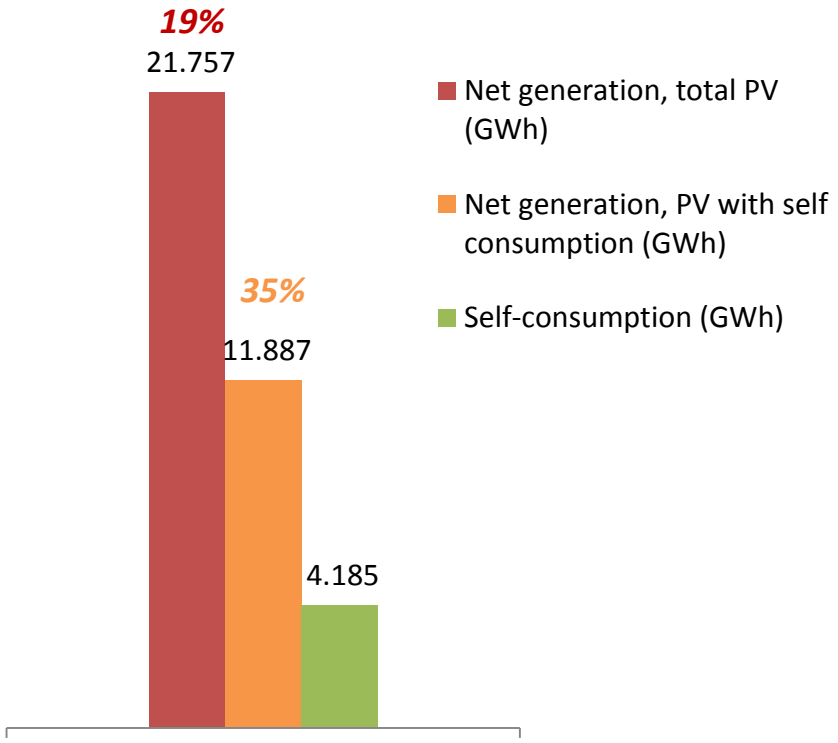
PV by sector



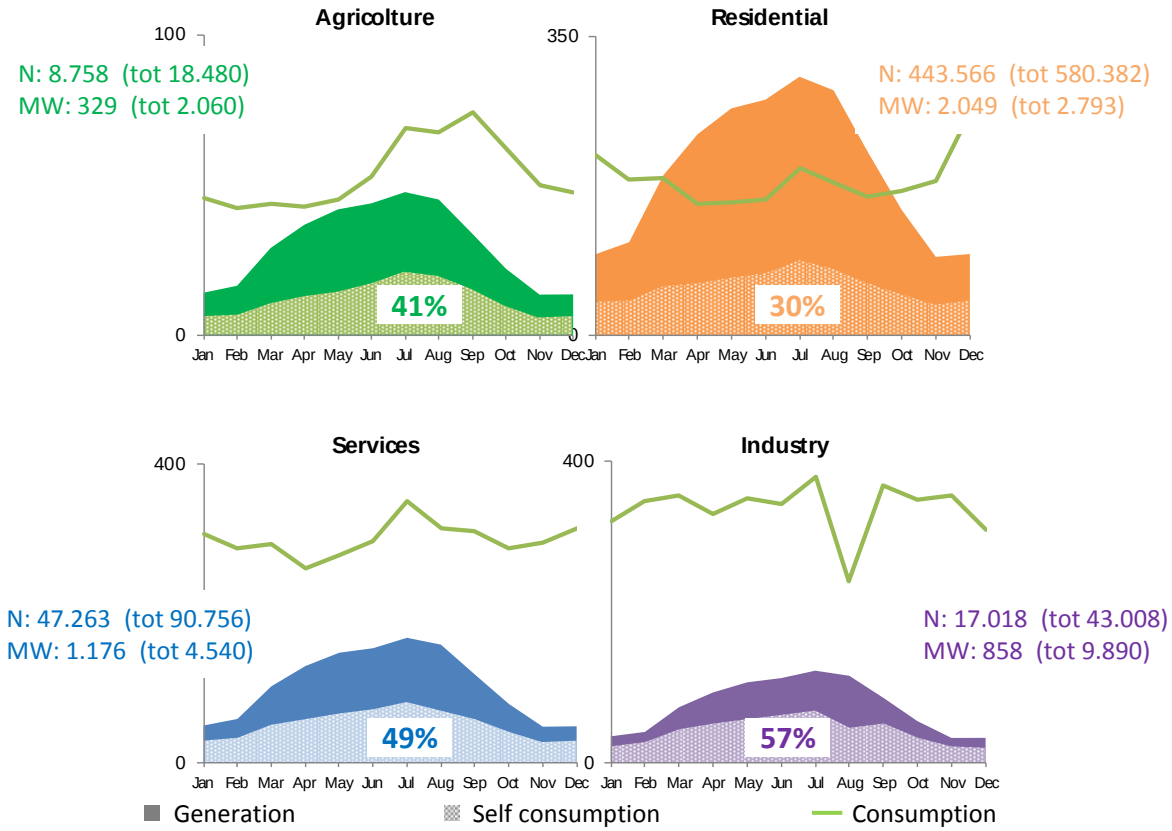
- **79% PV plants are residential,** mainly small size (about 5 kW)
- **52% of PV capacity refers to the industry sector**, including utility-scale plants (average size 230 kW)

PV self-consumptions

PV generation and self-consumption



PV production and self consumption profile by sector



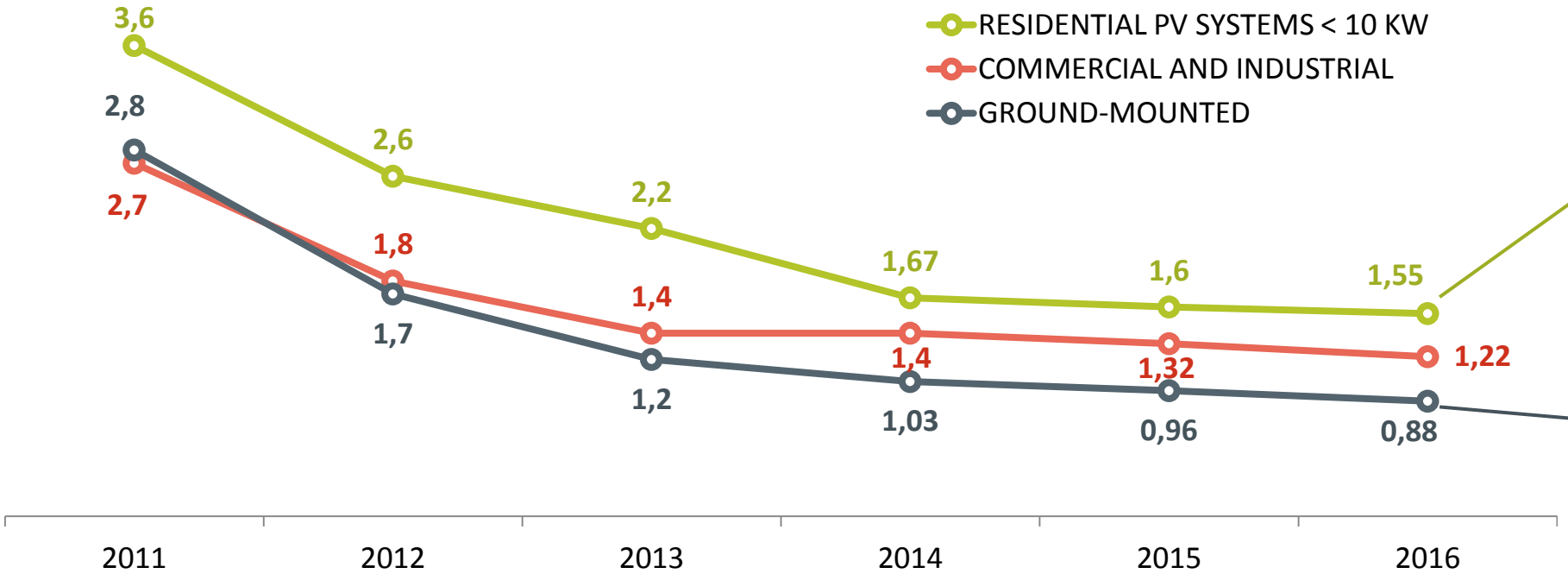
- PV self-consumption amounts to **4,3 TWh** in 2016, **35%** of net generation produced by PV plants with self-consumption, which is in turn almost half of total net generation
- Almost **all domestic plants have a self-consumption quota** (**30%** on average). These plants are usually small in size (C<=20 kW) under net billing scheme, which can limit self-consumption by mitigating the cost of grid exchange
- Industry sector includes power companies (that generate electricity only to fed to the grid)

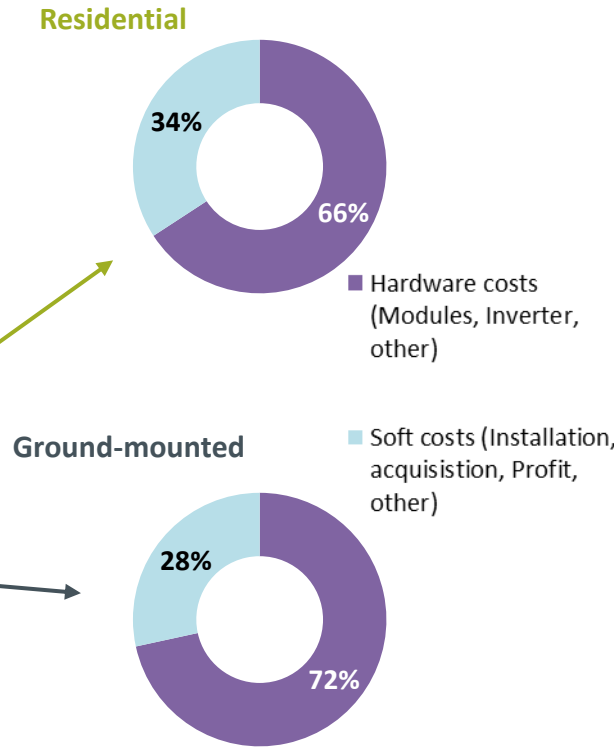
Market trends: system costs

GSE has performed an extensive monitoring of system costs:

- collecting data from plants accessing Energy Accounts until 2013 (510.000+ plants, 15,9 GW)
- dedicated surveys from 2013

Evolution of PV system cost [€/W]

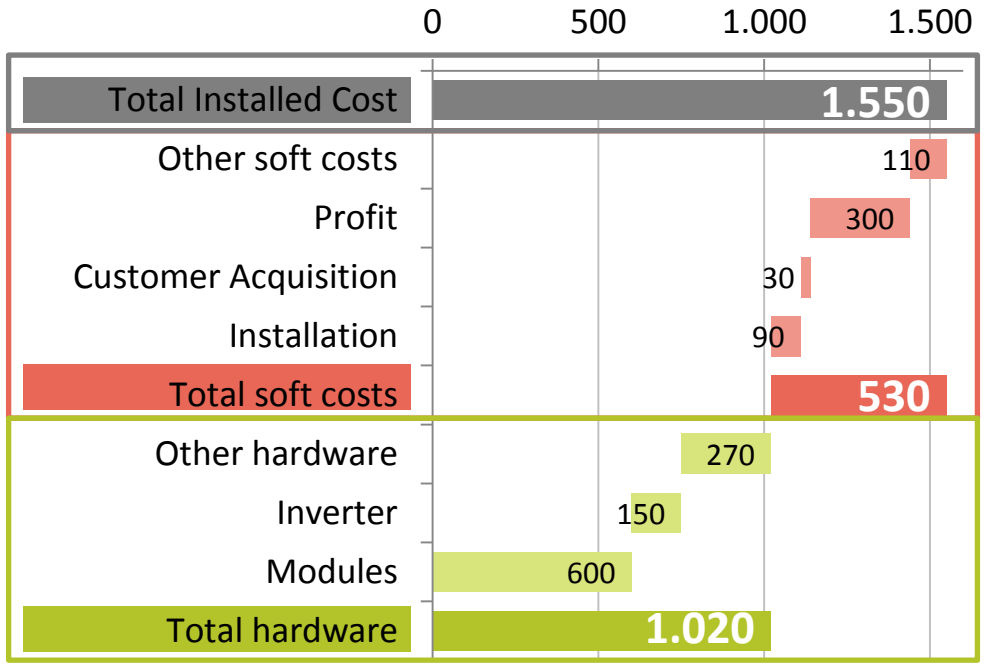




- In 2016 residential and commercial system prices are about **45%** of 2011 prices
- In 2016 ground mounted system prices are about **30%** of 2011 prices

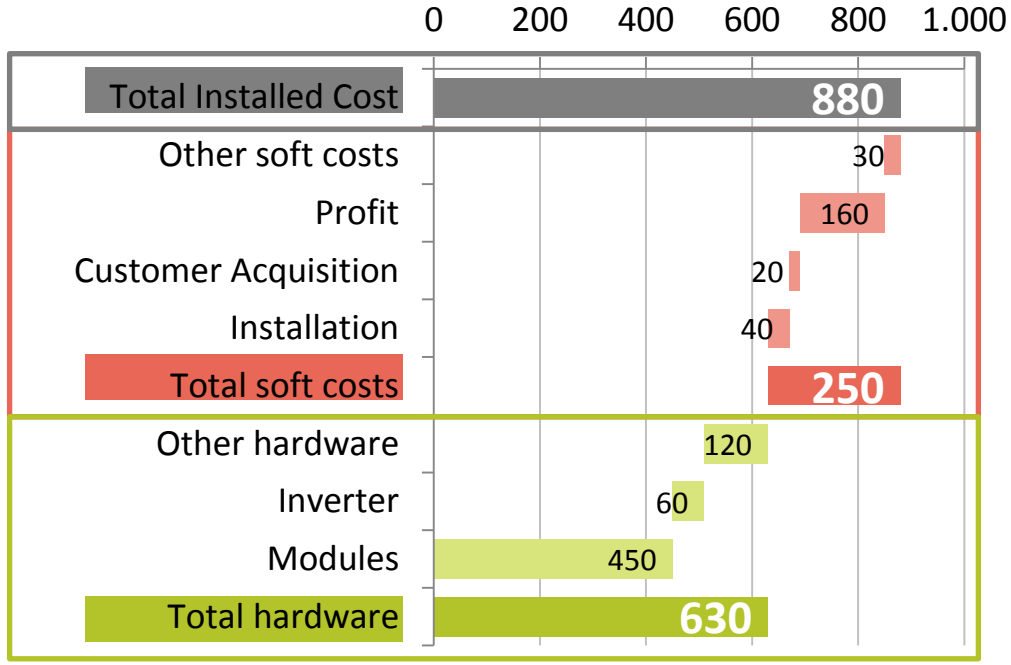
Market trends

Cost breakdown for a residential PV systems in 2016 [€/kW]



In the case of a residential PV system, the cost of modules cover the 39% of the total installed cost.
Hardware cost and soft cost amount to 66% and 34% of the total installed cost, respectively,

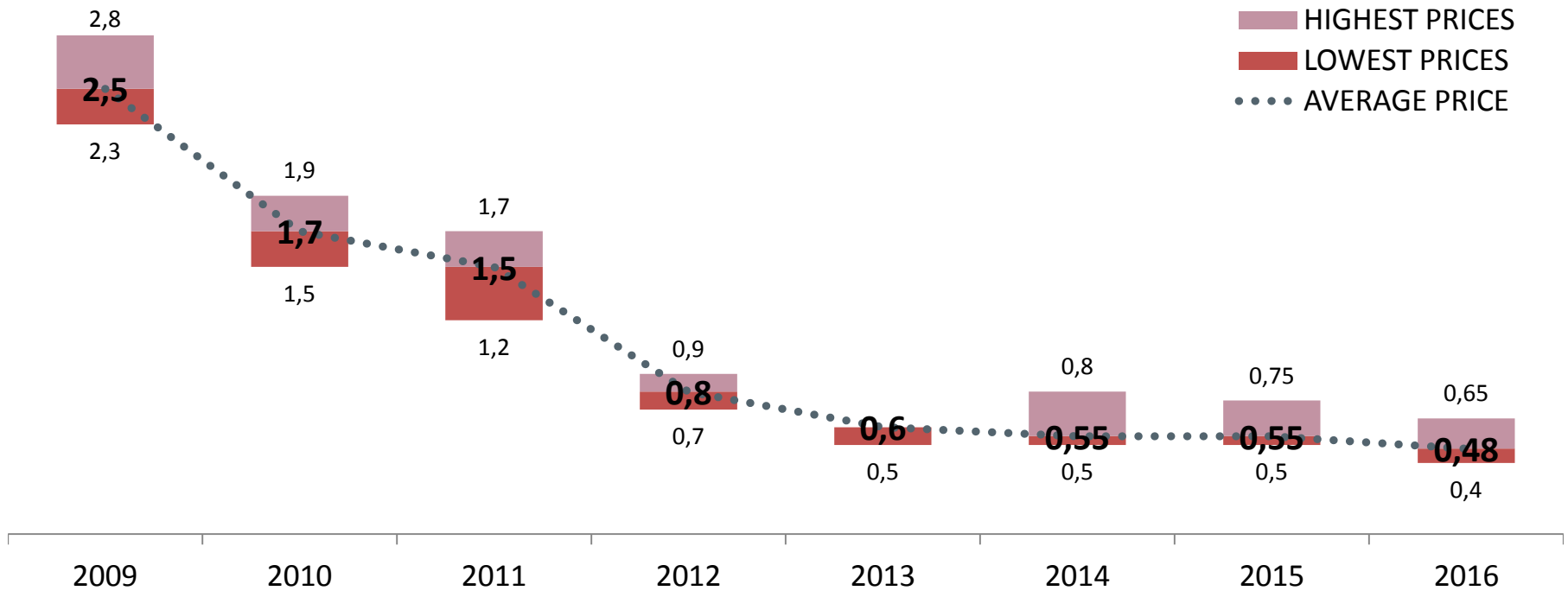
Cost breakdown for a Utility-scale PV systems > 5 MW in 2016 [€/kW]



In the case of utility-scale PV system , the cost of mudules cover the 51% of the total installed cost.
Hardware cost and soft cost amount to 72% and 28% of the total installed cost, respectively,

Market trends: modules

Evolution of prices of PV modules [€/W]

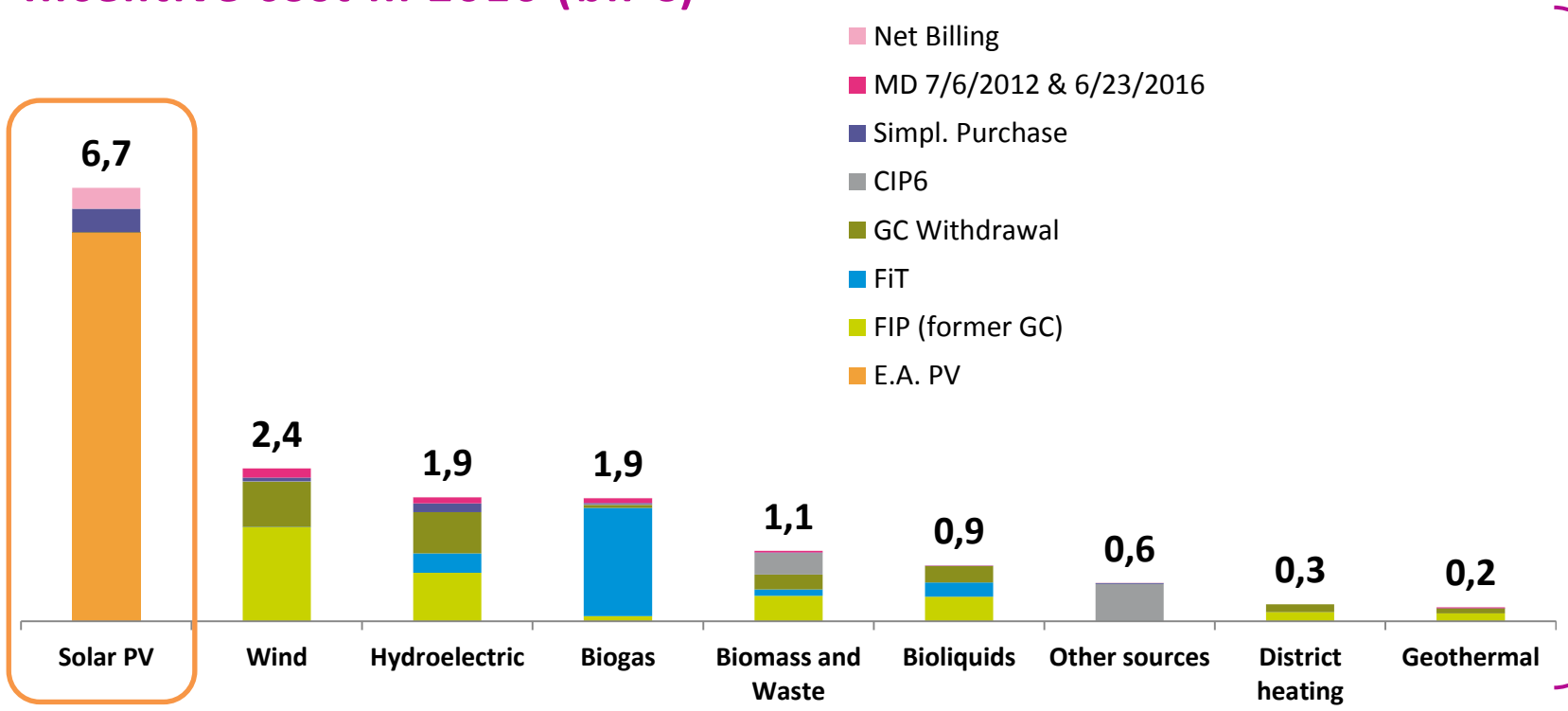


In 2016 PV modules price is about **20%** of 2009 price. In the last 4 years prices continued to decrease but at a slower rate compared to the past.

Cost of incentives: PV and other sources

- In 2016 the total expenditure of GSE for support and purchase of electricity was **15,9 billion euros**. The largest contribution is related to PV plants, with a cost of **6,7 € bn**, mainly related to the Energy Account (**6,0 € bn**)
- Part of the cost is restored by the revenues arising from the electricity sale (1,5 € bn), thus determining a **burden** on electricity bills of **14,4 bn €**

Incentive cost in 2016 (bn €)

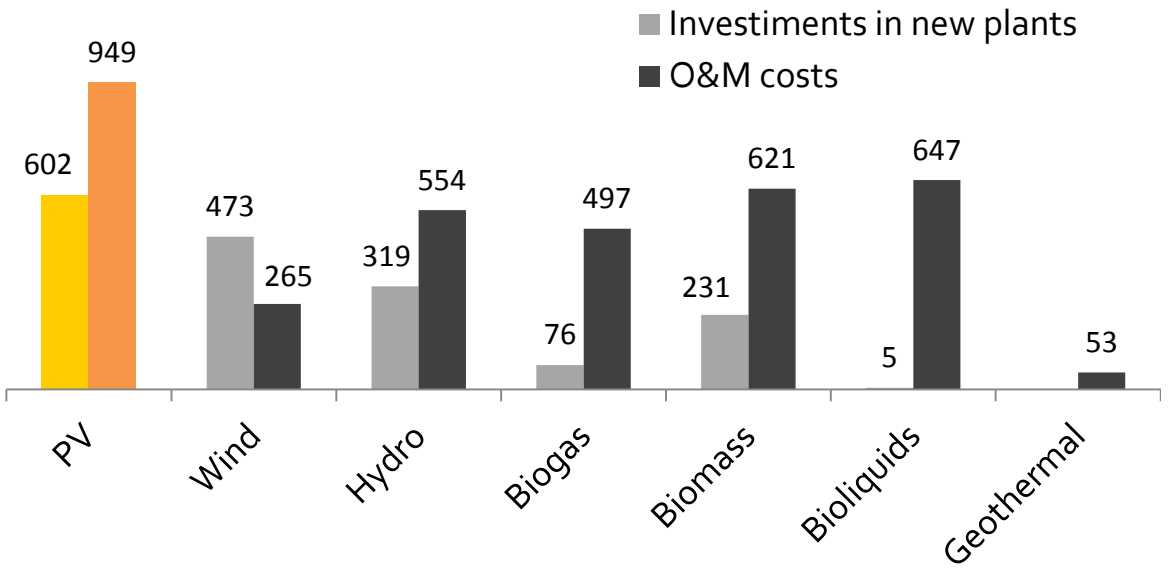


- Total cost: **15,9 € bn**
- Revenue: **1,5 € bn**
- Burden on consumers: **14,4 € bn**

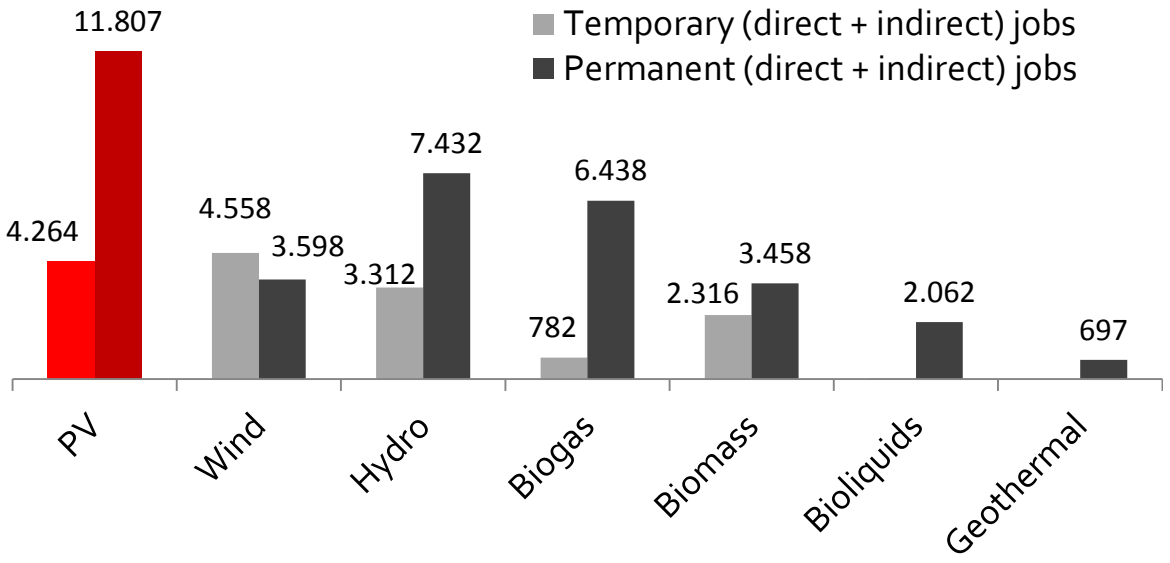
The assessment of economic and employment impacts

- GSE implemented a methodology for the calculation of economic and employment impacts of renewable energy deployment (according to Legislative Decree n.28 of 3rd March 2011)
- The contribution of RES to the Italian economy is calculated within the framework of a standard demand driven IO model, suitably integrated and matched with the statistical and technical-economic data collected and analyzed by GSE
- Results of RES-E sector in 2016 in terms of investments and O&M costs and of jobs (temporary and permanent):

Investments and O&M costs in 2016 [mln €]



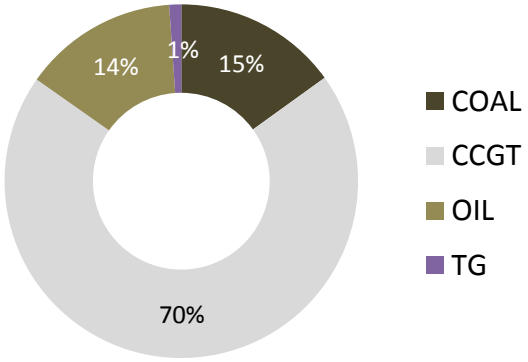
Temporary and permanent employment impacts in 2016 (Full Time Equivalent)



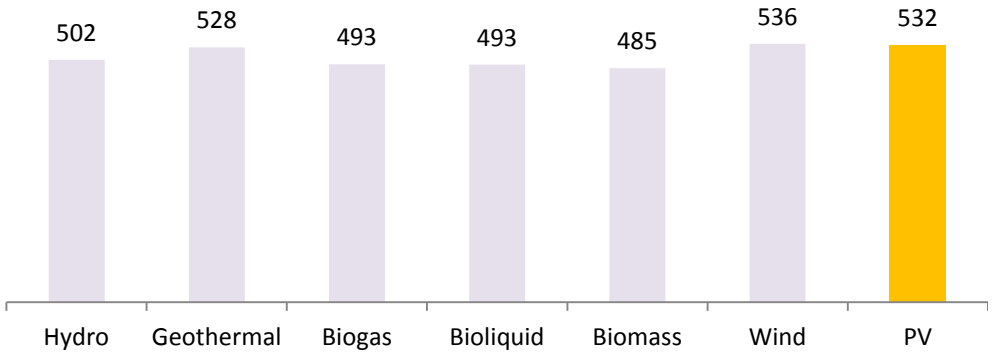
GHG saving by PV

- Each MWh produced by PV avoids **536 kg CO2** related to the marginal fossil fuel (mainly constituted by CCGT)
- **In 2014 8 MtCO2** are avoided by PV production corresponding to the 22% of the GHG saving by RES

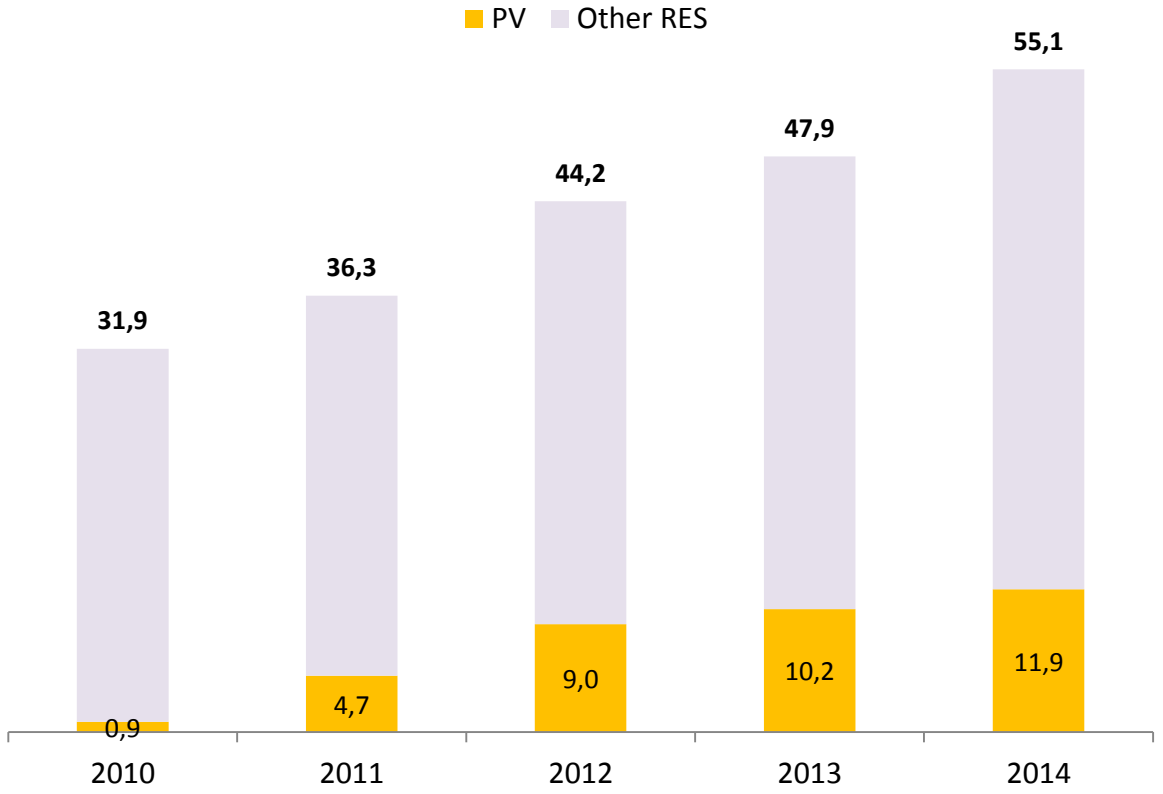
Substituted fossil fuel mix by PV



GHG saving emission factor [kgCO2eq/MWh]



Avoided GHG emissions by RES-E [MtCO2]



Outlook

- ✓ PV role in electricity generation in Italy
- ✓ Anatomy of PV deployment

distribution costs incentives impacts

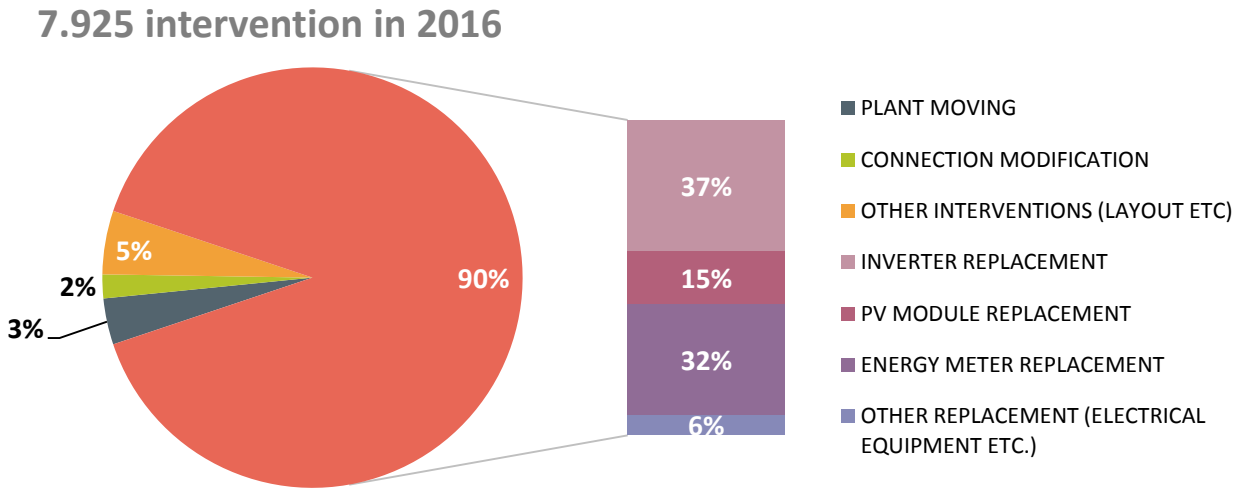
- ✓ New PV trends

optimize existing plants new plants

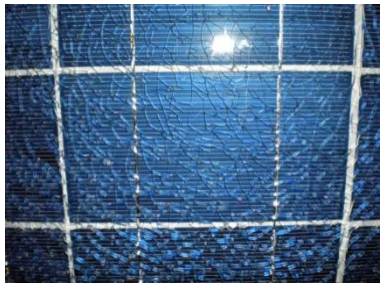
Optimizing existing PV plants: regulation and monitoring

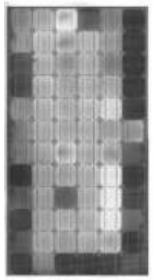
- In February 2017, GSE published the **procedures for maintenance and upgrading of PV plants** supported by Energy Account in order to:
  - **Preserve and optimize PV generation performance** to achieve renewable targets
  - **Simplify administrative practices** for operators dealing with the Energy Account constraints
  - **Disseminate good practices**
- In 2016, **90%** of PV maintenance interventions concern **PV component replacement** (inverter, module, electrical equipment)
- GSE is investigating the potential of behavioral economics for the increase of PV production performance

PV maintenance interventions breakdown



PV glass breaking





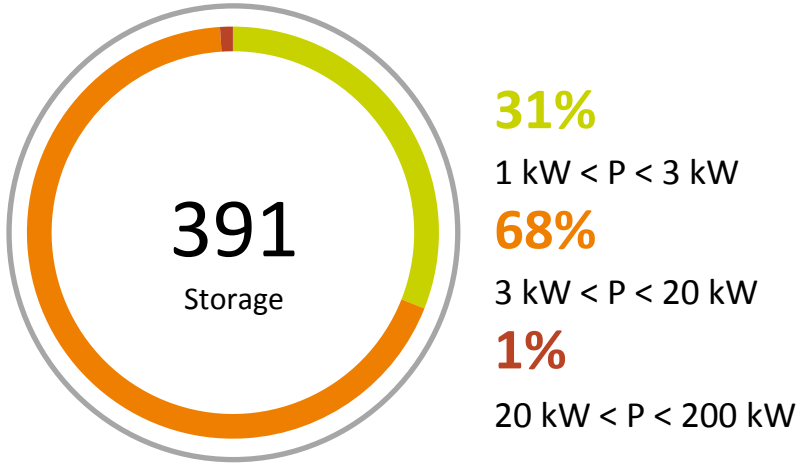
PID effect

Plant moving

Energy Storage Systems and PV

- By the end of 2016, **503 (391 in 2016)** communications of installation of **Energy Storage Systems** were received by GSE
- Most installations concern small size plants (< 20 kW), with the aim of **increasing self consumption**
- **Lithium-ion technology** is prevailing

storage systems by PV size in 2016

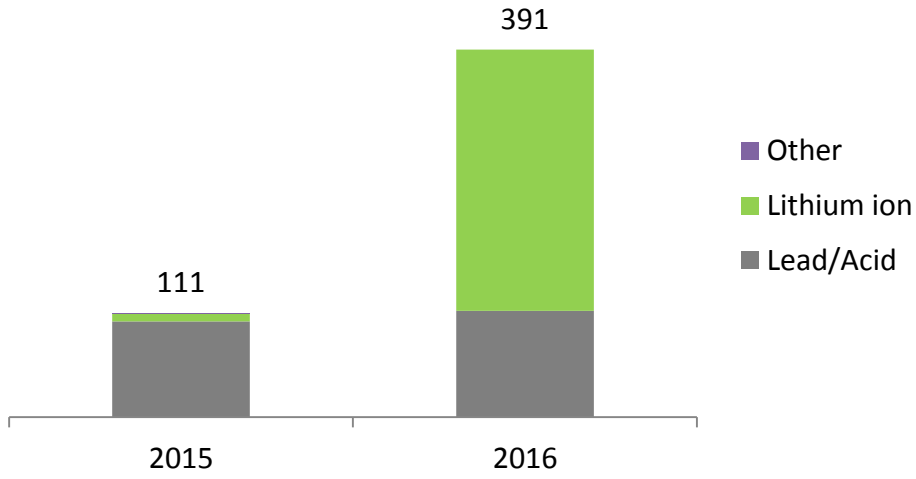


31%
1 kW < P < 3 kW

68%
3 kW < P < 20 kW

1%
20 kW < P < 200 kW

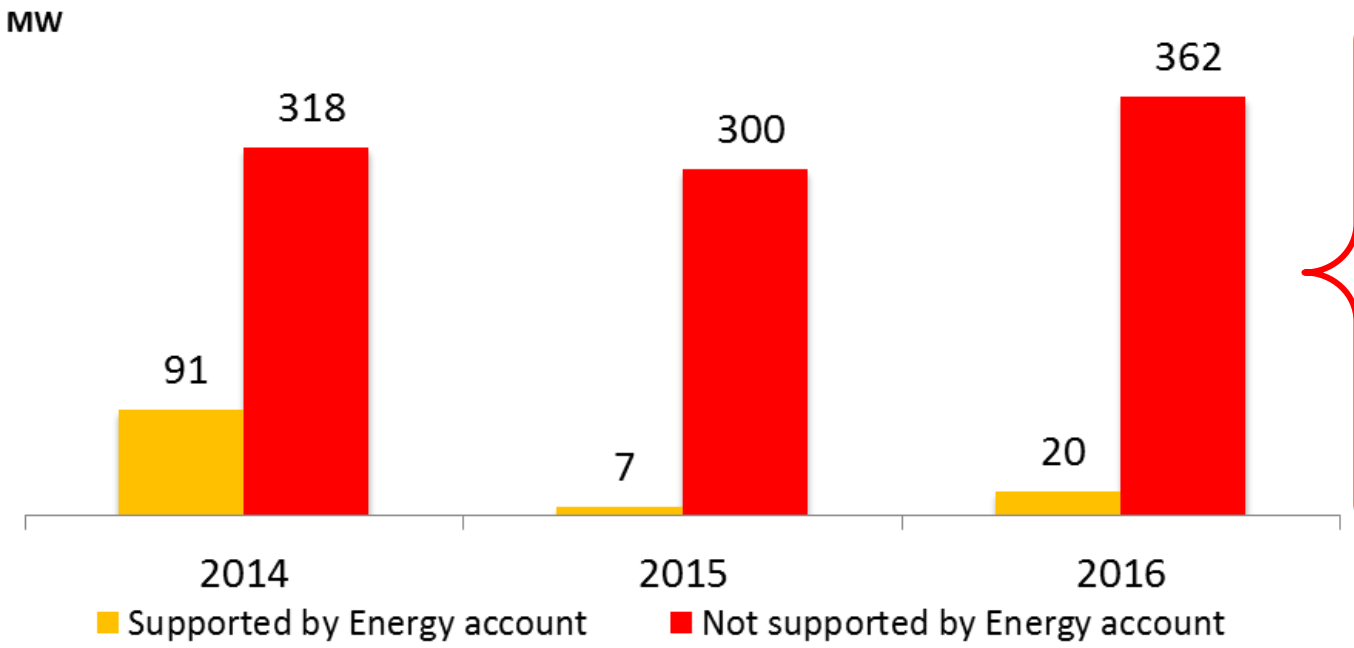
Installed storage systems by technology



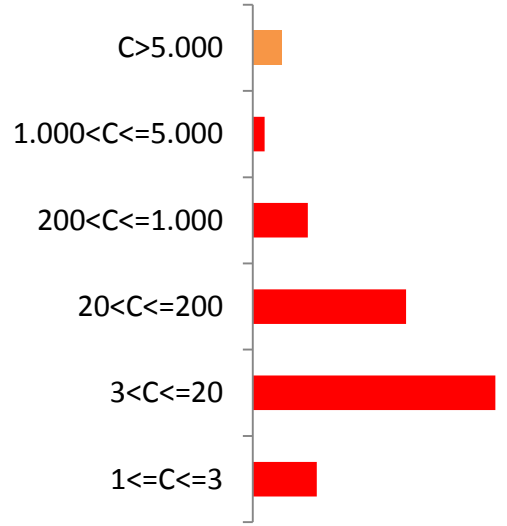
Recent trend of PV installations

- In the past 3 years **more than 300 MW per year** were installed without direct incentives
- Most plants have **small size**, and benefit from "Net billing" scheme and tax credit

New PV capacity 2014-2016



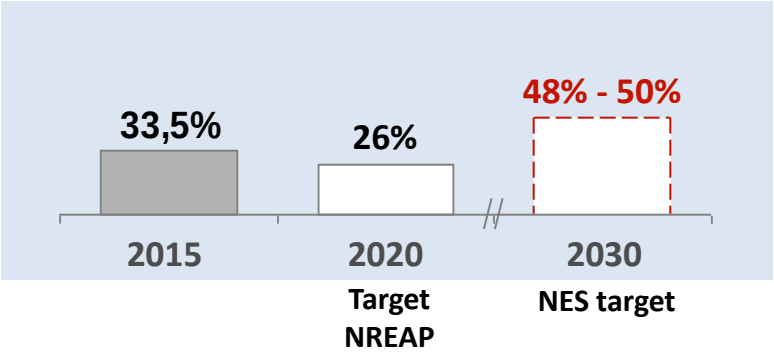
2016 new plants by size



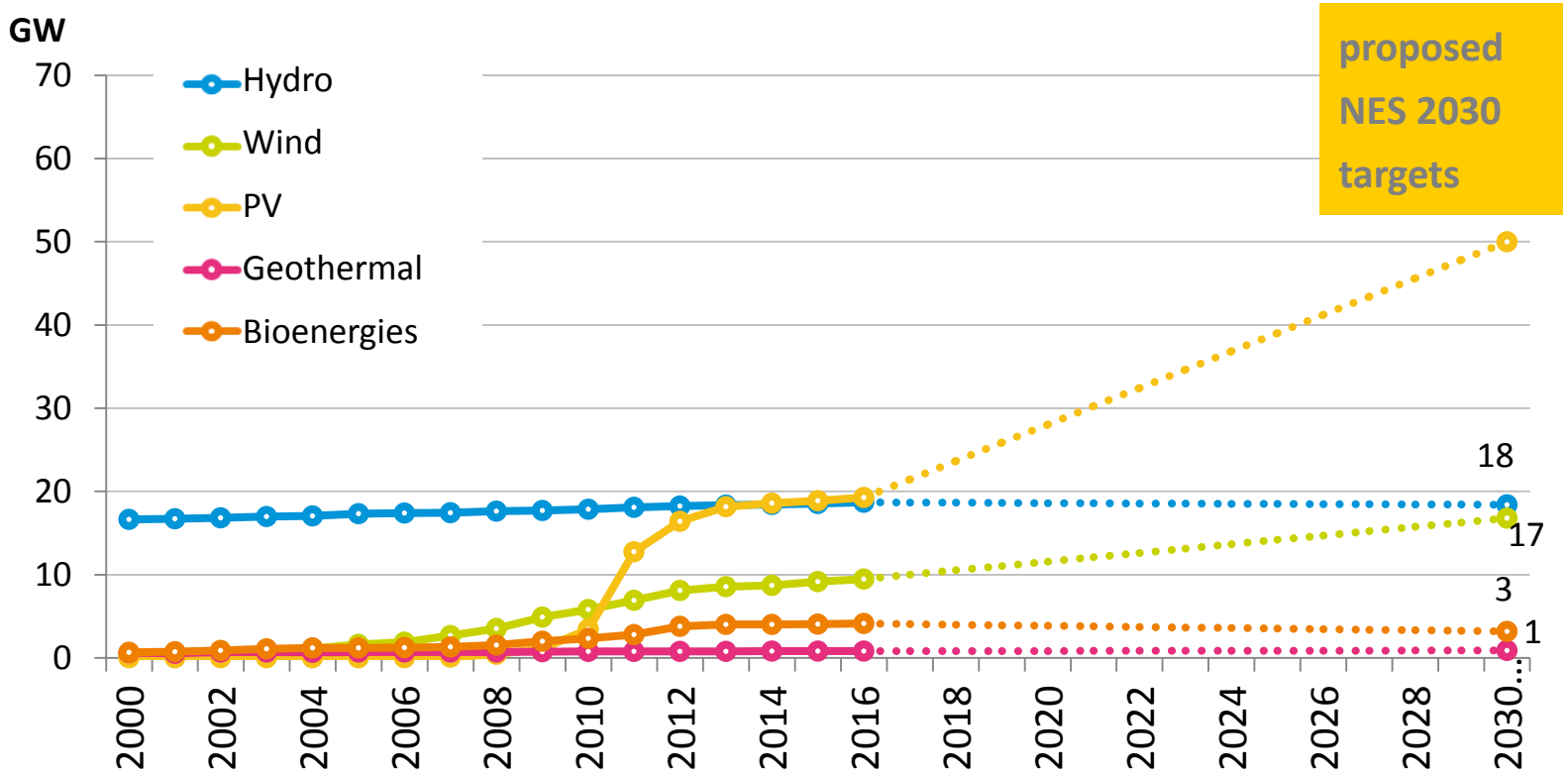
PV role in 2030 energy scenario

- Italy is defining 2030 renewable energy targets in the National Energy Strategy (NES)
- The current NES version defines an increase of **RES share up to 48%-50% in electricity sector** consumptions
- PV capacity is expected almost to **triple by 2030**. That would also require **large PV plants**, and **new business models**

RES share in electricity sector



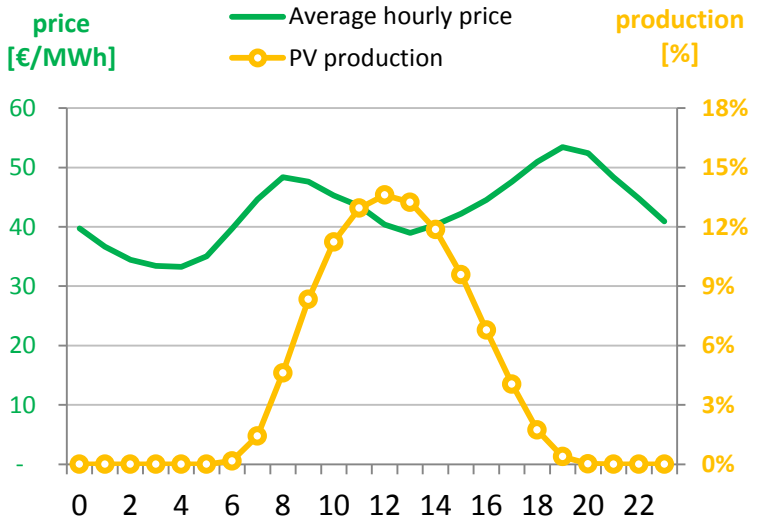
Evolution of PV capacity (GW) and future trends



Economics of future plants: market value of PV energy

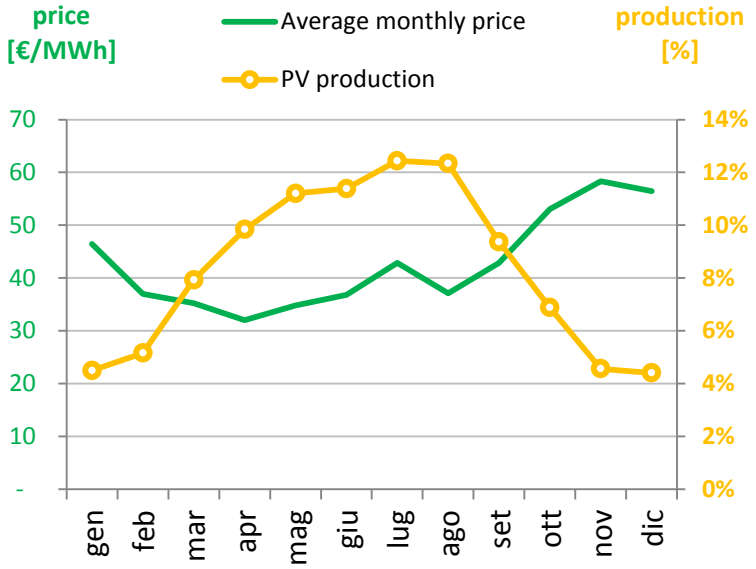
- The new era of large PV plants will require new business model (PPA, auctions etc.)
- The income will have to rely on the **sale of PV energy**. What is the **current value of PV energy in the market?**
- GSE carried out an analysis of PV energy market price in 2016, which depends on the **profiles of PV production and energy price**

Hourly profile



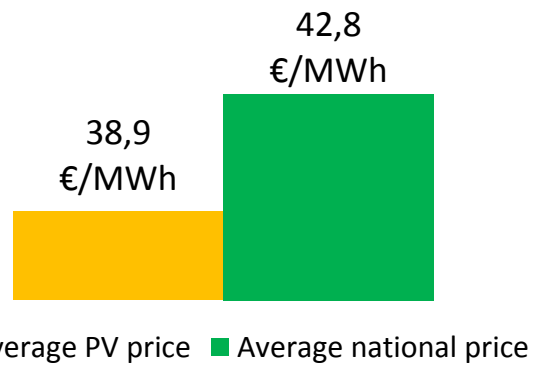
PV daily production bell does not match with the price peaks

Monthly profile



The seasonal PV profile is not in phase with price profile

Market price



In 2016 the average PV price was about **39 €/MWh**, **4 €/MWh less** than average price (43 €/MWh)

2017 latest news and key points for future PV trends

Latest news

- In 2017 more than 60 MW have already been realized in “market parity”
- Technology: ground mounted, with tracking system (mono-axial)
- Industrial approach to squeeze system and O&M costs
- Medium term PPA

Key points

- Address authorization length (30 years?)
- In the short-term, public auctions may be implemented, with a “two-way” approach to stabilize investor income
- After 2020, long term PPAs should be set, defining new standards

contacts

Thank you for your attention

matteo.gianni@gse.it

studi@gse.it