



**Pumped Storage
Hydropower**
International Forum



**Policy and Market
Frameworks
Working Group**

Italy - Europe

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Overview of the Italian electricity market

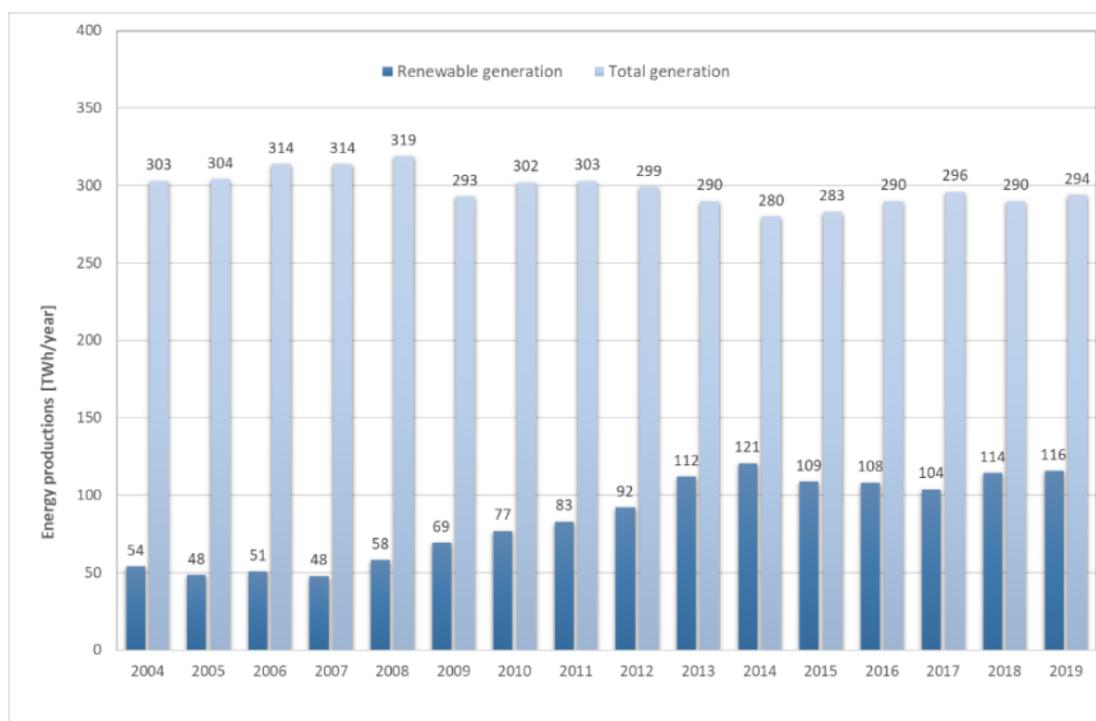
During 2019, as indicated by the European Commission, Italy prepared its National Energy and Climate Plan (NECP), specifying expected targets and actions for mitigating climate change over the next decades.

In particular, Italy intends to adopt specific tools in the medium-to-long term in order to ensure the availability of necessary capacity of the electricity system including CO2 emission limits per unit of energy supplied. This would thus promote low environmental impact plants and renewables, while excluding coal plants. In the electricity sector, this implies a commitment to move from around 36% renewables estimated in 2020, to 55% in 2030.

After the economic crisis of 2009, the demand for power generation on the Italian network had stabilized, decreasing to around 290 TWh, while the contribution of renewables gradually increased in 7 years from about 50 TWh in 2004 up to a maximum of 121 TWh in 2014, and reaching around 110-120 TWh in recent years, thanks to national policy incentives.

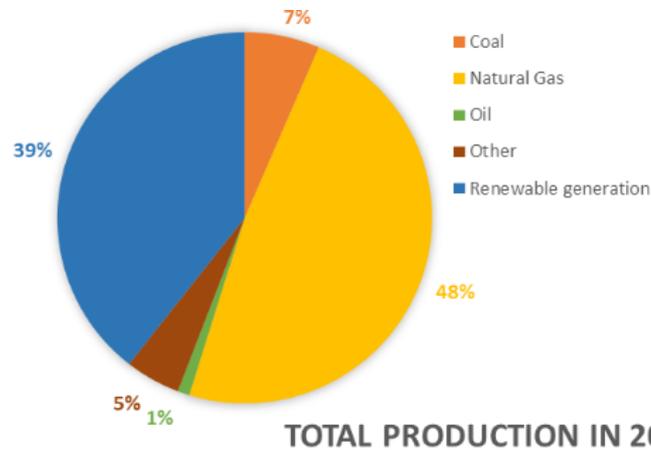
Meanwhile the use of all fossil sources has decreased, with the exception of natural gas which has increased by 51% since 2014; noting in 2019, 48.2% of national production derives from natural gas. The share of renewables in gross electricity production was 39.4% in 2019.

Figure 1 Renewable and total generation in Italy for the period 2004-2019 (GSE source¹)



¹ Gestore Servizi Energetici “[Fonti Rinnovabili in Italia e Nelle Regioni 2012 – 2018](#)”; and Gestore Servizi Energetici – “[Rapporto Statistico 2019](#)”

Figure 2 Sharing of the Italian electricity total production in 2019 (GSE source²)



Hydropower generation, which had been steadily above 70% of the total national renewable generation until 2007, gradually decreased its share in the following years down to 50% in 2014, and then recently settled at around 45%.

This progressive reduction of the hydropower share in the energy mix undoubtedly derives from the increase of the other renewable sources. But it has also been reduced due to the aging of existing plants which require rehabilitation and improvement interventions, which so far have been delayed by postponed renewals of the Hydroelectric Concessions.³



² Gestore Servizi Energetici – [“Rapporto Statistico 2019”](#)

³ Problem of renewing the expiring (and in part already expired) Italian hydroelectric concessions (possibly with a European common standard): Presently the Italian hydroelectric concessions last 30 years and are in majority expired or near to the end. It does not exist a national law to organize renewals tenders; some regional laws are at a discussion level.

Figure 3 Generation from different renewable energies in Italy for the period 2004-2019 (GSE source⁴)

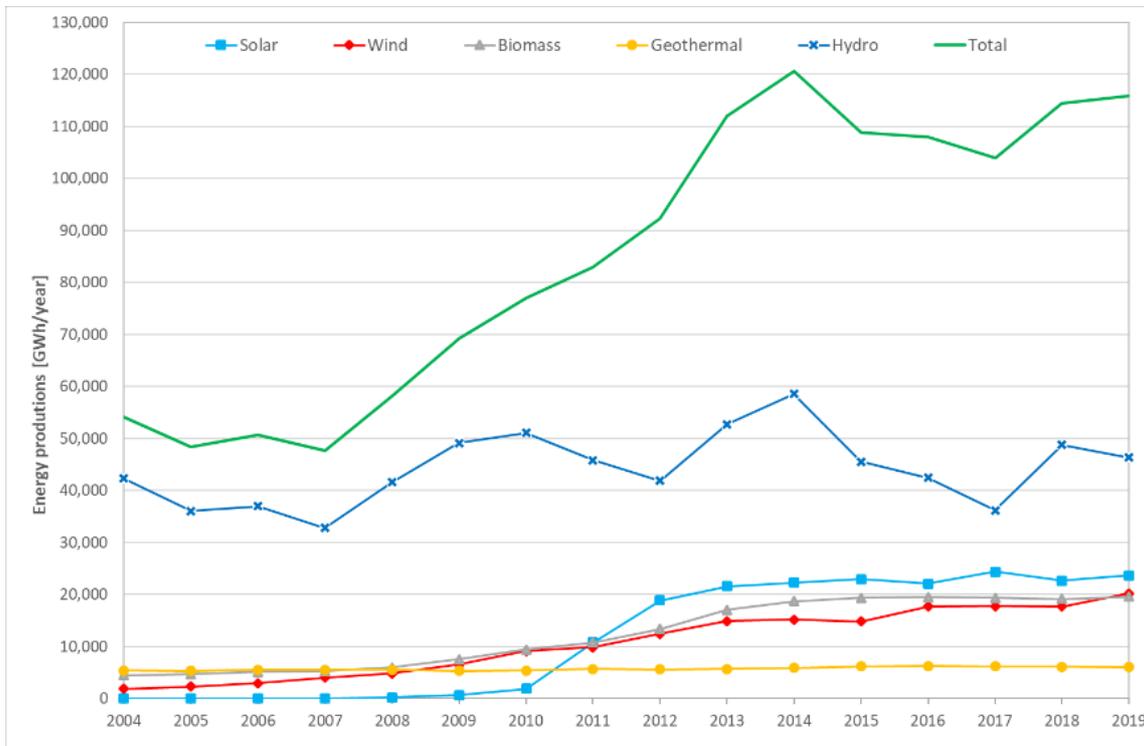
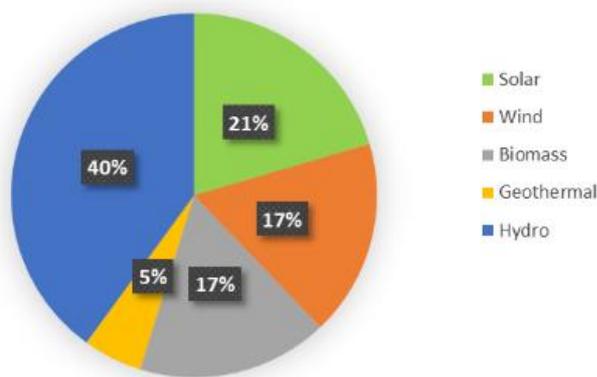


Figure 4 Sharing of the Italian electricity renewable production in 2019 (GSE source⁵)

Renewable energy in 2019



The main institutional subjects of the energy transition are the Government (particularly the recently instituted Ministry of Ecological Transition), GSE (Gestore dei Servizi Energetici – Energy Services Operator, in charge of the management of incentive schemes to renewables and energy efficiency), ARERA (the Regulatory Authority for Energy, Networks and Environment) and the Transmission System Operator Terna.

⁴ <https://www.gse.it/dati-e-scenari/statistiche>

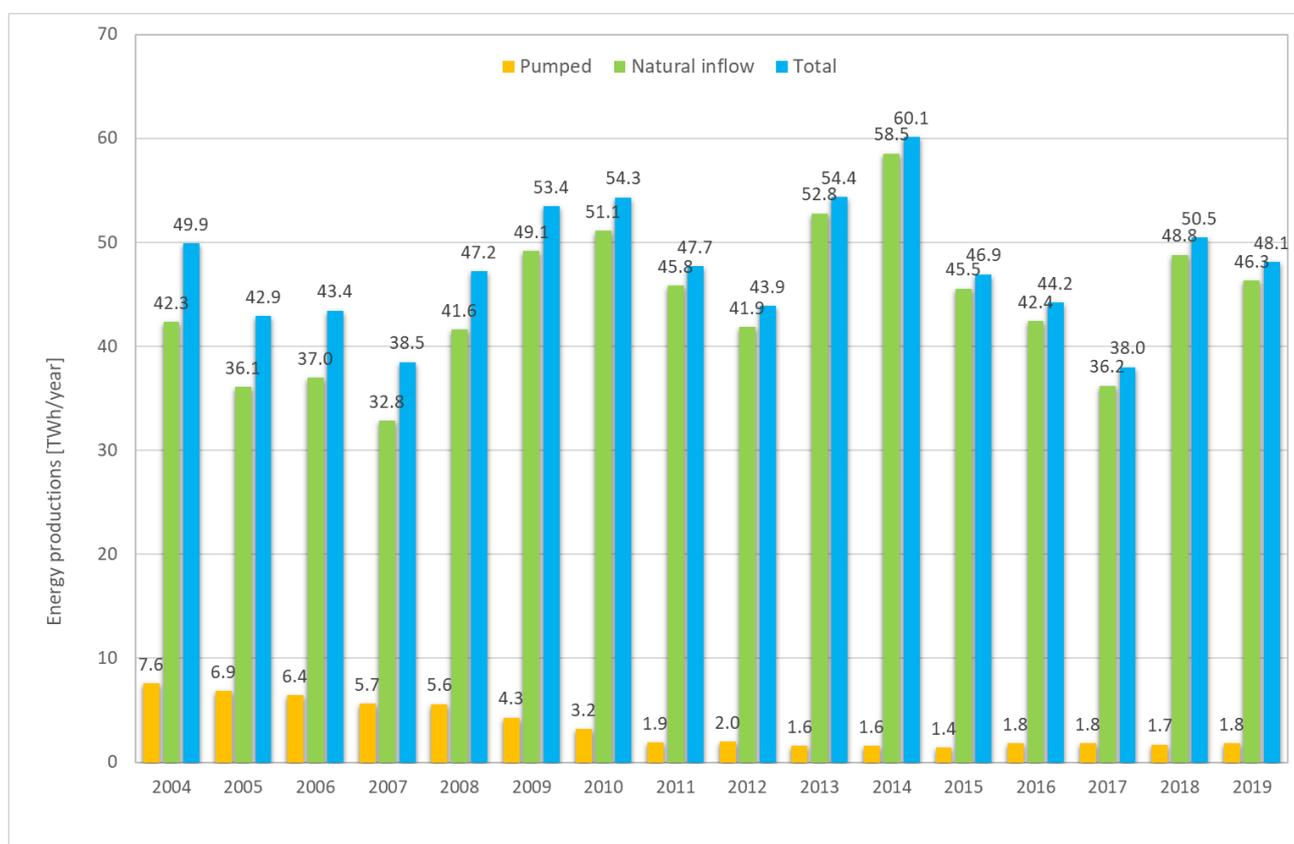
⁵ Gestore Servizi Energetici – “Rapporto Statistico 2019”

Current status of pumped storage and development potential

The progressive growth of electric production from non-programmable renewable sources tends to create serious difficulties for balancing the national power system. This leads to a growing need for energy storage systems to manage the difficult relationship between supply and demand, in order to stabilize the frequency of the grid and ensure continuity of service. Terna and GSE have studied on quantifying the future need for storage/PSH to ensure reliability/resilience in Italy.

Even if pumped storage hydropower plants have the advantage of being able to perform this function more efficiently and cheaply than other storage systems for important powers and long durations, the following figure shows how pumped hydro generation in Italy has drastically decreased in the last decade, stabilising below 2 TWh per year, compared to previously about 8 TWh per year. This highlights an already consolidated problem of insufficient remuneration of services provided to the system, as costs are not covered by operations under the present market conditions.

Figure 5 Pumped and natural inflow generation in Italy for the period 2004-2019 (GSE source⁶)

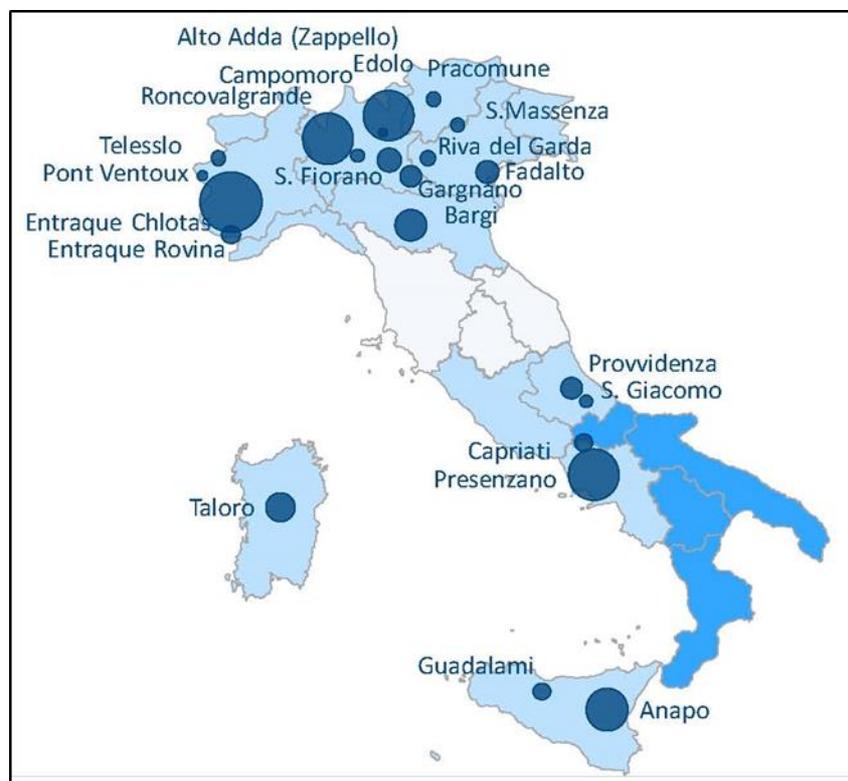


Currently 22 main PSH plants are operating in Italy, with a maximum capacity of about 6.5 GW in absorption (pumping) and 7.6 GW in production. Of these, the largest 6 exceed a capacity of 500 MW for a total of about 5,240 MW.

The overall geographic distribution is of 5,090.3 MW (66.9 %) in the North of Italy, 1,702.0 MW (22.3 %) in the Central and Southern regions and 820.0 MW (10.8 %) in Sicily and Sardinia.

⁶ <https://www.gse.it/dati-e-scenari/statistiche>

Figure 6 Location of existing hydroelectric pumped plants in Italy



Generation companies own the whole fleet of PSH plants, while the Transmission System Operator Terna is not authorized to build and operate any generation or pumped storage, according to the European Directive 944/2019 on the interior market of the electric energy. These plants' presently insufficient remuneration relies on price arbitrage between low and high price hours or Terna's services compensation.

Challenges, barriers and emerging opportunities for pumped storage development

In the Italian market, there is a recognized necessity to develop new hydroelectric pumped storage plants: the Italian National Energy and Climate Plan⁷ foresees 6 GW of new centralized storage systems, with 3-4.5 GW of pumped storage hydro plants.

For this purpose, the introduction of a sort of "capacity market" would seem necessary, to allow the feasibility of investments by providing long-term economic signals, since the shorter-term ones deriving from spot markets proved to be insufficient. However, such a measure is debated because it could introduce distorting effects on competition.

On the other hand, the long-standing problem of renewing the expiring (and in part already expired) hydroelectric concessions has not yet found a solution. Consequently, the regions are called to short-term legislate on this subject, with the State in the role of regulator and making a possible takeover in case of default. Since 2018 the national Transmission System Operator has commissioned a series of "Surveys", partly still in progress. These aim to verify in the southern regions and in the main islands, the possibility and feasibility of

⁷ Italian National Energy Contribution Plan

building new hydroelectric pumped storage plants using a portion of the capacity of existing reservoirs, either connecting between themselves, or in combination with a new suitable impound.

There is a timely need for one or more tenders to promote and at least partially finance new hydroelectric pumped storage plants. Especially in areas of the country particularly at risk of energy deficiencies following the abandonment of coal and / or of overgeneration from non-programmable renewables.

When considering the urgency of requiring sufficient electricity storage capacity between 2023 and 2030, developing specific legislation that rationalizes and simplifies the authorization procedures and timelines will also play a fundamental role to achieve this goal.

Recommendations

1. Government and Regulatory Agencies.

To find a solution to the long-standing problem of renewing the expiring (and in part already expired) Italian hydroelectric concessions (possibly with a European common standard).

2. Government and Regulatory Agencies.

To define a tariff policy that provides an economic remuneration for the role of strategic reserve and regulator instrument of the electricity grid which is attributed to hydroelectric pumped plants.

3. Government

To launch one or more tenders aimed to promote and at least partially finance new hydroelectric pumped plants in areas of the country particularly at risk of energy deficiencies following the abandonment of coal and / or of overgeneration from non-programmable renewables.

4. Government

To launch a specific legislation that rationalizes and simplifies the authorization procedures and timelines for new hydroelectric pumped plants.

