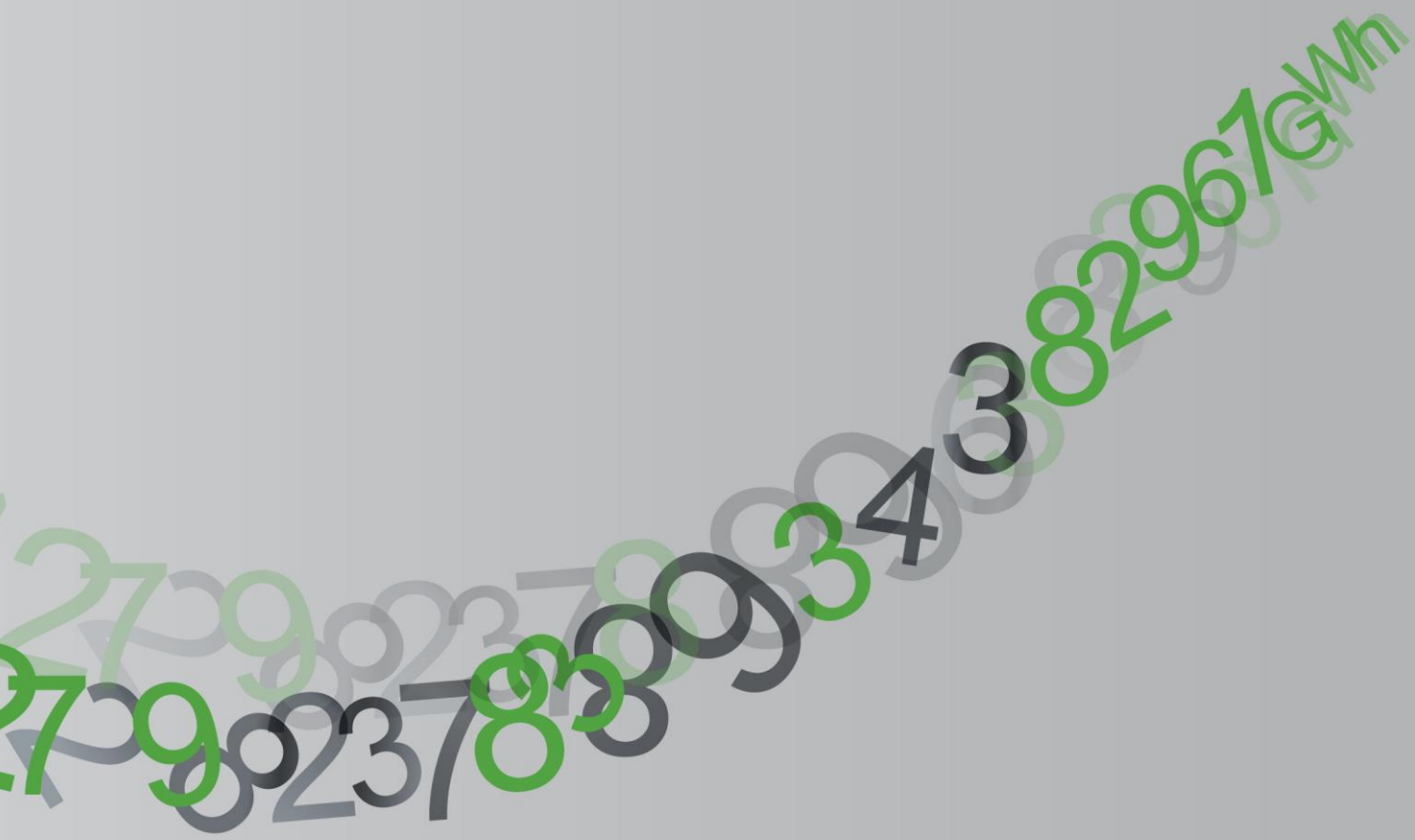
GSE
Gestore
Servizi
Energetici

Statistical Report 2011

Renewable Energy Power Plants in Italy



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Introduction

The yearly growth of renewable-energy power plants in Italy continues at a very fast pace. In each of the past six years, their number doubled with respect to the previous year, reaching **335,151** in 2011. Installed capacity in 2011 was equal to **41,399 MW**, more than twice the one of 2000 (18,335 MW). Major contributors are new wind farms, bioenergy plants and, above all, photovoltaic plants, which had a boom in 2011.
Thanks to the new installations, generation from renewables hit a new record of **82,961 GWh**, i.e. 8% more than in 2010.

The EU Directive on "renewables" requires Italy to increase renewable energy by up to 17% of gross final energy consumption. The National Renewable Energy Action Plan (NREAP) of June 2010 shared the related burden among the Electricity, Heating & Cooling and Transport sectors.
For the electricity sector, the target to be achieved by 2020 is 26.4% of electricity consumption from renewables. In 2011, Italy recorded 23.5%, surpassing by wide margins the 2011 intermediate target of 19.6%. Given this performance, the 26.4% target to be attained by 2020 will be revised upwards (based on the preliminary version of the National Energy Strategy).

GSE is a publicly-owned company with the mission of promoting renewable energy in Italy, by granting incentives and offering services to renewable power producers. Jointly with TERNA, it provides national electricity statistics as part of SISTAN, the official national statistical network.
GSE's Statistical Office supplies data on all plants using solar energy and on other plants of up to 200 kW. GSE statistics mostly rely on in-house certified databases, which have been set up for institutional duties. This assures data quality, accuracy and fast release.

This publication consists of three sections. The first one includes: an overview of national renewable power plants; the national electricity balance; the progress made towards the achievement of the Italian target as per Directive 28/2009/EC; the number of plants, their installed capacity and generation. The second section focuses on plants receiving support from or using the services provided by Gestore dei Servizi Energetici (GSE). National data are reported by: feed-in premium (*conto energia*), all-inclusive feed-in tariff (*tariffa onnicomprensiva*), feed-in tariff (*CIP6*), Green Certificates, indirect sale of electricity through GSE (*ritiro dedicato*) and net metering (*scambio sul posto*).
The report ends with a section devoted to international comparisons, which reports data on generation from renewables in the EU-15.

Any inconsistencies in the data shown in the tables are due to the rounding-off of the underlying elementary data.

Definitions

Bioenergy: the set of biomass (biodegradable municipal waste and other biomass), biogases and bioliquids.

- **Biomass**: the biodegradable fraction of products, waste and residues from agriculture, including vegetal and animal substances, forestry, fisheries, aquaculture and gardening (Legislative Decree 28/2011, transposing Directive 2009/28/EC).
- **Biogases**: mainly consisting of methane (at least 50%) and of carbon dioxide from anaerobic fermentation of organic matter of vegetal and animal origin. Legislative Decree 28/2011 defines them as landfill gas, sewage gas and others, depending on their origin and mode of fermentation.
- **Bioliquids:** liquid fuel for energy purposes other than for transport, including electricity and heating & cooling, produced from biomass (Legislative Decree 28/2011).

Electricity generated by a photovoltaic plant: electricity measured at the output of the unit converting direct current into alternating current (inverter), before being delivered to the consuming units of the end user and/or injected into the power grid.

Electricity generation from biodegradable municipal solid waste: under statistical arrangements with Eurostat, it is assumed to be equal to 50% of generation from municipal solid waste.

Electricity supplied to the grid (or electricity demand): electricity supplied for consumption, minus exports and plus imports. The electricity supplied is equal to the sum of electricity consumption at the premises of end users and of transmission and distribution losses along the grid.

Energy from Renewable Sources (RES): energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases (Legislative Decree 28/2011).

Equivalent utilisation hours of power plant capacity: hours equal to the ratio of generation to maximum capacity (kWh/kW).

Generation: conversion of an energy source into electricity. In analogy with capacity, it may be: gross, if it is measured at the terminals of the electrical generators of the power plant; and net, after deducting the power consumed by auxiliaries and the power lost in step-up transformers.

Gross Final Energy Consumption (GFC): energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy sector for electricity and heat production and including losses of electricity and heat in distribution and transmission (Legislative Decree 28/2011).

Gross Final Electricity Consumption (GFEC): gross generation of electricity, net of generation by pumped-storage plants, plus imports and minus exports (from/to foreign countries or regions) pursuant to Directive 2009/28/EC.

Gross Final Electricity Consumption from Renewable Energy (GFEC RES): equivalent to the amount of electricity produced from renewable energy sources. The contributions of hydro power and wind power have to be calculated with the normalisation rules set out in annex II of Directive 2009/28/EC.

Maximum capacity: maximum electrical capacity which may be generated continuously throughout a prolonged period of operation, assuming that all the parts of the plant are fully efficient and under optimum conditions. Maximum capacity may be: gross, if it is measured at the terminals of the electrical generators of the plant; and net, after deducting the power consumed by the auxiliaries of the plant and the power lost in the step-up transformers.

Pumped-storage plant: hydro reservoir power plant equipped with reversible turbines. This plant withdraws electricity from the grid to pump water from a lower reservoir to an upper reservoir and stores energy which may subsequently be converted into electricity and injected into the grid. A pure pumped-storage plant is one without significant natural cumulative flows.

Units of measurement:

Capacity	1 MW=1,000 kW	1 GW=1,000,000 kW	1 TW=1,000,000,000 kW
Generation	1 MWh=1,000 kWh	1 GWh=1,000,000 kWh	1 TWh=1,000,000,000 kWh

Number and capacity of renewable power plants in Italy

	2010		2011		2011 / 2010 % change	
	no.	MW	no.	MW	no.	MW
Hydro	**2,729**	**17,876**	**2,902**	**18,092**	**6.3**	**1.2**
0 _ 1 (MW)	1,727	523	1,858	568	7.6	8.5
1 _ 10 (MW)	700	2,210	743	2,328	6.1	5.3
> 10 (MW)	302	15,142	301	15,196	-0.3	0.4
Wind	**487**	**5,814**	**807**	**6,936**	**65.7**	**19.3**
Solar	**155,977**	**3,470**	**330,196**	**12,773**	**111.7**	**268.1**
Geothermal	**33**	**772**	**33**	**772**	**0.0**	**0.0**
Bioenergy	**669**	**2,352**	**1,213**	**2,825**	**81.3**	**20.1**
Biomass	142	1,243	170	1,289	19.7	3.7
– from municipal waste	*71*	*798*	*71*	*828*	*0.0*	*3.7*
– other biomass	*71*	*445*	*99*	*461*	*39.4*	*3.7*
Biogas	451	508	819	773	81.6	52.3
– from waste	*228*	*341*	*260*	*356*	*14.0*	*4.4*
– from slurries	*47*	*15*	*60*	*30*	*27.7*	*104.0*
– from animal dung	*95*	*41*	*165*	*89*	*73.7*	*116.3*
– from agriculture and forestry	*81*	*110*	*334*	*298*	*312.3*	*169.7*
Bioliquids	97	601	275	763	183.5	27.0
– vegetable oils	*86*	*510*	*234*	*654*	*172.1*	*28.2*
– other bioliquids	*11*	*91*	*41*	*110*	*272.7*	*20.1*
Total	**159,895**	**30,284**	**335,151**	**41,399**	**109.6**	**36.7**

The number and capacity of bioenergy plants are reported by group and by fuel.

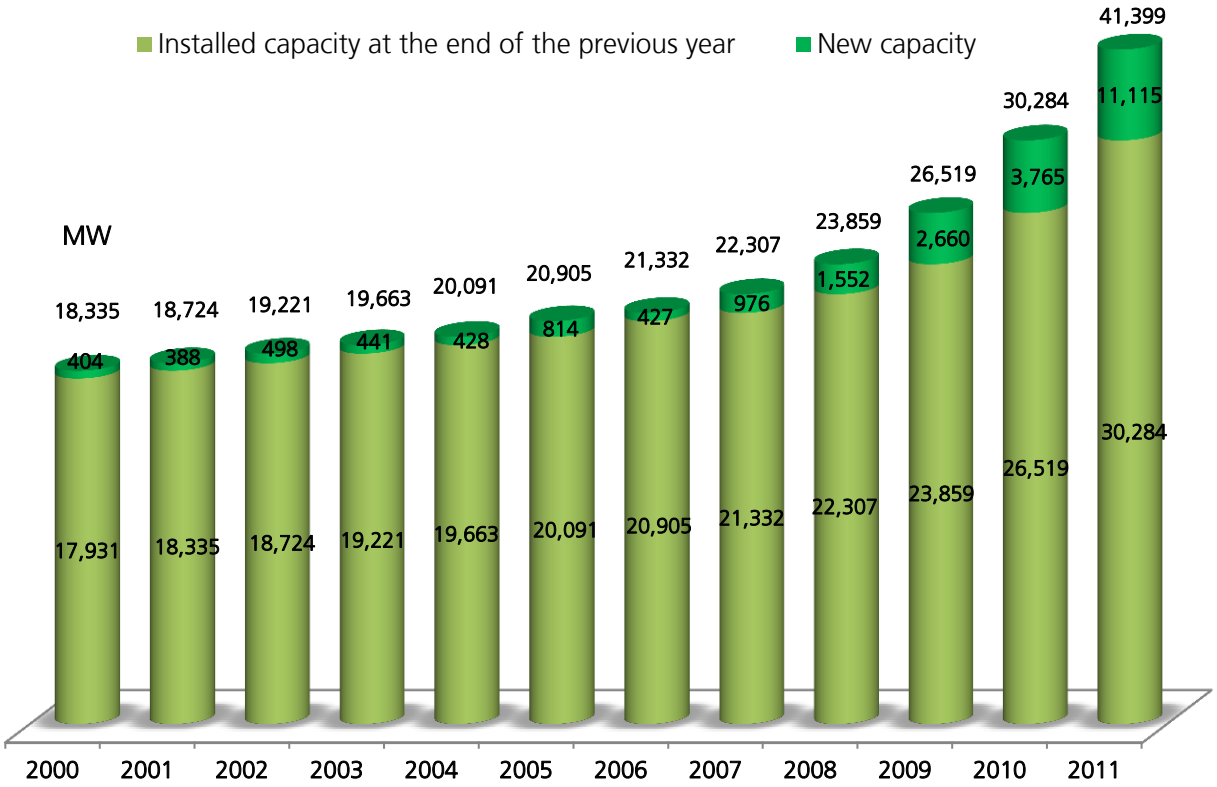
In 2011, renewable power plants totalled 335,151 (more than twice the value of 2010), with a gross maximum capacity of 41,399 MW thanks to 11,115 MW of new capacity (+37%).

The rise from 2010 is due to the sharp growth of the solar source. As in 2010, photovoltaic plants more than doubled their number, passing from 155,977 to 330,196, and more than tripled their installed capacity (from 3,470 MW to 12,773 MW).

Also the wind source increased in 2011: the number of wind power plants was up by roughly 320, with 1,122 MW of new installed capacity.

The strong growth of biogas and bioliquid plants explains the increase in the installed capacity (+20%) and number (+81%) of bioenergy plants.

Installed capacity of renewable power plants in Italy



From 2000 to 2011, gross maximum installed capacity mounted by 23,064 MW (from 18,335 MW to 41,399 MW), about one half of which commissioned in 2011.

From 2000 to 2011, the yearly average growth rate of overall capacity was 5%, while the one of new capacity was equal to 35%.

In effect, the renewable generating mix mostly includes hydro power plants, whose installed capacity remained practically steady in the past few years (+0.8% on average per year). Therefore, the capacity of hydro power plants, which accounted for about 91% of the total in 2000, was equal to as little as 44% in 2011.

The introduction of support schemes has sustained the fast-paced deployment of new sources (solar photovoltaic and wind) and of bioenergy.

Generation by renewable power plants in Italy

	2010		2011		2011 / 2010 % change	
GWh	Actual	Normalised[1]	Actual	Normalised[1]	Actual	Norm.[1]
Hydro	**51,117**	**43,393**	**45,823**	**44,012**	**-10.4**	**1.4**
Wind	**9,126**	**8,787**	**9,856**	**10,266**	**8.0**	**16.8**
Solar	**1,906**	**1,906**	**10,796**	**10,796**	**466.5**	**466.5**
Geothermal	**5,376**	**5,376**	**5,654**	**5,654**	**5.2**	**5.2**
Bioenergy	**9,440**	**9,440**	**10,832**	**10,832**	**14.7**	**14.7**
Biomass	4,308	4,308	4,730	4,730	9.8	9.8
– biodegradable municipal waste[2]	*2,048*	*2,048*	*2,218*	*2,218*	*8.3*	*8.3*
– other biomass	*2,260*	*2,260*	*2,512*	*2,512*	*11.2*	*11.2*
Biogas	2,054	2,054	3,405	3,405	65.7	65.7
– from waste	*1,415*	1,415	*1,528*	1,528	*8.0*	*8.0*
– from slurries	*28*	28	*63*	63	*121.5*	*121.5*
– from animal dung	*221*	221	*362*	362	*63.6*	*63.6*
– from agriculture and forestry	*390*	*390*	*1,453*	*1,453*	*272.3*	*272.3*
Bioliquids	3,078	3,078	2,697	2,697	-12.4	-12.4
– vegetable oils	*2,682*	*2,682*	*2,531*	*2,531*	*-5.6*	*-5.6*
– other bioliquids	*397*	*397*	*166*	*166*	*-58.1*	*-58.1*
Total	**76,964**	**68,902**	**82,961**	**81,561**	**7.8**	**18.4**
Total/Gross Final Consumption	22.4%	20.1%	24.0%	23.5%		
Gross Final Consumption	**342,933**	**342,933**	**346,368**	**346,368**	**1.0**	**1.0**

1) To smooth natural variability, the values of hydro and wind power generation have been normalised as follows pursuant to Directive 2009/28/EC:

for the hydro source, pure hydro plants (PHP) and mixed pumped-storage plants (MPSP) are considered separately:

$$Q_{N(norm)} = C_N^{PHP} * \frac{\left[\sum_{i=N-14}^{N} \frac{Q_i^{PHP}}{C_i^{PHP}}\right]}{15} + C_N^{MPSP} * \frac{\left[\sum_{i=N-14}^{N} \frac{Q_i^{MPSP}}{C_i^{MPSP}}\right]}{15}$$

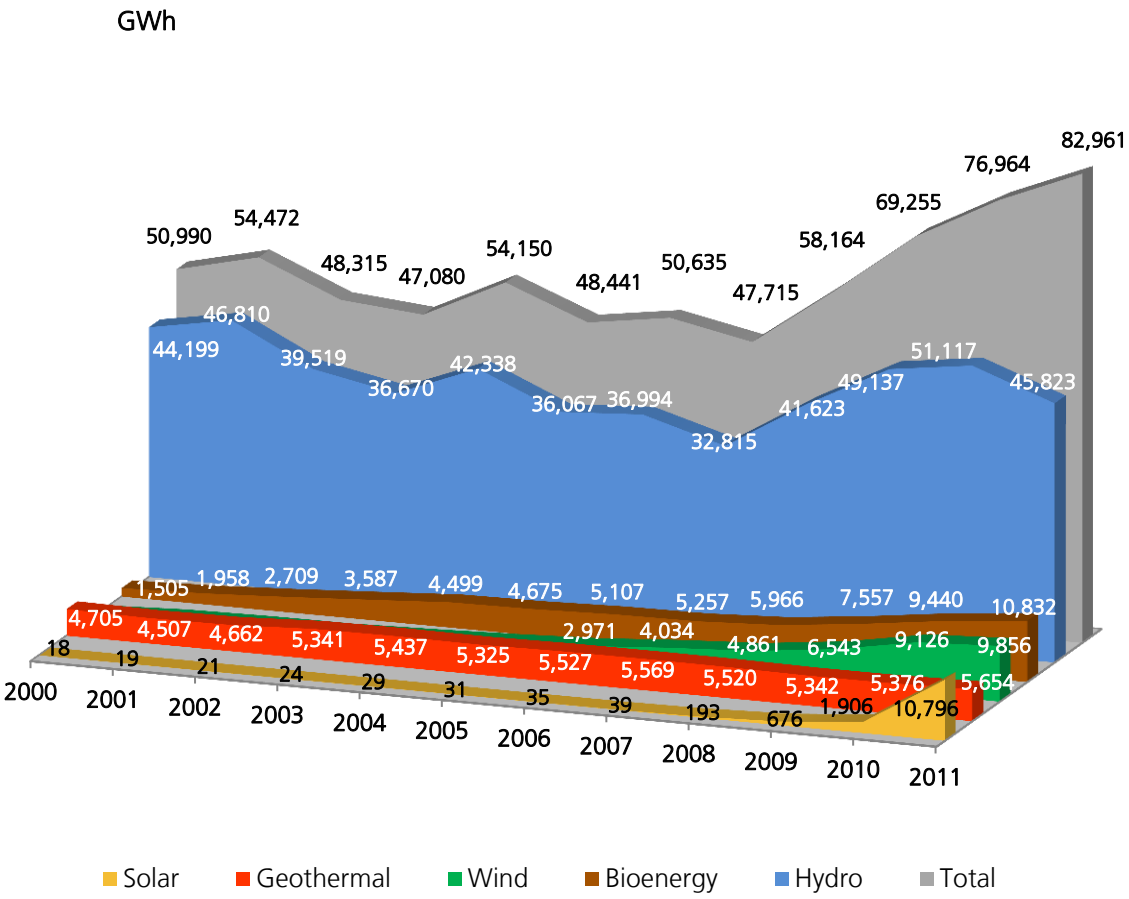
for the wind source

$$Q_{N(norm)} = \frac{C_N + C_{N+1}}{2} * \left[\frac{\sum_{i=N-n}^{N} Q_i}{\sum_{j=N-n}^{N}\left(\frac{C_j + C_{j-1}}{2}\right)}\right]$$

where
N = reference year;
$Q_{N(norm)}$ = normalised electricity generated by all the hydro or wind power plants in the year N;
Q_i = electricity in GWh actually generated in the year i;
C_i= total installed capacity in MW of all the power plants;
n = for the wind source, it is equal to the lower between 4 and the number of years preceding the year for which the data are available.

2) Only the biodegradable share, equal to 50% of the total (under Eurostat's statistical rules), is taken into account.

Electricity generation from renewables in Italy



In the past three years, electricity generation from renewables recorded high growth rates. In 2011, it continued to have an upward trend (+8% on 2010), reaching 82,961 GWh.

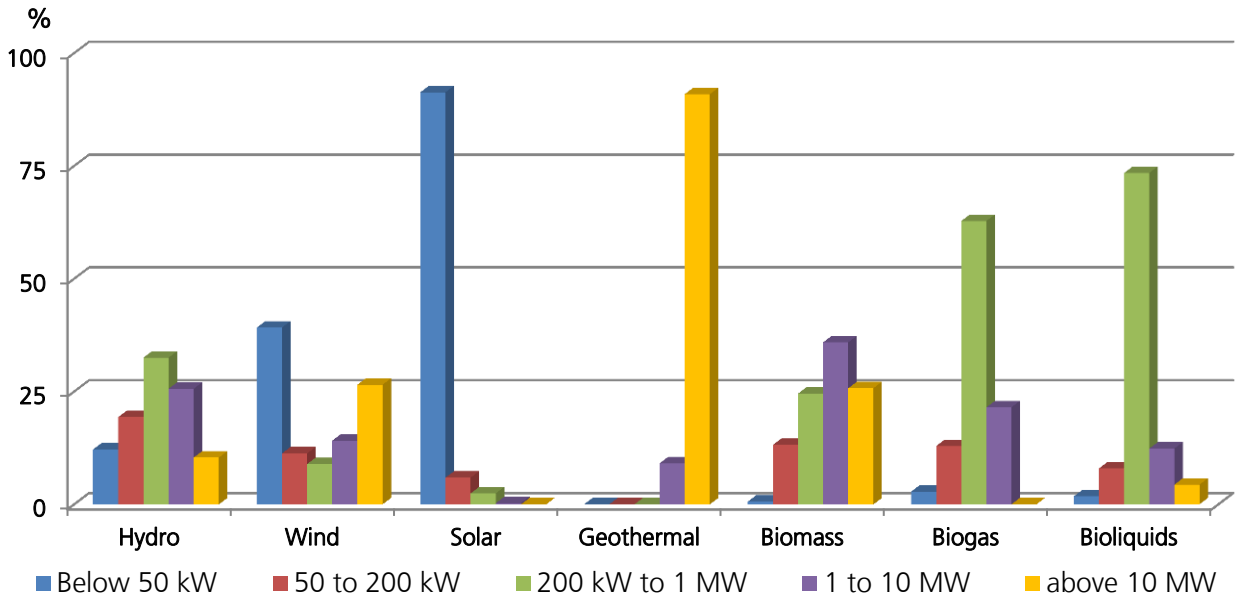
The year 2011 marked a turning point: until 2010, the variability and extent of renewable generation was mostly affected by the behaviour of the hydro source, while in 2011 the decrease of hydro output (from 51,117 GWh in 2010 to 45,823 GWh in 2011) was offset by the increase of the "new renewables" (solar, wind, bioenergy).

From 2000 to 2011, solar generation mounted to 10,796 GWh with a yearly average growth rate of 79% from 2000. Generation from bioenergy totalled 10,832 GWh (+15% on 2010) with a yearly average growth rate of 20%. Wind generation climbed to 9,856 GWh (+8% on 2010) at a rate of 30%.

Geothermal generation continued to be fairly stable.

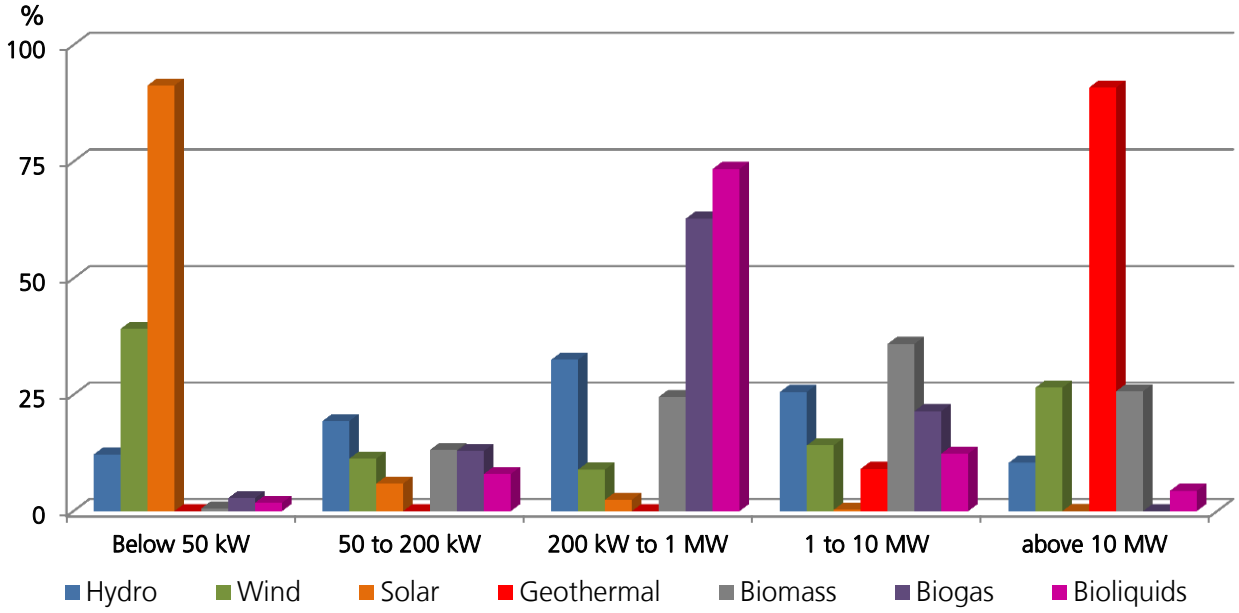
Mix of renewable power plants

Distribution of renewable power plants by capacity class

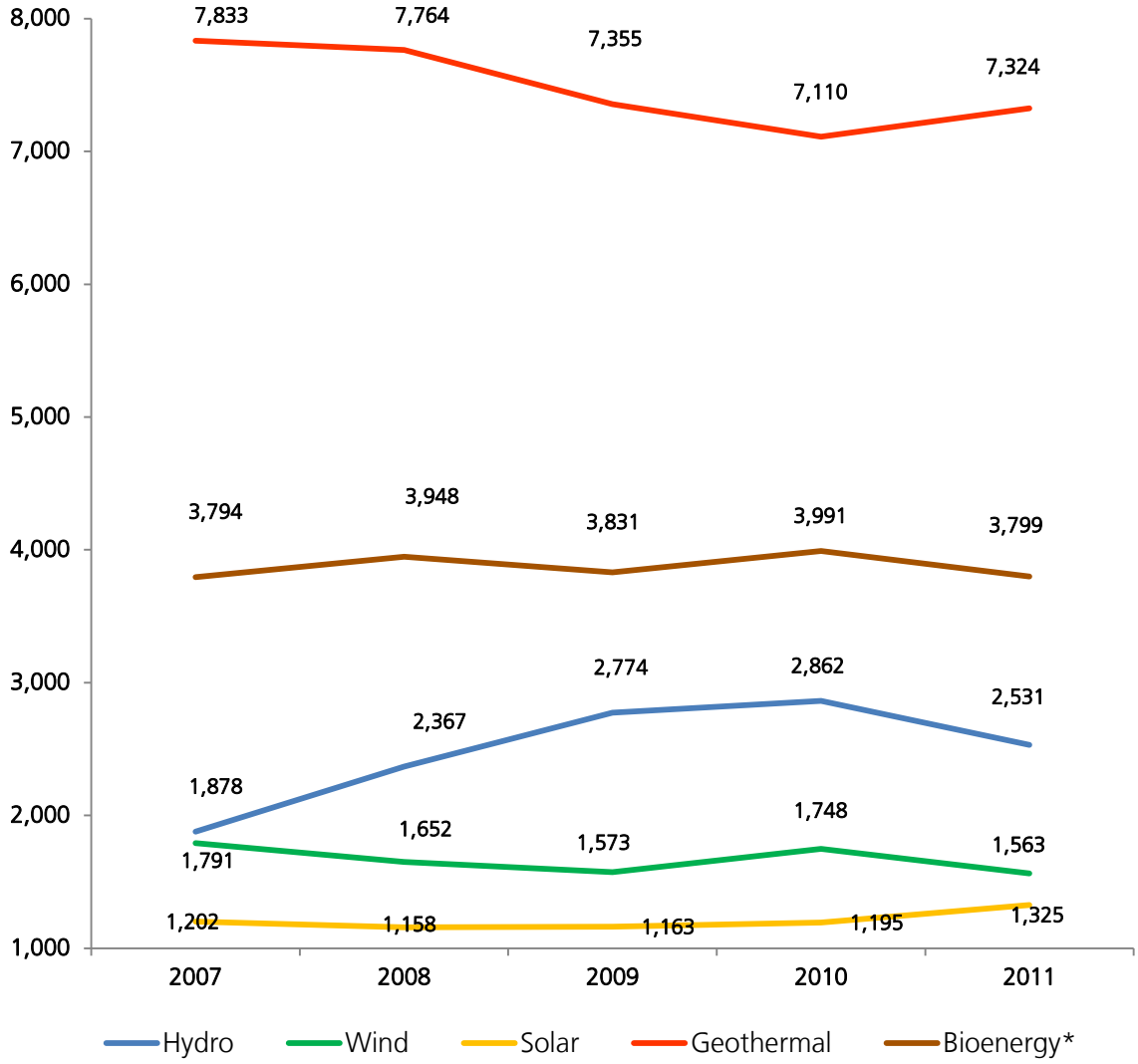


At the end of 2011, the mix of renewable power plants installed in Italy was extremely diversified in terms of sources, technologies and sizes.

Distribution of plants by capacity class and by renewable source



Utilisation hours of renewable power plants



*Hybrid plants are excluded.

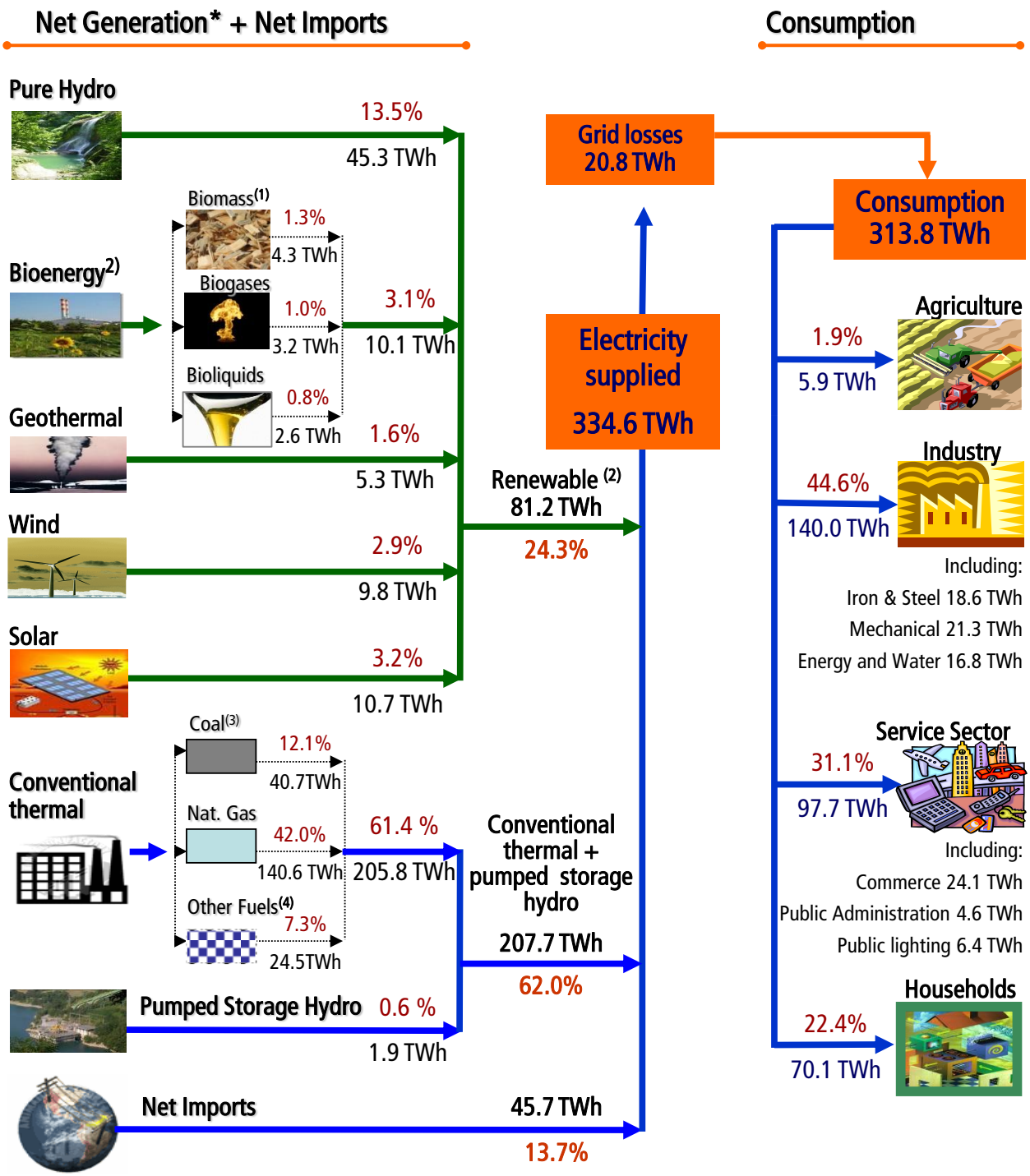
The equivalent utilisation hours at maximum capacity is a common indicator to compare the performance of power plants in an integrated power system.

This indicator depends on multiple factors, such as the features of power plants (technology and energy source) and the seasonal availability of the sources (climate, commercial scarcity, and high costs of input fuel) and network restrictions.

Only plants which were commissioned before the end of the year preceding the one of generation are taken into account to follow source availability and technology efficiency at best.

Among renewables, geothermal is the best performer. In 2011, geothermal plants generated electricity for 7,324 hours out of 8,760, i.e. with an utilisation factor of 84%. Bioenergy plants operated for about 3,800 hours (43%), down from the previous year owing to, among others, the high cost of raw materials (bioliquids). Hydro, wind and photovoltaic plants were much more affected by exogenous climate factors.

National electricity balance – 2011



*Net Generation: gross generation after deducting consumption by auxiliaries and pumping consumption

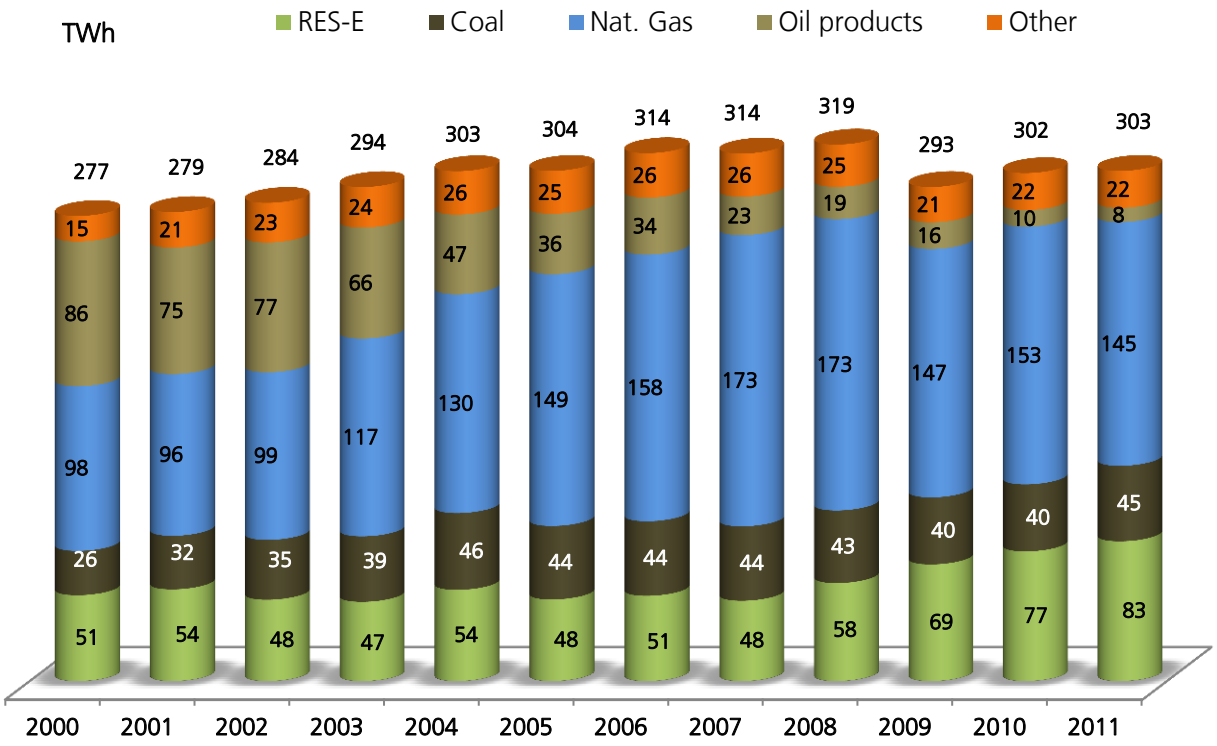
1) It includes the biodegradable fraction of waste

2) Net of non-biodegradable municipal solid waste, falling under the «Conventional thermal» heading

3) Coal + Brown coal

4) Net of generation from biomass, biogases and bioliquids and of pumping consumption

Total gross generation in Italy



In Italy, about 303 TWh were produced in 2011, a little more than in 2010.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
RES Gen / Total Gen %	18.4	19.5	17.0	16.0	17.9	16.0	16.1	15.2	18.2	23.7	25.5	27.4

The fuel mix for generation goes on shifting towards cleaning technologies.

Natural gas is still dominant, with a share of 48% in 2011 (35% in 2000). While renewables are increasing their role (27% in 2011), coal generation is quite steady in recent years, providing 14-15% of the total.

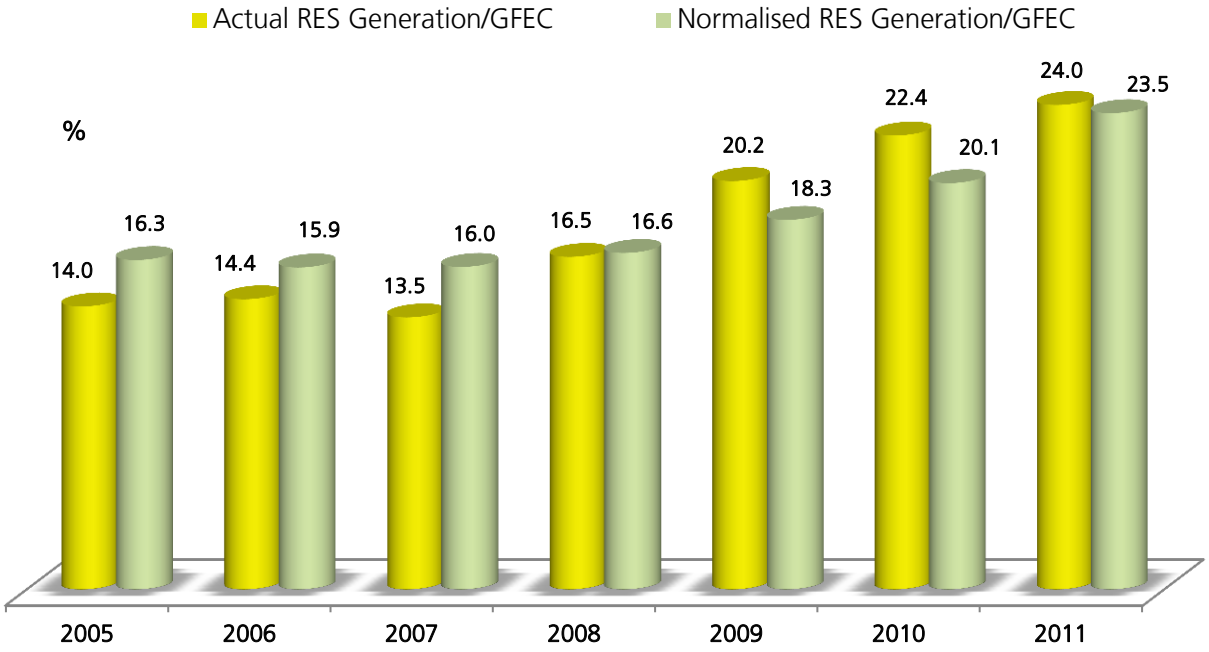
Oil, once dominant, is now residual (3% in 2011).

Share of renewable generation in gross final consumption of electricity in Italy

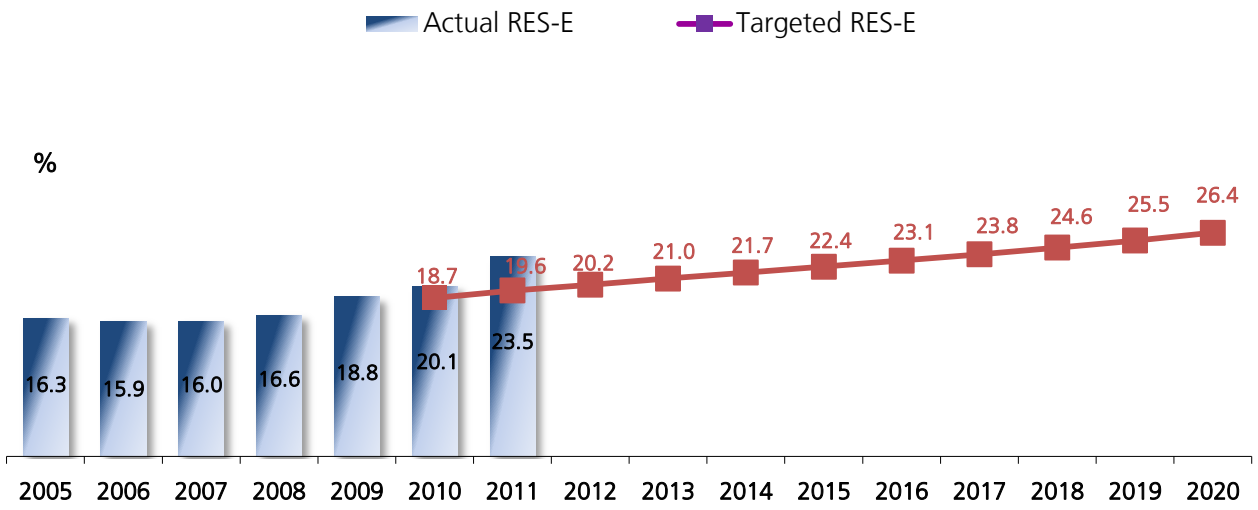
Year	RES Generation (TWh) Actual	RES Generation (TWh) Normalised	Gross Final Electricity Consumption GFEC (TWh)	Percentage share (%) Act/GFEC	Percentage share (%) Norm/GFEC
2005	48.4	56.4	346.0	14.0	16.3
2006	50.6	56.2	352.7	14.4	15.9
2007	47.7	56.6	354.5	13.5	16.0
2008	58.2	58.8	353.6	16.5	16.6
2009	69.3	62.7	342.9	20.2	18.3
2010	77.0	68.9	342.9	22.4	20.1
2011	83.0	81.6	346.4	24.0	23.5

Directive 2009/28/EC on the promotion of the use of energy from renewable sources requires Member States to achieve their targets by 2020. Italy will have to cover 17% of its national gross consumption with renewable energy. The National Renewable Energy Action Plan (NREAP) of June 2010 shared the burden among the Electricity, Heating & Cooling and Transport sectors.

For the *electricity sector,* the target, i.e. the ratio of normalised RES generation (GFEC RES) to gross final electricity consumption (GFEC), was set equal to 26.4% in 2020. Normalised generation should reach about 99 TWh, +21% from 2011 (82 TWh).



Progress towards the achievement of EU targets in the electricity sector



In the electricity sector alone, the RES-E target to be achieved by 2020 is 26.4% as the ratio of gross final renewable electricity consumption (GFEC RES) to gross final electricity consumption (GFEC).

In 2011, Italy attained a 23.5% share of renewable energy, i.e. above the one (19.6%) assumed in the NREAP. The difference is due to the strong growth of generation from renewables along with the contraction of gross final electricity consumption.

Year 2011 GWh	GFEC RES Actual	 Targeted	% Actual / Targeted
Normalised Hydro	44,012	42,127	4.5
Normalised Wind	10,266	9,358	9.7
Solar	10,796	3,327	224.5
Geothermal	5,654	5,744	-1.6
Bioenergy	10,832	9,658	12.2
GFEC RES	**81,561**	**70,214**	**16.2**

Electricity generation from all renewable sources, except geothermal, was higher than the targeted one. The solar source played a leading role, as it exceeded the installed capacity value assumed to be reached by 2020 as early as in 2010. Final gross consumption was 346 TWh, as against 359 TWh predicted when the effects of the current economic crisis had not yet been fully perceived.

Finally, it is worth noting that, taking into account the strong growth of new renewables (wind, bioenergy and above all photovoltaic) in the past few years and the preliminary version of the National Energy Strategy, the RES-E target to be achieved by 2020 is very likely to be revised upwards.

Solar photovoltaic

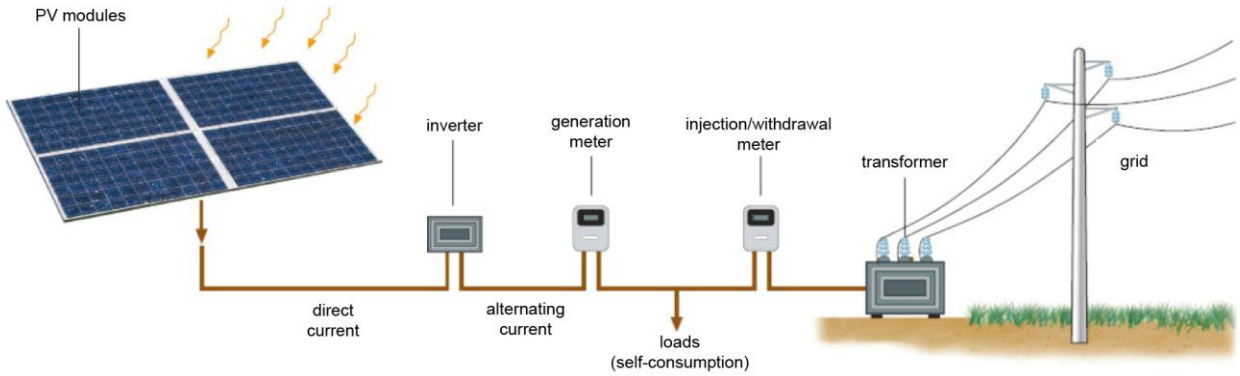
Photovoltaic plants

The photovoltaic technology converts directly solar energy into electricity via the photovoltaic (PV) effect, i.e. the property of appropriately treated semi-conductor materials of generating electricity when they are hit by light radiation. Doped silicon is the basic material for the elementary PV cell, a device whose 1.5-W DC power output is too low for common uses. Multiple connected and encapsulated cells are assembled in a framed *PV module*, the smallest commercially available component. PV modules, connected in series and in parallel, are conveniently arranged in the PV plant to give the desired output, usually in the range from few hundreds to millions of W. The inverter is placed after the PV modules; it converts the direct current generated by the cells into alternating current for end uses or for feeding into the grid. The modules may be fixedly oriented or equipped with a solar tracking system to maximise the capture of solar radiation. Each kWp installed requires a net space of about 8 – 10 m^2, if the crystalline silicon modules are coplanar with the building surfaces (larger space in case of multiple rows on flat surfaces to limit shadowing).

In Italy, the optimum fixed exposure is southwards with an inclination of about 30-35 degrees: a 1 kWp PV plant, optimally oriented, may yield from 1,000 kWh per kWp in northern Italy sites to 1,500 in southern ones.

The main applications of PV systems are as follows:

- systems with energy storage for off-grid users;
- systems for users connected to the low-voltage grid;
- power plants connected to the medium/high-voltage grid.



Number and capacity of photovoltaic plants in Italy

	2010		2011		2011 / 2010 % change	
Capacity class (kW)	no.	MW	no.	MW	no.	*MW*
1 <= C <= 3	61,720	167	110,577	303	79.2	81
3 < C <= 20	82,003	631	179,170	1,432	118.5	127
20 < C <= 200	10,115	706	31,379	2,446	210.2	246
200 < C <= 1,000	1,915	1,235	8,100	5,405	323.0	337
1,000 < C <= 5,000	196	376	827	1,876	321.9	400
P > 5,000	28	354	143	1,312	410.7	270
Total	**155,977**	**3,470**	**330,196**	**12,773**	**111.7**	**268**

As of 31 Dec. 2011, Italy had 330,196 PV plants with a gross maximum capacity of 12,773 MW.

The stock of PV plants mostly includes those supported under the *conto energia* scheme, except for a small number installed before the introduction of the scheme or receiving green certificates.

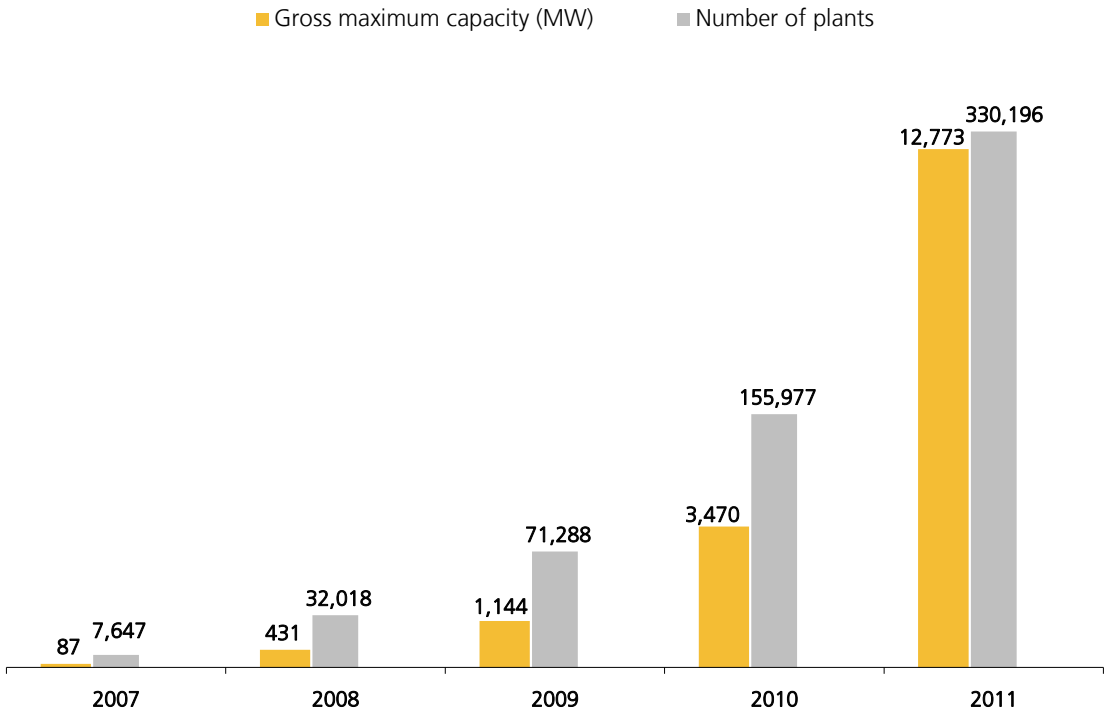
As in 2010, the growth of these plants in 2011 was again outstanding. Their number was up by 174,219, more than the number of plants existing in Italy at the end of 2010.

Installed capacity more than quadrupled as against 2010. The highest percentage increase was recorded for plants with a capacity of 1 to 5 MW (+400%).

The average size of plants of 1 to 5 MW increased by 18% on 2010, passing from 1.9 to about 2.3 MW on average. Conversely, the average size of plants of above 5 MW decreased by 27% (from 12.7 to 9.2 MW).

Average size (kW)	2010	2011	2011 / 2010 % change
1 <= C <= 3	2.7	2.7	1.1
3 < C <= 20	7.7	8.0	3.8
20 < C <= 200	69.8	77.9	11.6
200 < C <= 1,000	645.1	667.2	3.4
1,000 < C <= 5,000	1,916.1	2,268.5	18.4
P > 5,000	12,650.8	9,174.7	-27.5
Total	**22.2**	**38.7**	**73.9**

Number and capacity of photovoltaic plants in Italy



In the past few years, the number and capacity of PV plants grew at a very sustained pace.

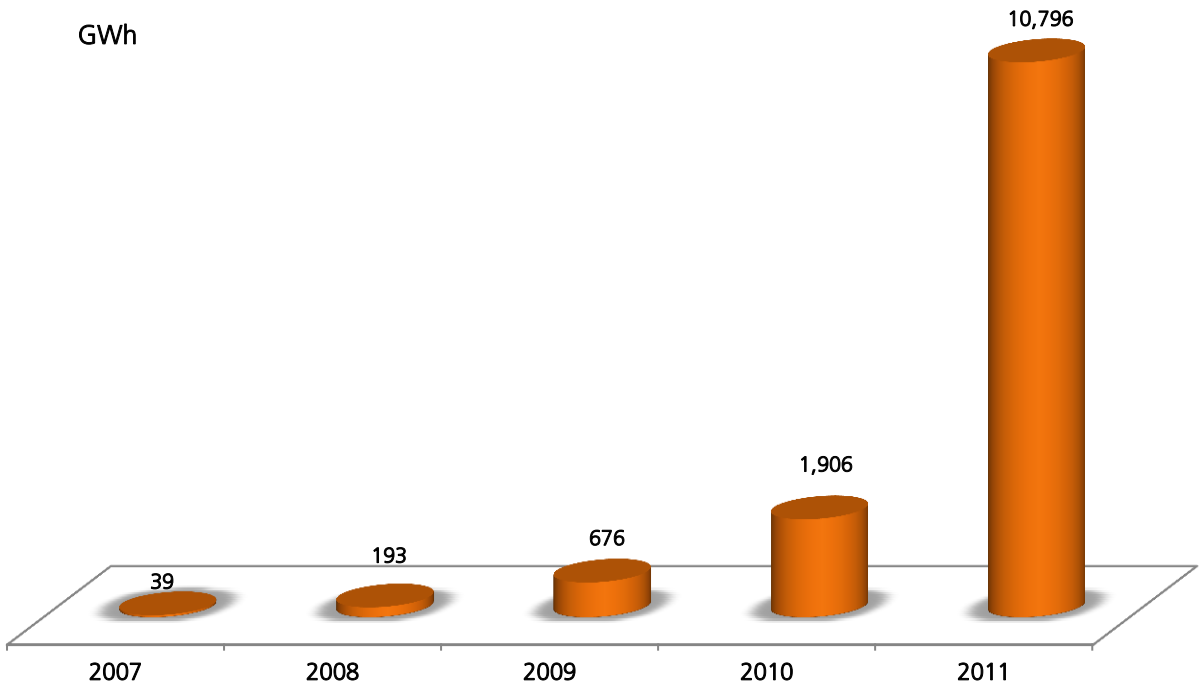
The number of plants existing at the end of 2008 was about five times higher than the one of those installed until 2007. In 2009, 2010 and 2011, the number of plants more than doubled with respect to the previous year.

Capacity passed from 87 MW in 2007 to 12,773 MW in 2011, up by 268% from the previous year.

Capacity grew more than proportionally to the number of plants, since plants of larger size were commissioned. This phenomenon is particularly evident at the end of 2011, when the average size of the generating mix mounted to 38.7 kW. Plants first synchronised with the grid in 2011 had an average capacity of 53.4 kW.

	2007	2008	2009	2010	2011
Cumulated average size (kW)	11.4	13.5	16.0	22.2	38.7
Yearly average size (kW)	10.4	14.1	18.1	27.5	53.4

Generation by photovoltaic plants in Italy



In 2011, electricity generation by PV plants in Italy reached 10,796 GWh, up by 466% from 2010. In just five years, generation rose about 280 times; consequently, the solar PV source is no longer the back marker of renewable sources used to generate electricity in Italy.

The region with the highest generation in 2011 was Puglia with 2,096 GWh (20% of the national total), followed at distance by Emilia Romagna with 1,092 GWh (10% of the total). Lombardia and Veneto produced 995 GWh and 913 GWh (with shares of 9% and 8% of the national value, respectively).

Generation in 2011 (GWh) by region

Piemonte	830	Friuli Venezia Giulia	246	Marche	658	Puglia	2,096
Valle d'Aosta	11	Liguria	44	Lazio	807	Basilicata	190
Lombardia	995	Emilia Romagna	1,092	Abruzzo	329	Calabria	196
Trentino Alto Adige	278	Toscana	424	Molise	84	Sicilia	670
Veneto	913	Umbria	286	Campania	302	Sardegna	344

Wind

Wind power plants

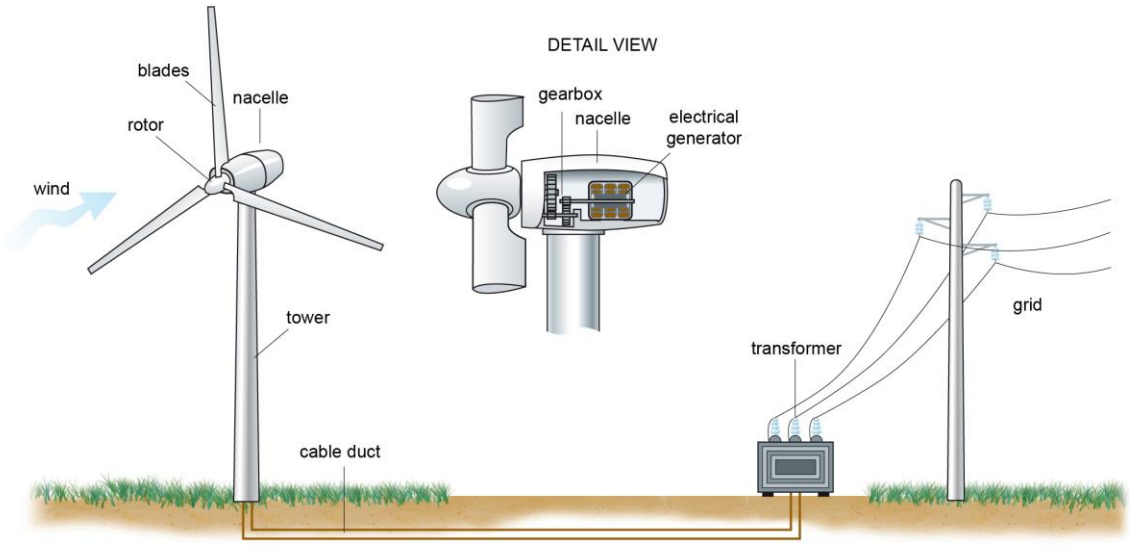
A wind power plant or wind farm generally consists of one or multiple wind turbines, which convert the kinetic energy from the wind into electricity. The wind drives a rotor, usually equipped with three blades and connected to a horizontal-axis shaft. The rotation is then transferred via a gearbox or directly to an electrical generator. The voltage of the generated electricity is stepped up to be injected into the power grid. The nacelle is the structure which houses the conversion systems - chiefly, the gearbox and the electrical generator - and the controls of the machine.

Wind turbines are mounted on towers at suitable height to capture more wind energy and prevent turbulence caused by terrain complexity or obstructions. Indeed, electricity generation by a wind power plant is proportional to the cube of the wind speed and small variations in the wind flows of the site induce major variability in electricity output. Furthermore, a horizontal-axis wind turbine requires a minimum wind speed (cut-in speed) of 3-5 m/s and generates the design capacity at a wind speed of 12-14 m/s. At high speeds (20-25 m/s, cut-off speed), the wind turbine is blocked by a braking system for safety reasons.

Wind turbine capacity classes are:

- Small-sized (1-200 kW): rotor diameter: 1- 20 m; tower height: 10 – 30 m
- Medium-sized (200 – 800 kW): rotor diameter: 20 – 50 m; tower height: 30 – 50 m
- Large-sized (above 1,000 kW): rotor diameter: 55 – 80 m; tower height: 60 – 120 m

Small wind turbines may be used to generate electricity for individual end users or groups of end users, whether connected to the low-voltage grid or isolated from the power grid. Medium and large wind turbines are mostly used in wind farms, connected to the medium or high-voltage grid.



Number and capacity of wind power plants in Italy

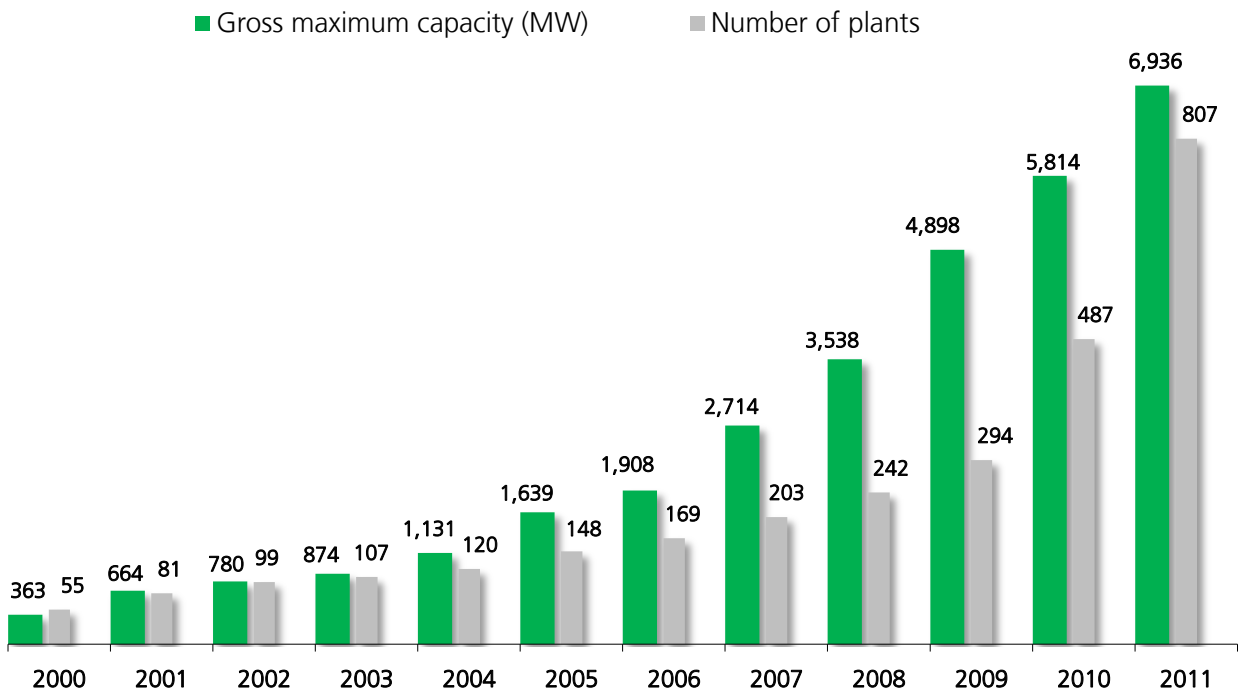
	2010		2011		2011 / 2010 % change	
Power classes (MW)	no.	MW	no.	MW	no.	MW
C ≤ 1 MW	191	27	479	74	150.8	170.8
1 MW < C ≤ 10 MW	105	489	114	522	8.6	6.9
C > 10 MW	191	5,298	214	6,339	12.0	19.6
Total	**487**	**5,814**	**807**	**6,936**	**65.7**	**19.3**

At the end of 2011, wind power plants were 807 with a gross maximum capacity of 6,936 MW.
In 2011, the capacity installed in wind power plants accounted for 17% of the capacity of the overall RES generating mix.

With respect to 2010, 320 new plants were installed (+66%), almost all of small size, with a capacity of less than 1 MW. The number of large-sized plants (above 10 MW) was up by 20%.

The overall capacity addition was equal to 1,122 MW (+19% as against 2010), 1,041 MW of which from plants of above 10 MW plants that topped about 6,339 MW (+20%). The class of up to 1 MW rose by 171%.

Number and capacity of wind power plants in Italy



Wind farms had a strong development in Italy from 2000 to 2011, particularly in the past few years.

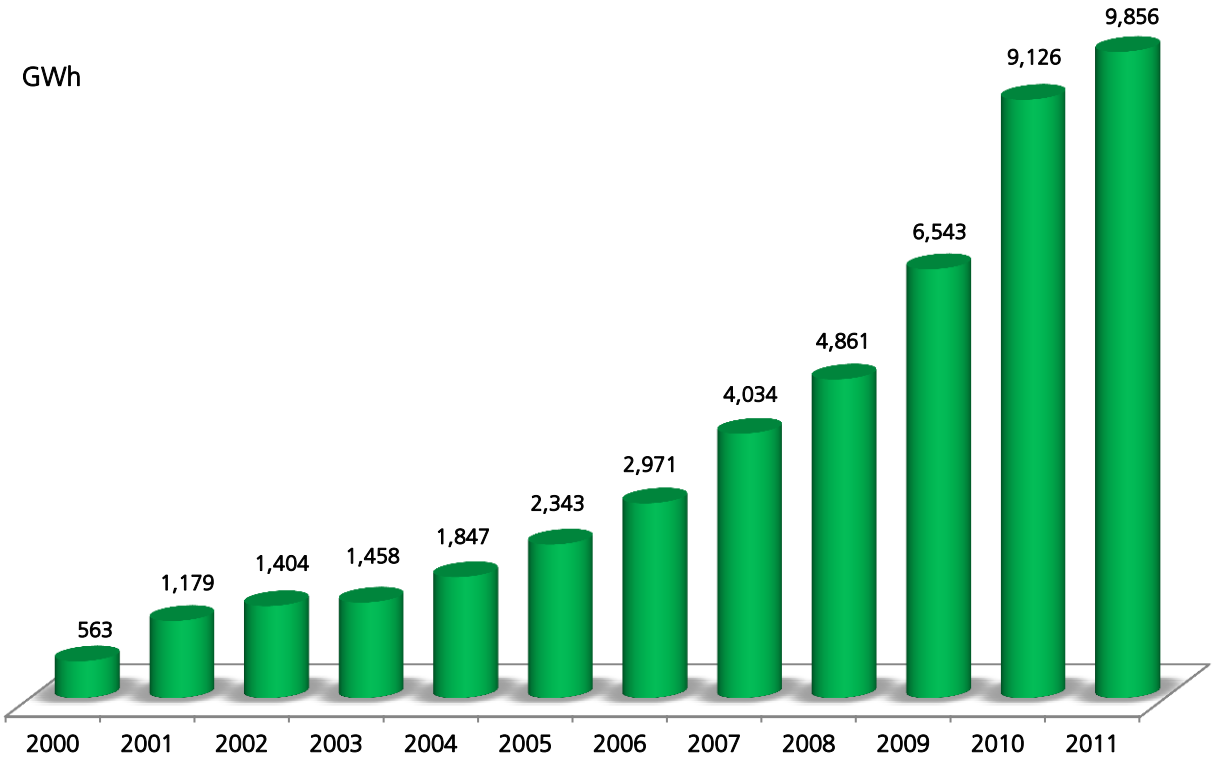
At the end of 2000, installed plants were 55 with a capacity of 363 MW. In 2011, wind plants were 807 with a capacity of 6,936 MW.

In 2011, the capacity installed in wind farms accounted for 17% of the overall RES generating mix while in 2000 it was only equal to 2%.

The table below shows that, from 2000 to 2011, the average size of wind plants grew from 6.6 to 8.6 MW, with a slight decline between 2009 and 2011 due to the commissioning of a lot of plants of less than 200 kW, as well as the inclusion of significant number of small plants into the statistical database.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Average size (MW)	6.6	8.2	7.9	8.2	9.4	11.1	11.3	13.4	14.6	16.7	11.9	8.6

Generation by wind power plants in Italy



From 2000 to 2011, wind generation was up by over 9,300 GWh (+1,651%), of which about 730 GWh in 2011 alone.

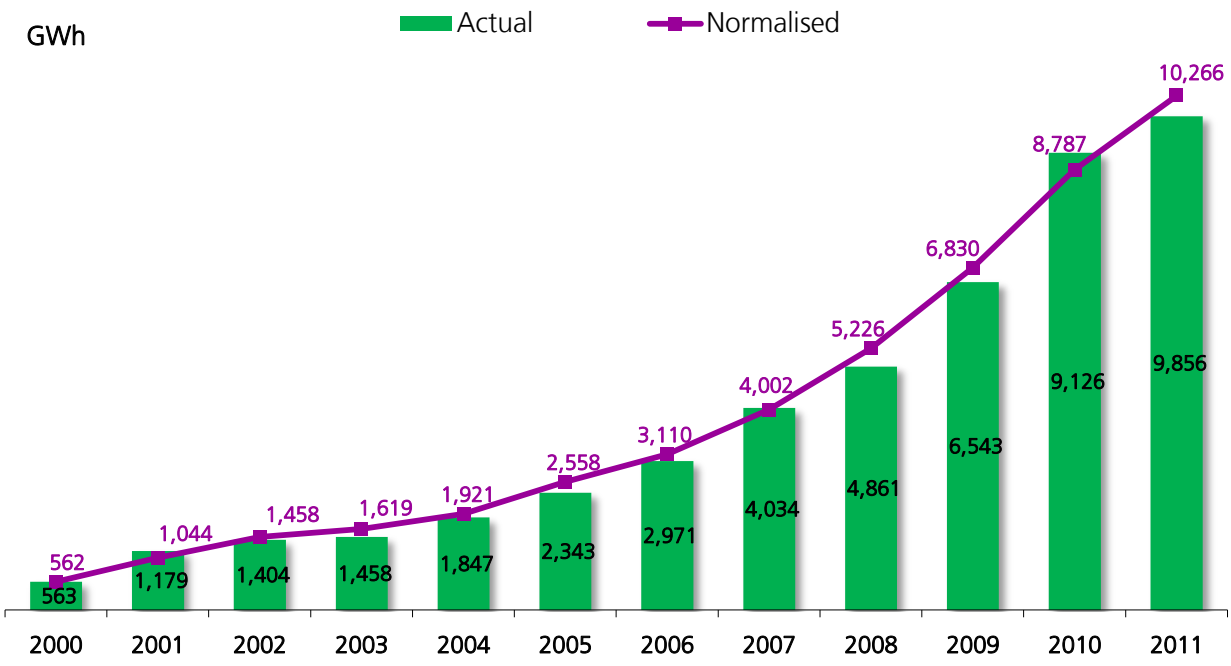
Sicilia (2,730 GWh) ranked no. 1 in terms of wind generation, followed by Puglia (2,256 GWh) and Campania (1,344 GWh). These three regions together covered 61% of the national total.

Wind generation in 2011 was lower than in the previous year in some regions, especially in Abruzzo where, despite 2 MW of additional capacity with respect to 2010, it was down by roughly 32 GWh.

Generation in 2011 (GWh) by region

Piemonte	22	Friuli Venezia Giulia	0	Marche	0	Puglia	2,256
Valle d'Aosta	0	Liguria	46	Lazio	22	Basilicata	455
Lombardia	0	Emilia Romagna	20	Abruzzo	297	Calabria	1,281
Trentino Alto Adige	0	Toscana	73	Molise	617	Sicilia	2,370
Veneto	1	Umbria	2	Campania	1,344	Sardegna	1,048

Actual and normalised wind power generation in Italy



Wind generation reflects source variability year by year. To take it into account, Directive 2009/28/EC requires Member States to normalise generation as follows:

$$Q_{N\,(norm)} = \frac{C_N + C_{N-1}}{2} \; x \; \frac{\sum_{i=N-n}^{N} Q_i}{\sum_{j=N-n}^{N} \left(\frac{C_j + C_{j-1}}{2} \right)}$$

Where:

N = reference year;

$Q_{N(norm)}$ = normalised electricity

Q_i = actual generation in year i

C_j = total installed capacity in year j

n = it is equal to the lower between 4 and the number of years preceding year N for which capacity and production data are available.

Normalised electricity in 2011 was equal to 10,266 GWh, 17% more than the normalised one in 2010 and 4% more than the actual 9,856 GWh in 2011.

Hydro

Hydro power plants

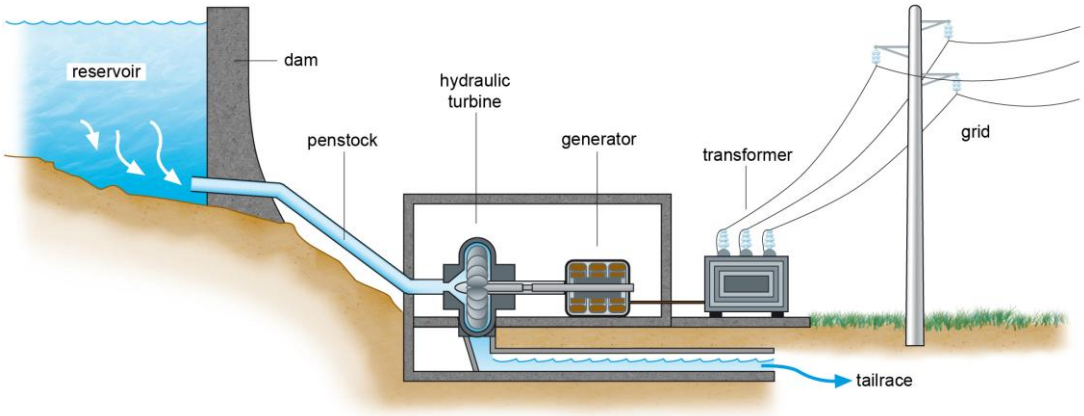
A hydro power plant converts the potential energy of water into rotational mechanical energy, which spins a turbine and is directly converted to electricity via a generator. A hydroelectric scheme consists of civil engineering and hydraulic structures and of electromechanical equipment. As shown below, a hydroelectric scheme includes:

- *dam or weir* across a stream, which may create a reservoir volume, permitting or not permitting the storage of natural flows, with one or multiple intake gates, followed by a stilling basin and silt-trap scour gates;
- *diversion canal* and/or diversion tunnel and one forebay, usually provided with outlet works;
- *one or more penstocks* conveying water to the hydraulic turbines;
- *powerhouse* or power plant, equipped with one or multiple turbine-generator units, which release the turbined water into the streambed downstream of the dam.

Hydro power plants are classified on the basis of the filling period of their reservoir, i.e. the time required to fill the reservoir with a volume of water equal to its active storage capacity, at the yearly mean water inflows.

Accordingly, hydro power plants are categorised on power system duty basis, as follows:

- *reservoir hydro* with a maximum filling period equal to or longer than 400 hours;
- *pondage hydro* with a weekly or daily "modulation reservoir" and a filling period shorter than 400 hours and longer than 2 hours;
- *run-of-river hydro* without reservoir or with a reservoir having a filling period equal to or shorter than 2 hours. They are generally located along streams or drainage canals; their generation depends on the flow available in the stream or canal. It includes plants in aqueducts where the hydraulic turbine can replace the pressure reducing valve in order to recover the otherwise lost energy.



Number and capacity of hydro power plants in Italy

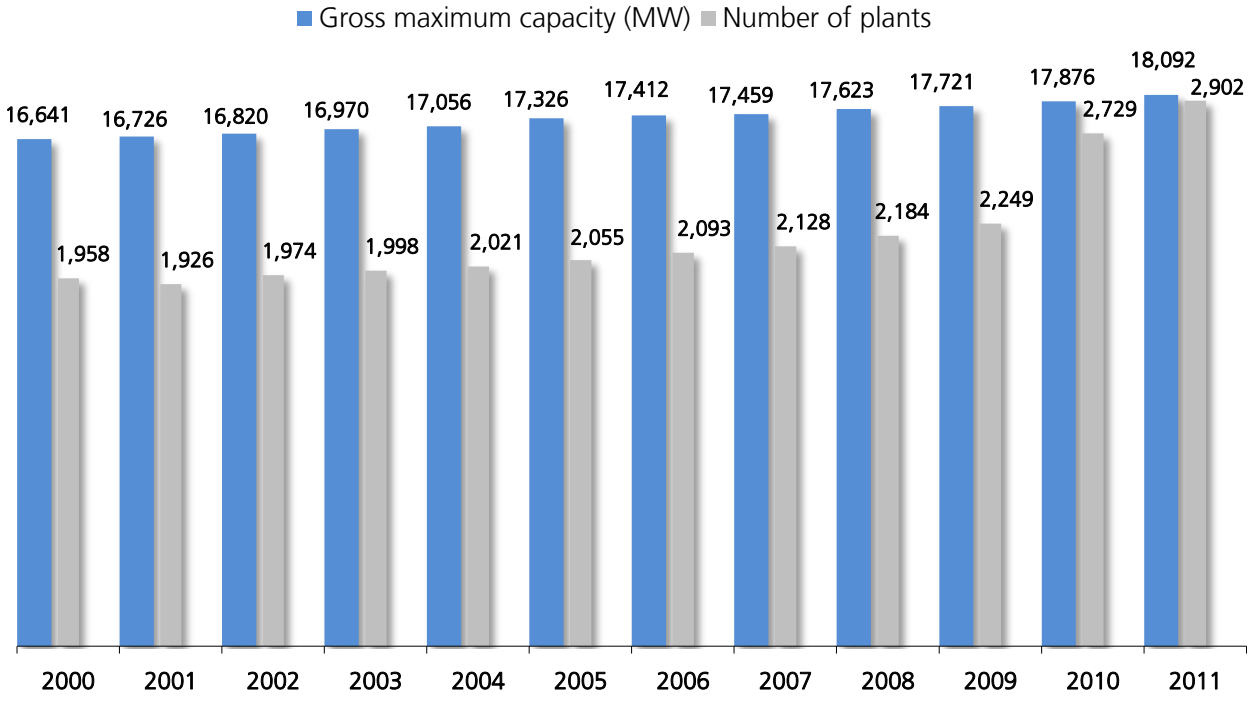
	2010		2011		2011 / 2010 % change	
Capacity class (MW)	no.	MW	no.	MW	no.	MW
C ≤1 MW	1,727	523	1,858	568	7.6	8.5
1 MW < C ≤ 10 MW	700	2,210	743	2,328	6.1	5.3
C > 10 MW	302	15,142	301	15,196	-0.3	0.4
Total	**2,729**	**17,876**	**2,902**	**18,092**	**6.3**	**1.2**

The table displays the number and gross maximum capacity of renewable hydro power plants, including mixed pumped-storage plants; for the latter, only the generation from natural inflows is taken into account. Pure pumped-storage plants are thus excluded.
The capacity class with the highest number of plants is the one lower than or equal to 1 MW (64%), followed by the one in the range of 1 - 10 MW (26%); together, these plants account for as little as 16% of the overall installed capacity. Conversely, 84% of the overall installed hydro capacity is concentrated in 301 plants. This means that the national hydro generating mix mostly consists of few large-sized plants.

From 2010 and 2011, the number of plants was up by 6% (+173 plants). 76% of the new plants belong to the capacity class lower than or equal to 1 MW. The increase is to be attributed not only to new installations but also to the entry of previously unreported plants into the statistical database.

Overall capacity was up by as little as 1% (+216 MW), of which 54 MW (25%) were due to plants belonging to the capacity class of above 10 MW, 44 MW (20%) to the capacity class lower than or equal to 1 MW and 118 MW (55%) to the capacity class of 1 to 10 MW.
In 2011, the capacity installed in hydro plants accounted for 44% of the capacity of the overall stock of RES plants. In 2010, it accounted for 59%.

Number and capacity of hydro power plants in Italy



In the period from 2000 to 2011, the number of plants grew at a yearly average rate of 4%, whereas their capacity was up by 1% on average per year.

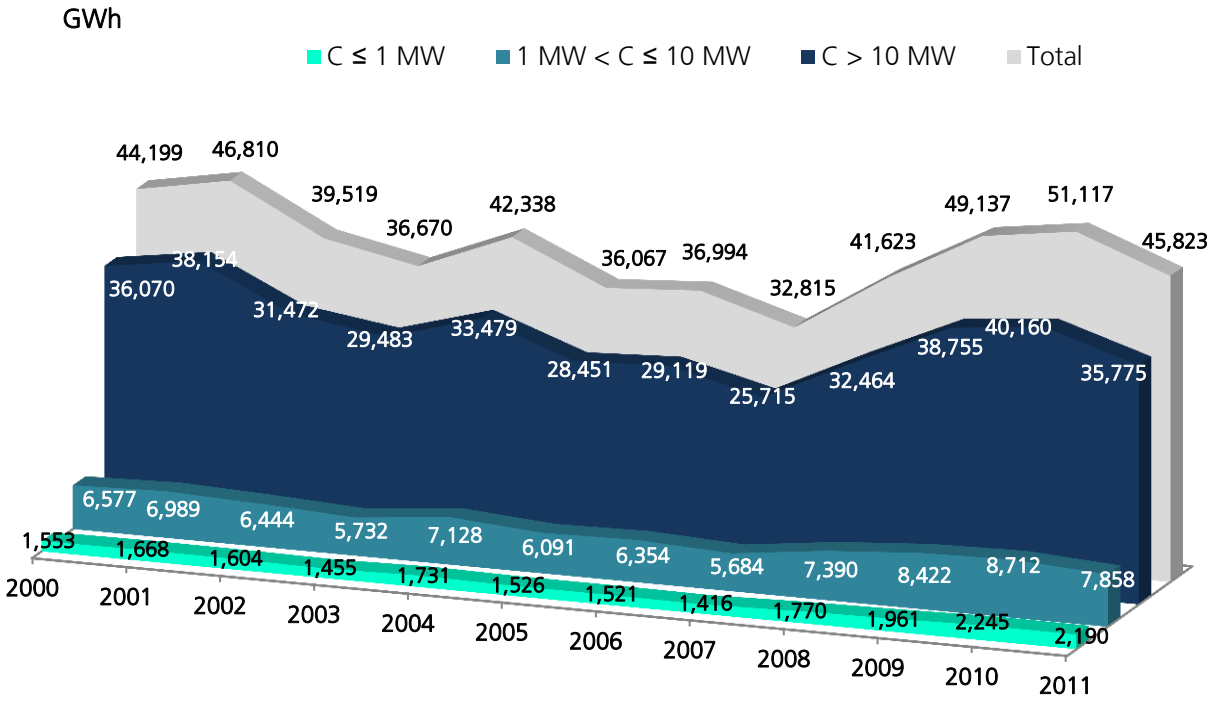
Installed capacity and number of plants over the decade show no noticeable changes. The only noteworthy fact is the commissioning of many small-sized run-of-river plants. In the future, the development of small and mini-hydro plants is expected to become dominant, in line with their trend in the past few years.

Furthermore, the average size of plants continued to shrink, from 8.5 MW in 2000 to 6.2 MW in 2011. The remarkable 2010 drop is due, above all, to the inclusion of numerous plants of below 0.2 MW - of significant number but of low capacity - into the statistical database

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Average size (MW)	8.5	8.7	8.5	8.5	8.4	8.4	8.3	8.2	8.1	7.9	6.6	6.2

Hydro power generation in Italy

By capacity class



In the period from 2000 to 2011, the capacity of hydro power plants grew at a yearly average rate of 1%. In contrast, in the same period, generation was very variable owing to weather factors.

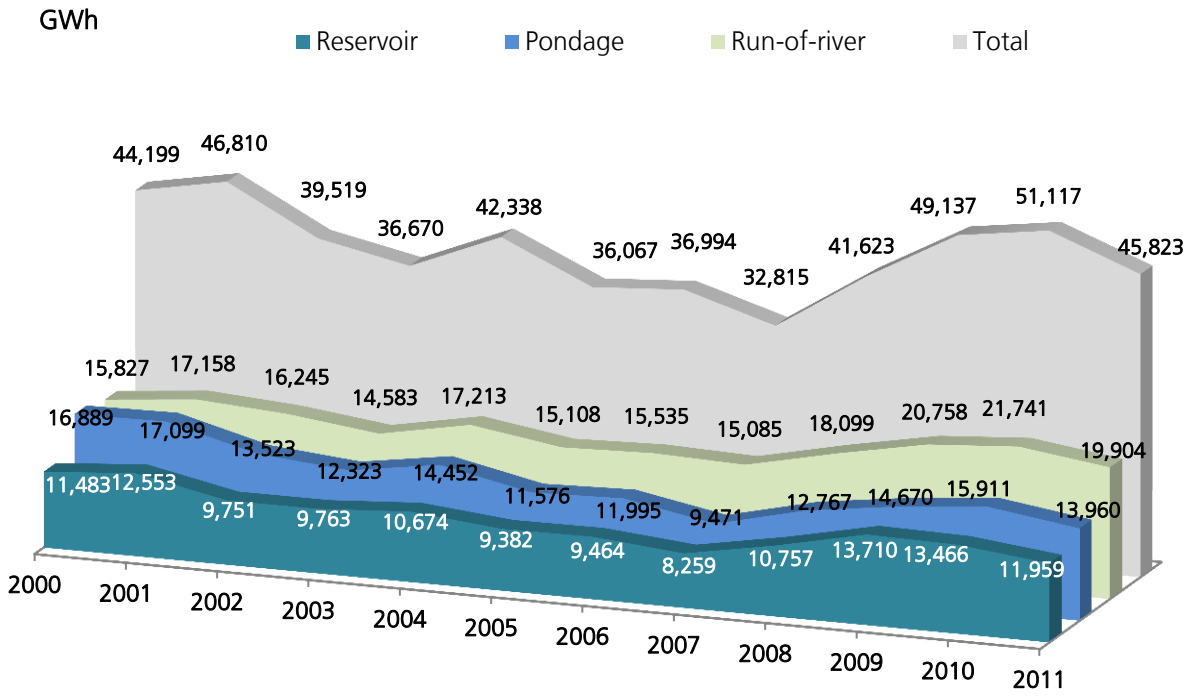
During 2011, electricity generation by hydro plants was equal to 45,823 GWh, i.e. lower than in 2010 and 2009.

Generation in 2011 (GWh) by region

Piemonte	6,575	Friuli Venezia Giulia	1,832	Marche	446	Puglia	6
Valle d'Aosta	2,743	Liguria	191	Lazio	950	Basilicata	341
Lombardia	11,049	Emilia Romagna	873	Abruzzo	1,840	Calabria	1,470
Trentino Alto Adige	9,773	Toscana	576	Molise	222	Sicilia	98
Veneto	4,228	Umbria	1,574	Campania	583	Sardegna	453

Hydro power generation in Italy

By type of plant

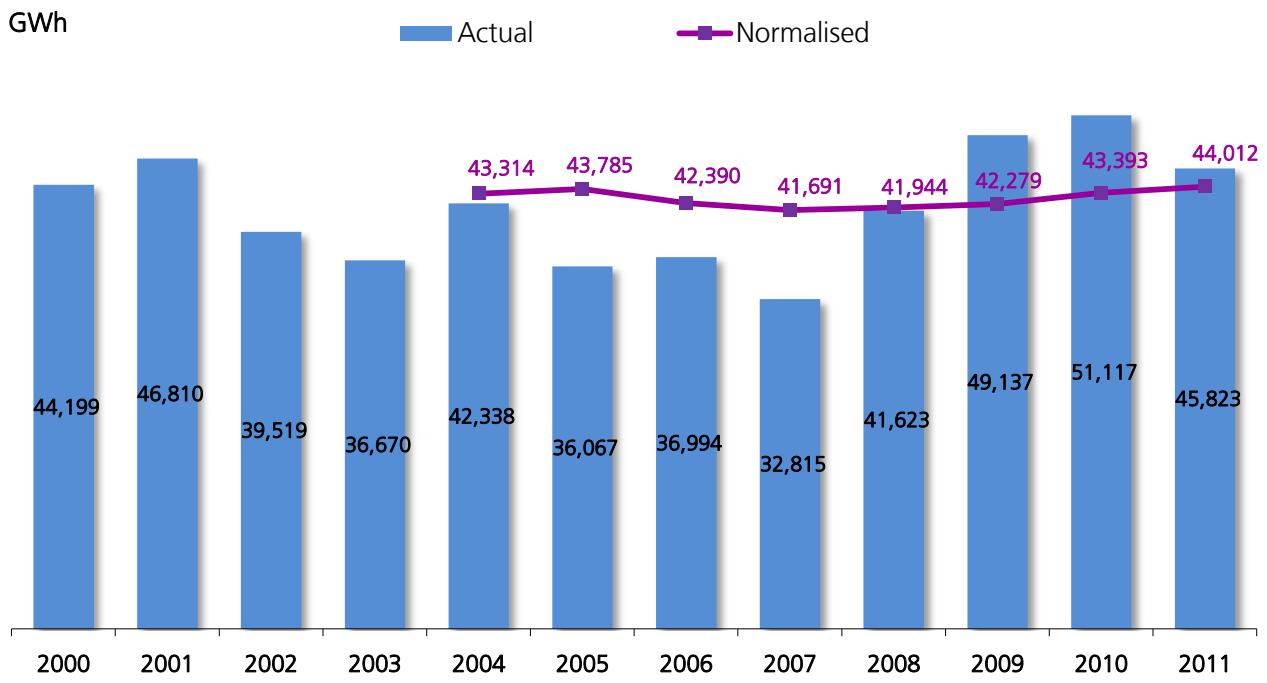


Run-of-river plants are those which mostly contribute to gross generation from natural inflows. In 2011, as much as 43% of the 45,823 GWh produced in Italy came from these plants, although they accounted for as little as 27% of overall capacity.

Pondage plants accounted for 31% of generation and for 28% of installed capacity. Reservoir plants only accounted for 26% of generation in spite of 45% of capacity.

As compared to the 2010 record year, all types of hydro generation decreased: reservoir by 12%, pondage by 11% and run-of-river by 8%.

Actual and normalised hydro power generation in Italy



To take into account the effects of weather variations, Directive 2009/28/EC requires Member States to normalise hydro generation having regard to actual generation in the past 15 years.

This makes it possible to homogeneously compare the performance of EU Member States.

In 2010, the normalisation formula was modified to account for the contribution of mixed pumped-storage plants:

$$Q_{N(norm)} = C_N^{PHP} * \frac{\left[\sum_{i=N-14}^{N} \frac{Q_i^{PHP}}{C_i^{PHP}}\right]}{15} + C_N^{PM} * \frac{\left[\sum_{i=N-14}^{N} \frac{Q_i^{MPSP}}{C_i^{MPSP}}\right]}{15}$$

where:

N = reference year

$Q_{N(norm)}$ = normalised electricity generated by all the hydro power plants of the Member State in year N

Q_i = quantity of electricity actually generated, measured in GWh, excluding generation from pumped storage

C_i = total installed capacity, measured in MW

PHP = pure hydro plants

MPSP = mixed pumped-storage plants.

In 2011, normalised hydro generation was equal to 44,012 GWh, +1.4% on 2010 and -4.1% vs. its actual value in 2011 (45,823 GWh).

Bioenergy

Bioenergy power plants

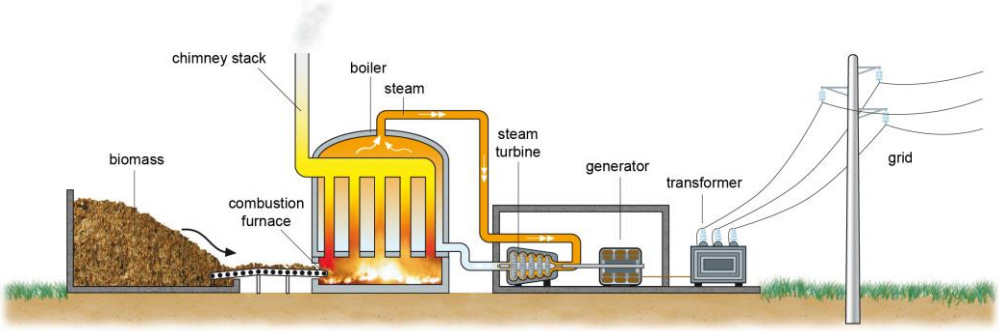
Bioenergy consists of biomass, biogases and bioliquids. Biomass covers a wide range of virgin or residual materials from agriculture and industry and the biodegradable fraction of industrial and municipal waste.

Biomass and bioliquid plant designs depend on fuel type, technology and end products (electricity only, Combined Heat & Power - CHP, heat only). Advanced raw-biomass treatment processes (carbonisation, pyrolysis and gasification) yield solid, liquid and gaseous intermediate fuels that are more suitable for plant operation and more environmentally benign. Gasification is particularly interesting as biosynthetic gas (biosyngas) provides high combustion efficiencies and limited emissions. Bioenergy plant sizes may range from average-sized units fuelled with solid biomass, usually wood chips, down to small stand-alone generators fired by liquid biofuels.

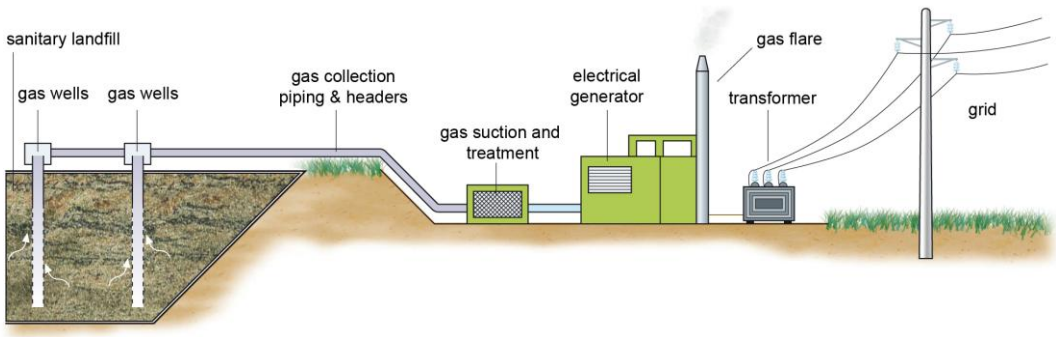
Biomass-fired thermal plants are similar to conventional-fossil fired ones.

Common generation schemes are:

- conventional plants with a furnace for combustion of solid biomass and a steam turbine;
- gas turbines fuelled with biosyngas, single-cycle or combined with steam turbines;
- hybrid plants co-firing biomass and conventional sources;
- internal combustion engines fed by bioliquids, vegetable oils, biodiesel.



Biogas has an excellent calorific power, given its high methane content. Therefore, it can be converted into energy via direct combustion in a boiler (heat only) or in engine-driven generators (electricity only or CHP). A typical plant using landfill gas is shown below:



In the case of non-landfill gas, the extraction system is replaced by systems for production (digester) and collection (gasholder or gasometer) of gas, to be fed to power generating units.

Number and capacity of bioenergy power plants in Italy

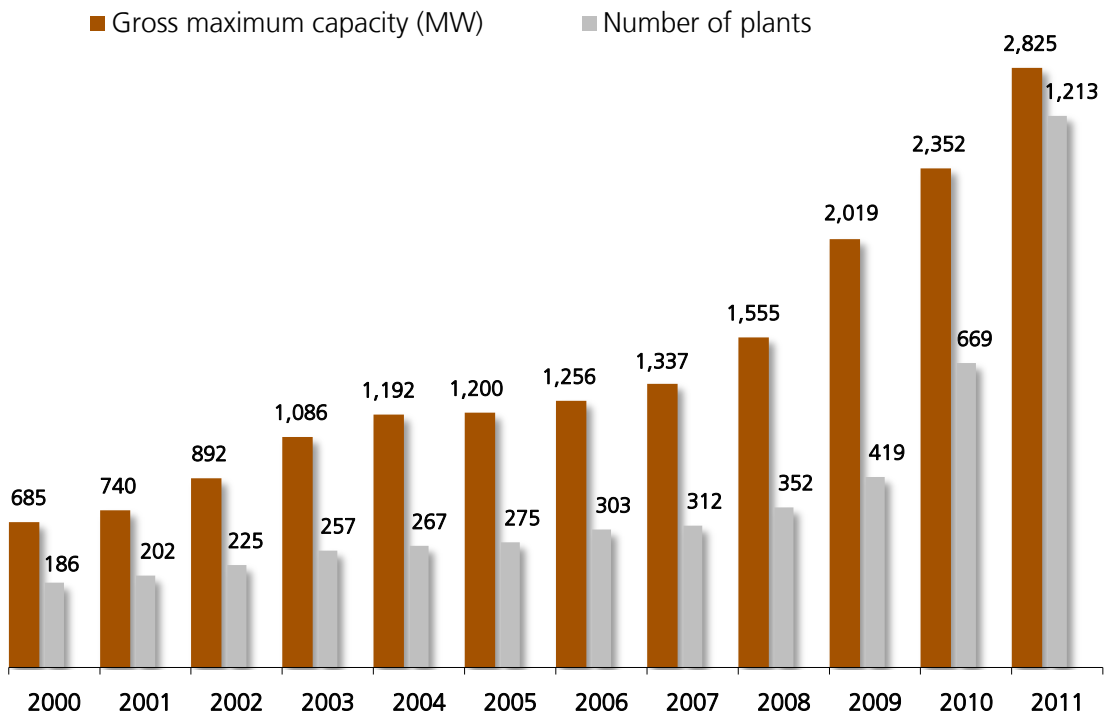
	2010		2011		2011 / 2010 % change	
	no.	MW	no.	MW	no.	MW
Biomass	142	1,243	170	1,289	19.7	3.7
– municipal waste	*71*	*798*	*71*	*828*	*0.0*	*3.7*
– other biomass	*71*	*445*	*99*	*461*	*39.4*	*3.7*
Biogases	451	508	819	773	81.6	52.3
– from waste	*228*	*341*	*260*	356	*14.0*	*4.4*
– from slurries	*47*	*15*	*60*	*30*	*27.7*	*104.0*
– from animal dung	*95*	*41*	*165*	89	*73.7*	*116.3*
– from agriculture and forestry	*81*	*110*	*334*	*298*	*312.3*	*169.7*
Bioliquids	97	601	275	763	183.5	27.0
– vegetable oils	*86*	*510*	*234*	*654*	*172.1*	*28.2*
– other bioliquids	*11*	*91*	*41*	*110*	*272.7*	*20.1*
Bioenergy	**669**	**2,352**	**1,213**	**2,825**	**81.3**	**20.1**

The number and capacity of bioenergy plants are reported by group and by fuel.

The table shows the number and gross maximum capacity of bioenergy plants. It does not include hybrid plants, i.e. those producing electricity mostly from fossil fuels: gas, coal and other.
Biogas plants (65%) outnumber biomass (13%) and bioliquid (22%) ones. In the total capacity of 2,825 MW, the shares of biomass, bioliquid and biogas plants (in operation as of 31 December 2011) were equal to 46%, 27% and 27%, respectively. This fact depends on the average size of the plants: biogas plants have an average installed capacity of slightly more than 1 MW, whereas biomass and waste ones have about 8 MW on average.
Thanks to the cooperation between GSE and Terna, plants unreported in previous years have been included into the statistical database.

In 2010, the capacity of plants fuelled with bioenergy accounted for 7% of the overall RES generating mix.

Number and capacity of bioenergy power plants in Italy



From 2000 to 2011, the number of plants rose at a yearly average rate of 19%, whereas capacity was up by 14% on average.

The stock of bioenergy plants experienced a constant and sustained growth throughout the period and in particular in the past three years. The year 2009 saw a spike of additional capacity (roughly 500 MW). During 2010, instead, a lot of small plants (mostly fuelled by biogases) were commissioned, with an increase in their total number of over 260 (+57%), with 250 MW of additional capacity. Finally, during 2011, these plants grew both in number (+544) and in capacity (+474 MW).

Average size (MW)	2005	2006	2007	2008	2009	2010	2011
C ≤ 1 MW	0.6	1.0	0.6	0.6	0.6	0.5	0.6
1 MW ≤ C ≤ 10 MW	3.1	4.2	2.9	2.9	3.3	3.4	3.3
C > 10 MW	21.6	21.5	23.2	23.4	27.4	28.0	28.6
Bioenergy	**4.4**	**4.1**	**4.3**	**4.4**	**4.8**	**3.5**	**2.3**

The above fact explains the contraction in the average size of plants, which was 2.3 MW in 2011 vs. 3.5 MW in 2010. The contraction was also due to many new biogas plants with an installed capacity of below 1 MW and intermediate plants (1MW ≤ C ≤ 10 MW). By contrast large plants continued to grow. In 2011, plants with a capacity of 1-10 MW had an average size of 3.3 MW as against 3.1 MW in 2005. Plants with an installed capacity of above 10 MW reached 28.6 MW on average as compared to 21.6 MW in 2005.

Generation by bioenergy power plants in Italy

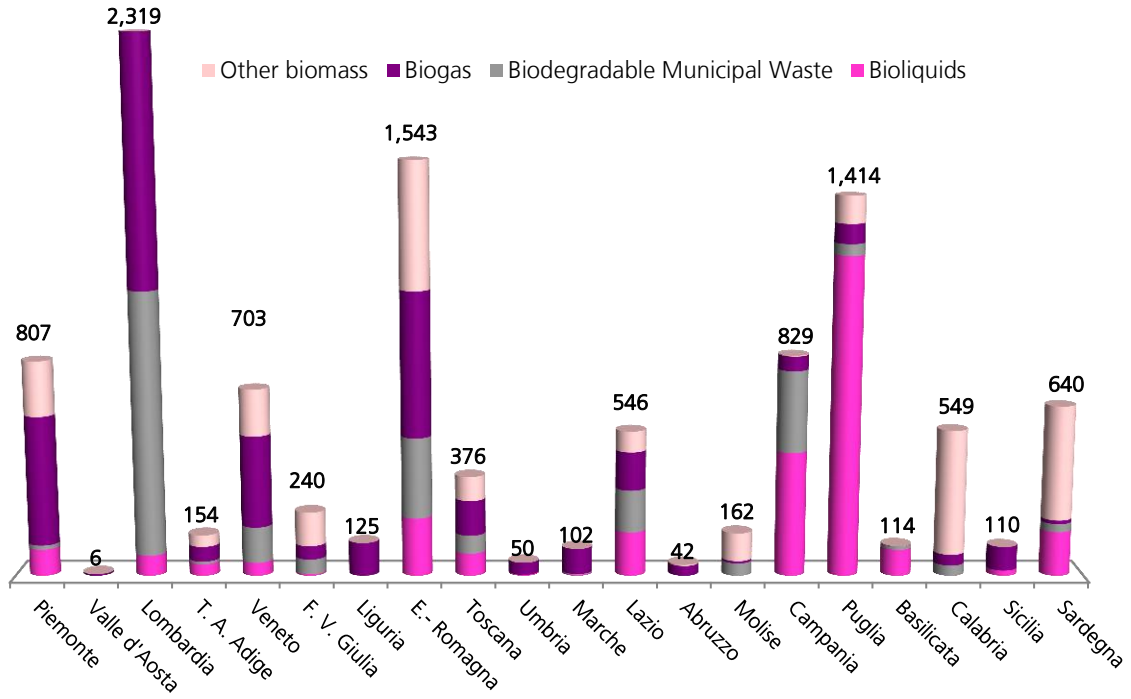
GWh	2010	2011	2011 / 2010 % change
Biomass	4,308	4,730	9.8
– biodegradable municipal waste	*2,048*	*2,218*	*8.3*
– other biomass	*2,260*	*2,512*	*11.2*
Biogases	2,054	3,405	65.7
– from waste	*1,415*	*1,528*	*8.0*
– from slurries	*28*	*63*	*121.5*
– from animal dung	*221*	*362*	*63.6*
– from agriculture and forestry	*390*	*1,453*	*272.3*
Bioliquids	3,078	2,697	-12.4
– vegetable oils	*2,682*	*2,531*	*-5.6*
– other bioliquids	*397*	*166*	*-58.1*
Bioenergy	**9,440**	**10,832**	**14.7**

In 2011, gross generation of bioenergy plants mounted by 15% (from 9,440 MW to 10,832 MW), accounting for 13% of national RES generation (83 TWh).

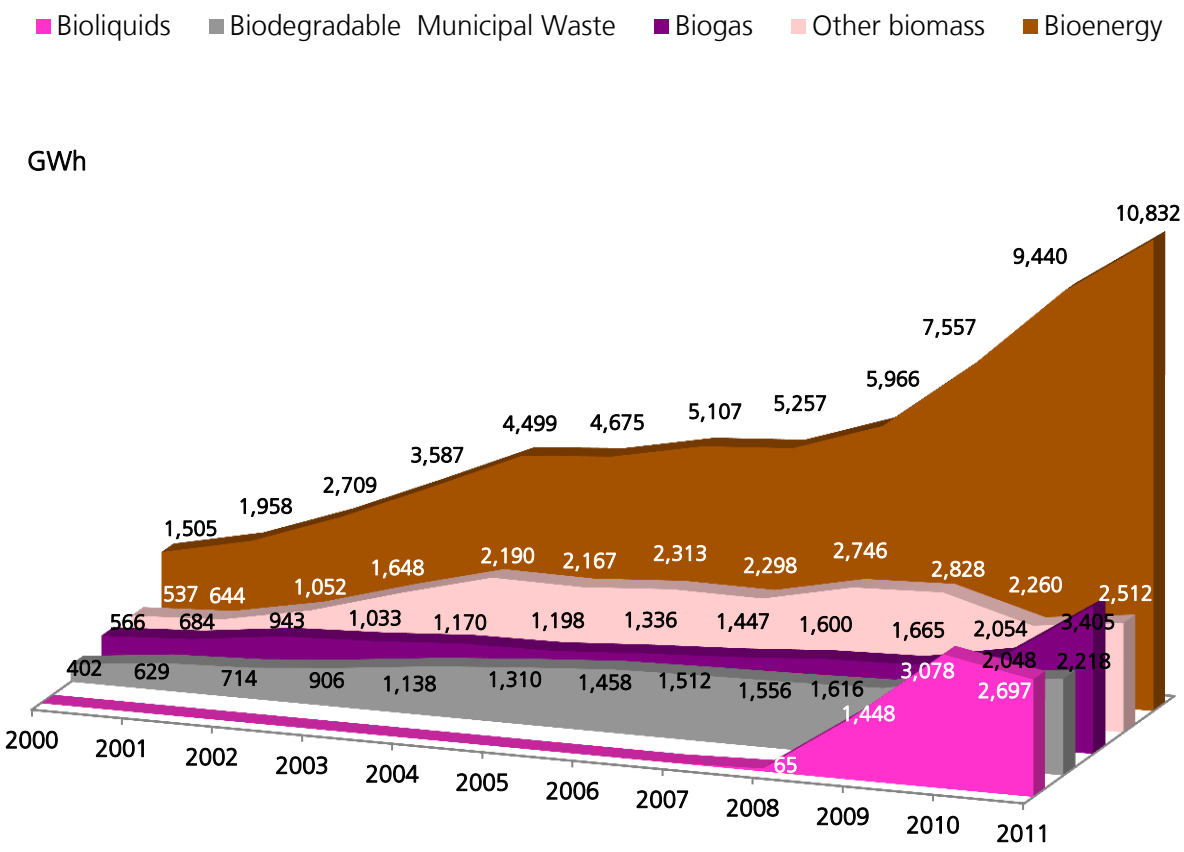
Generation from bioliquids decreased by 12% in 2011, since the high prices of the input fuels undermined its profitability, despite the value of incentives.

Generation from biomass was up by about 10% (+423 GWh).

In 2011, 3,405 GWh were generated from biogases, i.e. +66% from 2010. The difference is due to plants using residues from agriculture and forestry, whose generation climbed from 390 GWh to 1,453 GWh, and biogases from animal dung (from 221 GWh to 362 GWh).



Generation by bioenergy power plants in Italy



From 2000 to 2011, electricity generated from bioenergy grew by 32% on average per year, passing from 1,505 GWh to 10,832 GWh.

Generation from biogases and biodegradable municipal waste rose at yearly average rates of 25% and 33%, respectively.

In the past three years, bioliquids gave a substantial contribution to the growth of generation from bioenergy. Generation of electricity from bioliquids in 2011 fell by 12% on 2012, because of pressures on the prices of input fuels, notably palm oil.

In 2000, generation was equal to 1,505 GWh, 38% from biogases and 62% from biomass, in particular 27% from biodegradable municipal waste and 35% from other biomass.

The introduction of the "bioliquids" class and the contribution of new plants changed the mix over time: out of the 10,832 GWh produced in 2011, 31% came from biogases, 44% from biomass (21% from biodegradable waste and 23% from other biomass) and 25% from bioliquids.

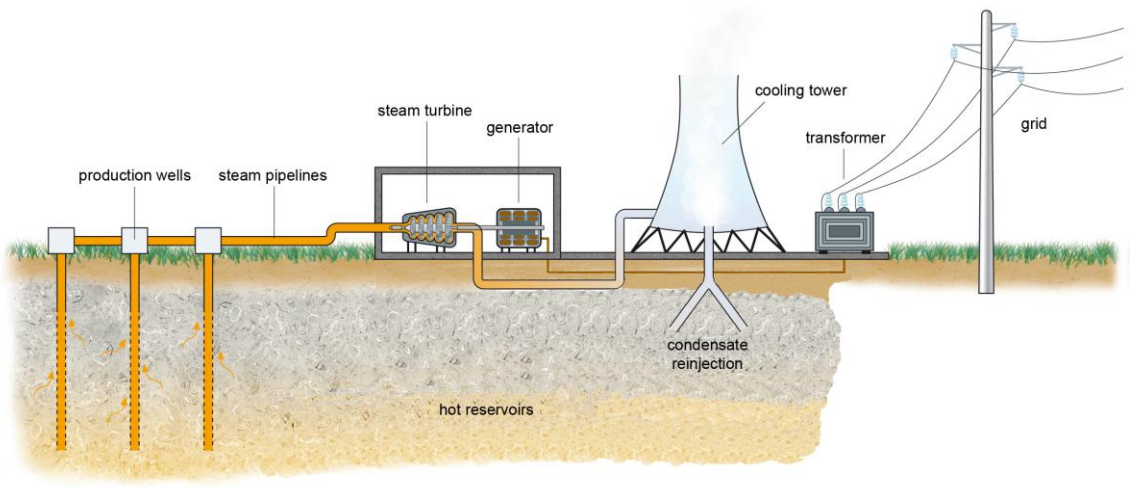
Geothermal

Geothermal power plants

A geothermal power plant converts the thermal energy of a geothermal fluid - steam or water-steam mix, resulting from the circulation of water within high-temperature reservoir rocks - into electricity.
Hot reservoirs harnessed for electricity generation have temperatures above 150°C and depths ranging from some hundreds to some thousands of metres. Generally, a geothermal plant consists of:

- systems for collecting, treating and supplying geothermal fluid to the power plant;
- system for power generation including: steam manifold, turbine, generator, step-up transformer;
- system for the steam cycle including: gas extraction, condensing and cooling;
- system for reinjecting condensed water into the geothermal reservoir.

The plant may also be equipped with systems to abate some compounds contained in the non-condensable gases and to mitigate the environmental impact.
The emissions of these plants into the atmosphere depend on the characteristics of the geothermal fluid. However, their emissions per unit of generated electricity are definitely lower than those from fossil-fired plants.



Number and capacity of geothermal power plants in Italy

	2010		2011		2011 / 2010 % change	
Capacity class (MW)	no.	MW	no.	MW	no.	MW
C ≤ 20	27	435	27	435	0.0	0.0
20 < C ≤ 40	2	75	2	75	0.0	0.0
C > 40	4	262	4	262	0.0	0.0
Total	**33**	**772**	**33**	**772**	**0.0**	**0.0**

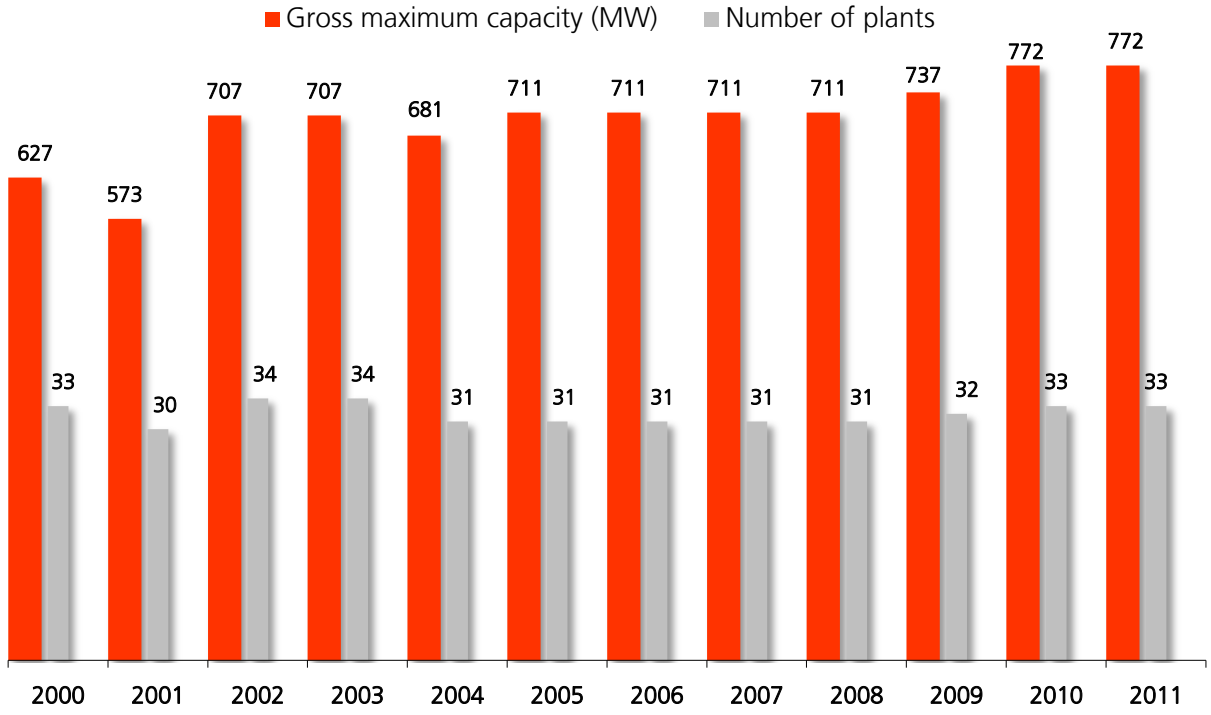
The table displays the number and gross maximum capacity of geothermal power plants.

With respect to the previous year, no change occurred in terms of number of plants or installed capacity.
Plants of up to 20 MW are the most numerous, covering 82% of the total geothermal plants and 56% of the overall geothermal capacity.
The capacity class of above 40 MW covers 12% of the total in terms of number and 34% of the total in terms of capacity. The two plants of the 20-40 MW class (6%) account for 10% of the capacity.

The largest plants (of above 40 MW) account for 12% of the total and 34% of the capacity.
The two plants in the intermediate range (20-40 MW) have a 10% share of the country's geothermal capacity.

Geothermal plants are only sited in the Tuscany Region.

Number and capacity of geothermal power plants in Italy

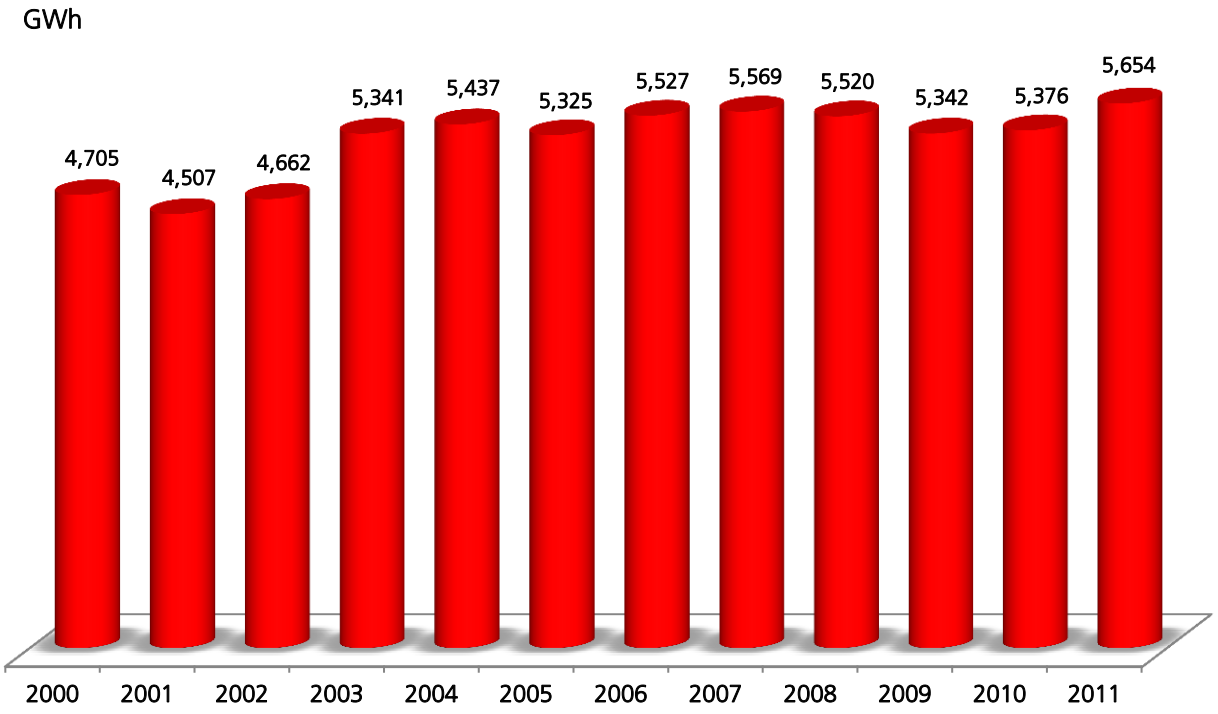


The graph shows the number and gross maximum capacity of geothermal power plants in Italy from 2000 to 2011. Variability over the years is limited, because of the proximity to the maximum exploitation of the source.

In 2011, the stock of geothermal power plants in Italy had an average installed unit capacity of 23.4 MW.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Average size (MW)	19.0	19.1	20.8	20.8	22.0	22.9	22.9	22.9	22.9	23.0	23.4	23.4

Geothermal power generation in Italy



In the period of time elapsed from 2000 to 2011, gross generation grew at a yearly average rate of 1.7%, whereas capacity was up by 1.9% on average.

The contribution of the geothermal source to total RES generation had some variability in the years from 2000 to 2011, passing from 9% in 2000 to a maximum of 12% in 2007 and then dropping to a minimum of 7% in 2011. Its contribution to total generation was more constant (1.6-1.9%).
The availability of the geothermal source is constant throughout the year, so much so that geothermal power plants historically have a number of hours of full-capacity utilisation of about 7,500.

Support schemes

Support schemes and services for renewables in 2011

GSE is the implementing body of schemes of support for RES generation and also provides services for renewables. Owners of RES plants may rely on the following schemes and/or services: feed-in premium tariff (*conto energia*), tradable green certificates (GCs) and all-inclusive feed-in tariff (*tariffa onnicomprensiva*), indirect sale of electricity through GSE (*ritiro dedicato*), net metering (*scambio sul posto*) and feed-in tariff (*CIP6)*.

The legislation governing support and services for RES generation has changed. The Ministerial Decrees of 5 and 6 July 2012 laid down new rules for the feed-in scheme and for generation from renewable sources other than solar photovoltaic, whose effects will be reported in the statistics of the coming years. The previous legislation remains applicable to the 2011 generation.

The **feed-in premium (*conto energia*)** is the main support scheme for solar power generation. The scheme, which has been in place since 1 November 2005, has experienced frequent adjustments[1] due to the changing PV market context. The support is granted for electricity generation as of the date of commissioning of the plant over a period of twenty years. The tariffs vary by capacity class and level of integration of the plant and are constant throughout the support period.

Feed-in premium (Conto Energia) - Year 2011

	Supported capacity	Supported generation	Incentive granted	Average incentive per kWh
Solar	MW	MWh	thousand €	€/kWh
Italy	12,305	10,411,275	3,855,411	0.370

In 2011, incentives were granted to photovoltaic plants with a total capacity of 12,305 MW. The overall incentives, net of adjustments, were equal to € 3,855 million, in respect of a total generation of 10,411 GWh. As compared to 2010, the average incentive per kWh fell from 0.407 to 0.370 €/kWh, since many of the plants were large-sized and eligible for the lowest tariff. The supported generation passed from about 1,899 GWh in 2010 to 10,411 in 2011, whereas the granted incentives passed from about € 773 million in 2010 to € 3,855 million in 2011, highlighting the strong growth of the solar sector.
The total amount of incentives will tend to grow significantly also in 2012.

[1] Ministerial Decrees of 28 July 2005 - 1th *Conto Energia*; Ministerial Decree of 19 February 2007 - 2th *Conto Energia*; Ministerial Decree of 6 August 2008 - 3rd *Conto Energia*; and Ministerial Decree of 5 May 2011 - 4th *Conto Energia* for PV plants commissioned after 31 May 2011.

Green Certificates (GCs) - introduced by Legislative Decree 79/99 - are issued to RES producers in respect of generation by plants which have been commissioned in the period from 1 April 1999 to 31 December 2012 and which have obtained an appropriate qualification. These tradable certificates give proof of RES generation[2]. GCs may be sold to parties having the obligation to inject a quota of RES-E into the power grid; unsold GCs are bought back by GSE. The underlying electricity represents an additional source of revenue, as it may be sold in the market. The support period is 15 years if the plant has been commissioned after 31 Dec. 2007.

Green Certificates (GCs) - Year 2011

	Supported capacity	Supported generation	Green Certificates (GC)		Value at the buy-back price of 2011
Source	MW	MWh	no.	%	thousand €
Hydro	5,008.2	15,298,191	6,308,451	28.2	518,050
Bioenergy	1,254.9	4,623,845	5,556,425	24.9	456,294
Wind	6,212.8	9,178,501	9,178,501	41.1	753,739
Geothermal	550.0	3,373,944	1,308,575	5.9	107,460
Solar	3.4	3,487	3,487	0.0	286
Italy	**13,029.2**	**32,477,968**	**22,355,439**	**100.0**	**1,835,829**

In 2011, GSE issued 22,355,439 GCs, each worth 1 MWh. 41.1% of the GCs were issued in respect of wind generation and 28.2% in respect of hydro generation.
The GSE buy-back price for 2011 was 82.12 €/MWh. The value of the GCs issued in respect of RES generation in 2010 was equal to roughly € 1,836 million.

The **all-inclusive feed-in tariff (*tariffa onnicomprensiva*)** support scheme for small RES plants - excluding photovoltaic ones - represents an alternative to the GC scheme. The tariff includes both the incentive and the value of electricity fed into the power grid. The tariff is granted, upon request, to plants which have been commissioned after 31 Dec. 2007 and with a capacity not exceeding 1 MW (200 kW for wind farms). The support period is 15 years.

All inclusive feed-in tariff - Year 2011

	Supported capacity	Supported generation	Feed-in tariff	
Source	MW	MWh	thousand €	%
Hydro	217.1	664,385	146,163	22.4
Bioenergy	431.8	1,873,650	504,147	77.4
Wind	7.2	4,374	1,312	0.2
Geothermal	-	-	-	-
Solar	-	-	-	-
Italy	**656.0**	**2,542,408**	**651,622**	**100.0**

[2] GCs are not allowed to be cumulated with feed-in tariffs. The Budget Law 2008 established that owners of photovoltaic plants may opt for the GC scheme as an alternative to the feed-in premium scheme, provided that they have submitted the application for authorisation of their plants before the enactment of the same Budget Law.

RES generation supported by the **all-inclusive feed-in tariff** in 2011 was more than twice the one of 2010 (2,542 GWh and 1,303 GWh, respectively). Bioenergy benefited the most from the scheme in 2011 with 1,874 GWh of generation and € 652 million of incentives paid to producers.

Since 1 January 2008, GSE has provided producers with a service of sale of their renewable electricity (***ritiro dedicato***). Under this service, producers entrust GSE with the task of selling their electricity in the power market. Owners of RES plants must sign an agreement with GSE, which undertakes to withdraw all the electricity that they have generated and to be injected into the grid. The price that GSE pays for this electricity is the hourly market price of the zone where the plant is located. Plants with a nominal capacity of up to 1 MW may apply for minimum guaranteed prices[3] - established by AEEG (the Italian electricity & gas regulator).

Since 1 January 2009, GSE has run a **net metering service** (*scambio sul posto*) for RES plants with a capacity of up to 200 kW, 20 kW for those commissioned until 31 December 2007. Under net metering, the electricity injected into the grid is economically offset with the value of the electricity withdrawn from the grid.
Ritiro dedicato and net metering are alternative with each other.

Indirect sale and net metering - Year 2011

	Electricity covered by the agreements	Indirect sale and net metering remuneration	
Source	MWh	thousand €	%
Hydro	4,223,470	341,040	20.7
Bioenergy	1,197,100	90,000	5.5
Wind	5,505,140	413,020	25.1
Geothermal	-	-	-
Solar	8,605,000	801,000	48.7
Italy	**19,530,710**	**1,645,060**	**100.0**

The indirect sale remuneration is the power valued at the minimum guaranteed prices[3] or the hourly zonal market price in accord with the applicable agreements. The net metering remuneration is equal to the lower value between the electricity fed into and the electricity withdrawn from the grid by the producer/user.

[3] Minimum guaranteed prices are paid in respect of electricity generated by RES plants with a yearly average nominal capacity not exceeding 1 MW and only for the first 2 million kWh fed into the grid during the year. For 2011, the minimum guaranteed prices were as follows:

- 103.4 €/MWh for up to 500 MWh of electricity injected into the grid every year;
- 87.2 €/MWh for over 500 and up to 1,000 MWh of electricity injected into the grid every year;
- 76.2 €/MWh for over 1,000 and up to 2,000 MWh of electricity injected into the grid every year.

The *CIP6* scheme is another form of support that GSE manages and that is no longer applicable to new projects. The *CIP6/92* decree has promoted the construction of plants using renewable and other eligible sources, by remunerating the electricity fed into the grid at a feed-in tariff. GSE purchases the electricity and resells it on the power exchange; the charge resulting from the difference between the costs and revenues from the sale of electricity and of the possibly associated GCs is passed onto the electricity bills as tariff component A3.

CIP6 - Year 2011

	Capacity covered by the agreements	Energy withdrawn	CIP6 remuneration			Revenues from sale	Support scheme costs
Source	MW	MWh	thousand €	%	€/kWh	thousand €	thousand €
Hydro	0.2	11,050	1,437	0.2	0.130	808	629
Bioenergy	658.0	4,445,000	873,700	94.3	0.197	324,930	548,771
Wind	346.2	465,023	51,360	5.5	0.110	33,993	17,367
Geothermal	-	-	-	-	-	-	-
Solar	-	-	-	-	-	-	-
Italy	**1,004.4**	**4,921,073**	**926,497**	**100.0**	**0.188**	**359,730**	**566,767**

RES generation supported under the *CIP6* scheme diminished, passing from about 6,047 GWh in 2010 to 4.921 GWh in 2011. The remuneration dropped from about € 1,079 million in 2010 to about 926 in 2011. The decrease is to be ascribed to the expiration of the agreements and the fact that no new applications for the scheme may be submitted.

The total revenues were equal to roughly € 360 million, whereas the total support costs amounted to about € 567 million.

All the data reported in this section are updated until the end of July 2012 and to be considered as provisional.

Support schemes for renewables in the EU-27

A number of support schemes have been put in place all over Europe.
The most common are:

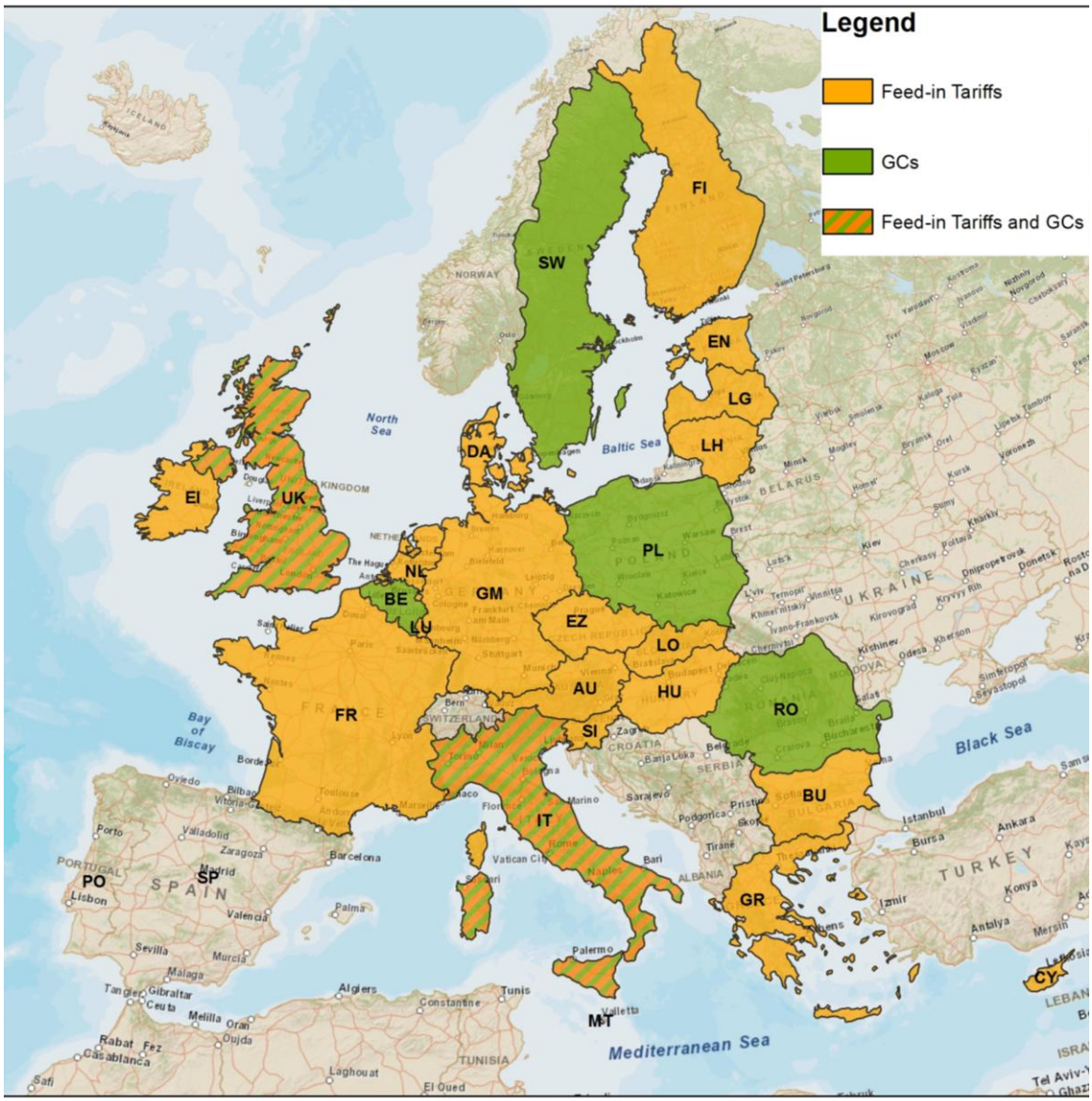
Feed-in Tariff: under the applicable legislation, some parties are required to buy RES-E to be injected into the grid, typically at predetermined fixed prices higher than market prices. The obliged parties - public entities or private grid operators - take on the responsibility of reselling this electricity in the market. The cost of the incentive is given by the difference between the purchase price and the revenue from the electricity sale; this cost is passed onto the electricity bills through a special cost item, e.g. component A3 in Italy.

Feed-in Premium*:* RES generation is remunerated through two separate components: the first comes from the sale of electricity to be fed into the grid, which is exposed to demand/supply fluctuations; the second is the premium for electricity generated, or fed into the grid; this premium is paid by transmission system operators or other designated entities under the applicable legislation. Generally, the legislation specifies a maximum and/or minimum limit to the total remuneration or, where necessary, a zero premium. In Italy, the feed-in premium scheme for photovoltaic plants involves a tariff based on the generated electricity.

Tradable Green Certificates (TGCs) and quota system: similarly to the feed-in premium, RES generation is remunerated through two separate components: sale of electricity and TGCs, certifying generation of a given quota of RES-E. The TGCs are issued by a specially designated entity - GSE in Italy, Ofgem in the UK, SvK in Sweden, etc. - directly to producers. Therefore, under the applicable legislation, some parties engaged in the electricity business are required, by a given date, to surrender a number of TGCs proportional to the amount of electricity that they have managed, generated, sold, imported or dispatched. Hence, the obliged parties are held to purchase TGCs and to guarantee one of the two remuneration components to RES producers. The price of TGCs often falls within a range specified in the relevant legislation. Italy is the only country which identified RES producers and importers as obliged parties. In the other countries, the obligation generally falls on electricity suppliers.

Grants: contributions given by the State to producers with the purpose of supporting in part the construction of their plants.

Tax incentives: this support scheme is widespread but of limited extent. It consists in totally or partially exempting RES producers or consumers from taxes or charges or granting them with benefits, such as accelerated depreciation rates.



Source: GSE

The map shows the schemes of support for RES in Europe: Feed-in tariff/FIT and Feed-in premium/FIP), GCs, combined feed-in tariffs and GCs.

20 countries of the EU-27 use FITs and FIPs, whereas Belgium, Poland, Romania and Sweden use GCs only.

Grants and tax incentives, albeit of limited extent, are widespread all over Europe.

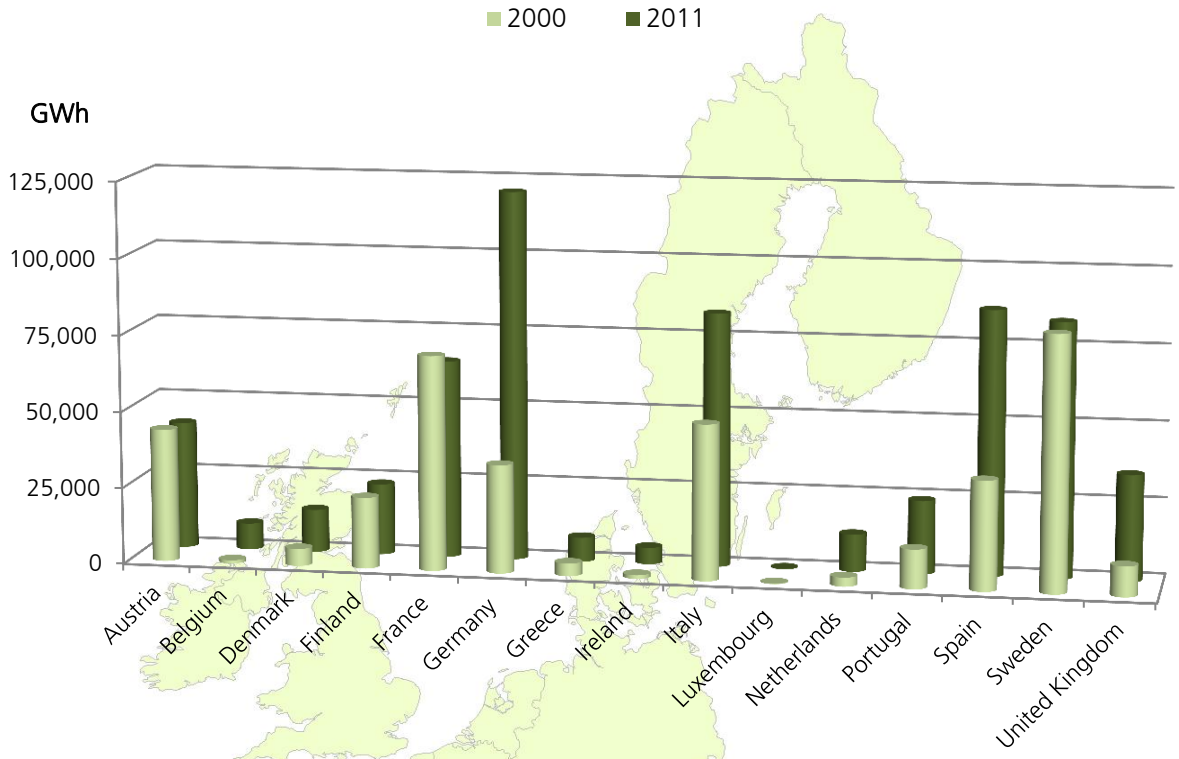
Italy and the UK use both feed-in tariffs and GCs.

The GC scheme will cease to be applicable in Italy at the end of 2012. RES plants will have access to feed-in tariffs only.

Currently, Spain and Portugal have no longer schemes of support for RES, although incentives for old plants are still in force.

International comparisons

Comparison of gross RES generation in the EU-15



Source: IEA, provisional data

Between 2000 and 2011, Germany and Spain recorded the strongest growth in RES generation among the EU-15 Member States.

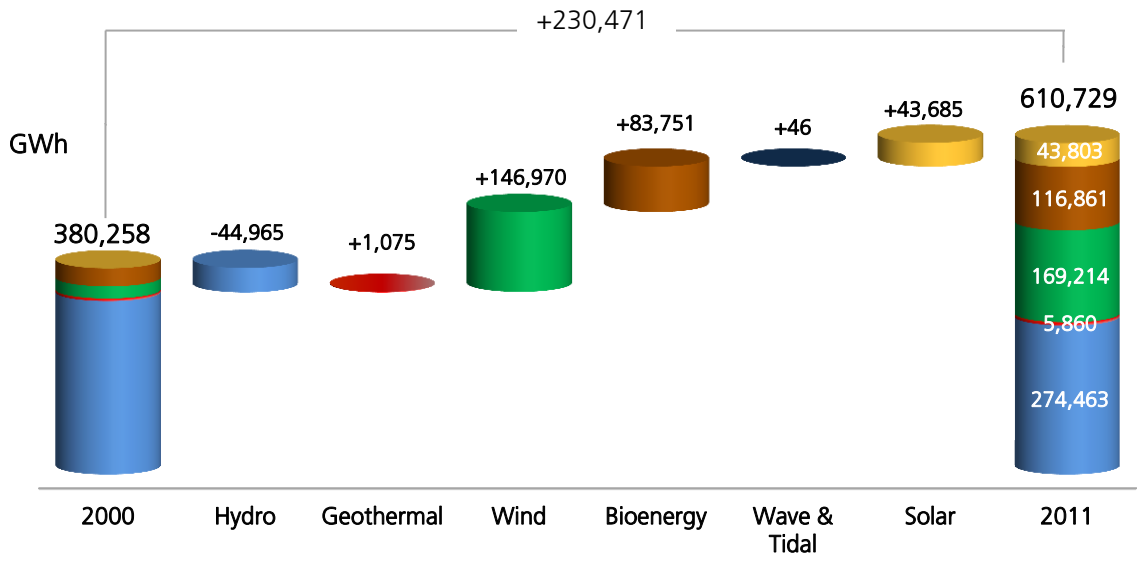
Belgium was the country which grew the most, as its generation in 2011 was up by 727% on 2000.

RES GEN / Total Gen in 2000 and 2011

	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Sweden	United Kingdom	EU-15
2000	71%	1%	16%	33%	13%	6%	8%	5%	18%	15%	3%	29%	16%	57%	3%	15%
2011	63%	10%	40%	32%	12%	20%	15%	20%	27%	6%	11%	46%	30%	55%	10%	22%

Over the past years, the EU-15 increased the weight of RES generation in total electricity generation, except Austria (-8%), France (-1%), Luxembourg (-9%), Finland (-1%) and Sweden (-2%). The countries with the highest growth were Denmark (+24%) and Portugal (+17%).

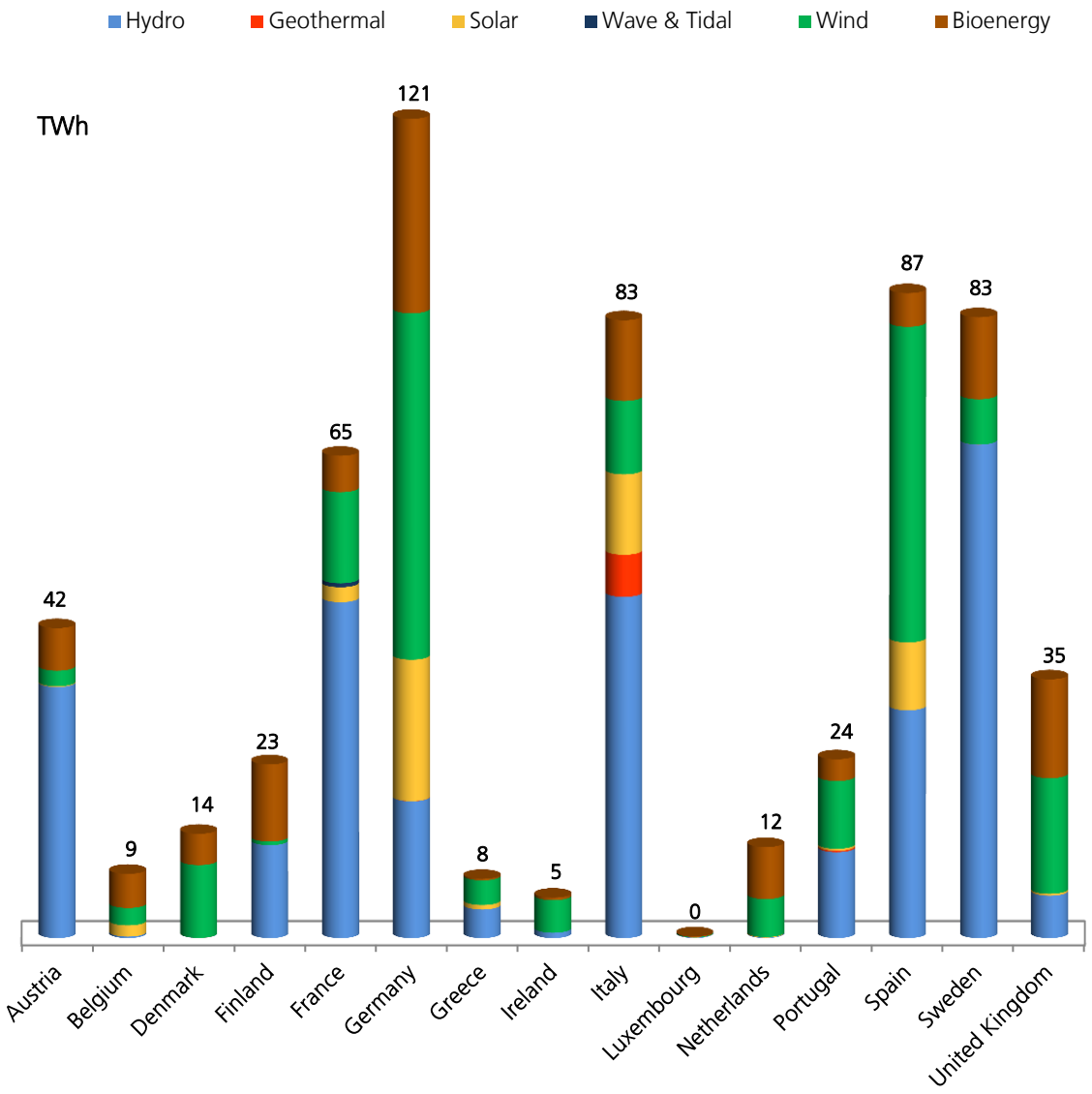
Change in RES generation in the EU-15 - by source



From 2000 to 2011, RES generation in the EU-15 grew by 230,471 GWh (about +61%).
In this period of time, a generalised increase in generation from the various sources - especially from wind and bioenergy, followed by solar - was observed.

Also the distribution among the different sources changed substantially.
Hydro, which was almost exclusive initially (84% of RES generation), accounted for 45% of RES generation in 2011. Wind and bioenergy increased their contribution to total RES generation, reaching 28% and 19%, respectively. The solar source, which was almost non-existent, accounted for 7% of RES generation in 2011.

Gross RES generation in the EU-15 in 2011 by source (1/2)



The comparison of the RES generating mix in the EU-15 shows that, in 2011, hydro power generation in Austria, Sweden and France was equal to or higher than 70%. Wind power generation was very widespread in Denmark and Ireland, with 70% and 81% of RES generation, respectively. Spain and Germany had shares of 49% and 45%, respectively, though being the countries with the highest wind power generation in absolute terms.

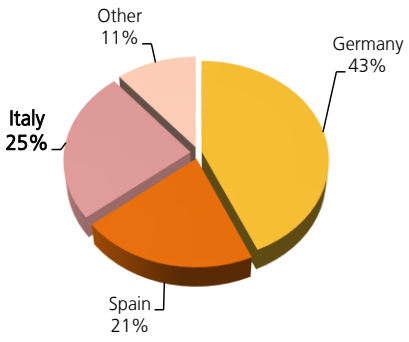
Bioenergy had the highest weight in the RES generating mix of the Netherlands (57%), Belgium (53%) and Finland (44%). Germany and Spain exceeded 10 TWh of solar power generation, whereas geothermal generation was significant only in Italy (over 5 TWh). Only France generated electricity from tidal and wave energy (0.5 TWh).

Gross RES generation in the EU-15 in 2011 by source (2/2)

GWh	Hydro	Geothermal	Solar	Wave & Tidal	Wind	Bioenergy	Total
Austria	33,716	1	107	-	2,086	5,719	41,629
Belgium	199	-	1,503	-	2,336	4,591	8,629
Denmark	17	-	6	-	9,774	4,213	14,010
Finland	12,478	-	5	-	483	10,371	23,337
France	45,106	-	2,015	527	12,235	4,888	64,771
Germany	18,372	19	19,000	-	46,500	36,920	120,811
Greece	3,831	-	610	-	3,315	190	7,946
Ireland	707	-	-	-	4,380	342	5,429
Italy	45,823	5,654	10,796	-	9,856	10,832	82,961
Luxembourg	61	-	21	-	64	93	239
Netherlands	57	-	84	-	5,097	6,991	12,229
Portugal	11,545	186	265	-	9,106	2,915	24,017
Spain	30,593	-	9,120	-	42,374	4,513	86,600
Sweden	66,264	-	12	-	6,083	11,007	83,366
United Kingdom	5,694	-	259	-	15,525	13,276	34,754
UE15	**274,463**	**5,860**	**43,803**	**527**	**169,214**	**116,861**	**610,728**

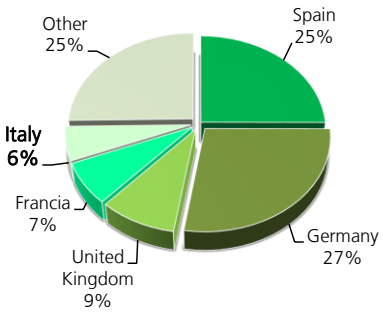
Generation from solar, wind and bioenergy had the highest growth in the past few years. The following are the top producers from these sources in the EU-15:

Solar



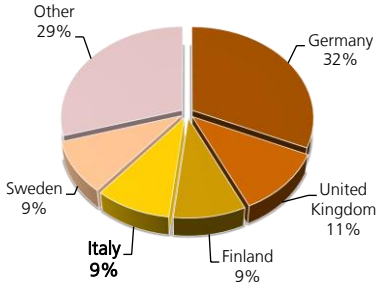
Italy
2nd place

Wind



Italy
5th place

Bioenergy



Italy
4th place