



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

Biomass Gasification for Power Production Country Report - Italy

Task IEA 33

Innsbruck – 2 May 2017

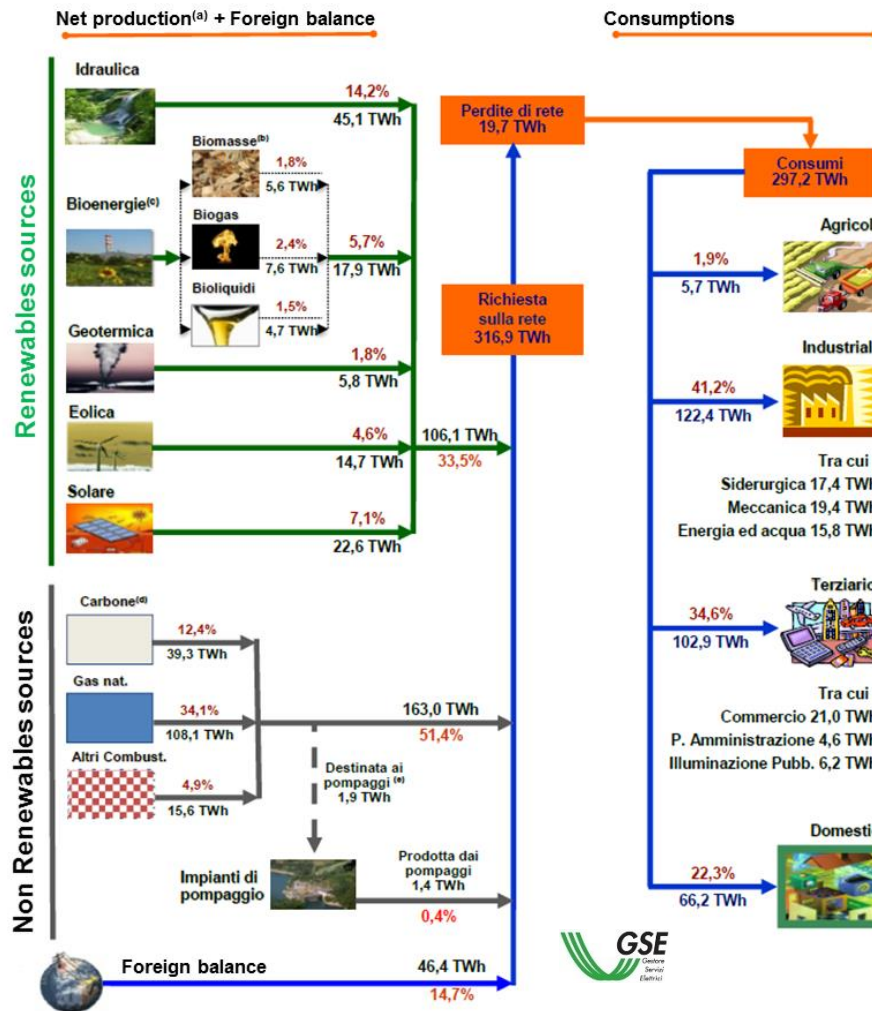
Donatella Barisano - Enea



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National Electricity Balance in 2015



Total grid requirement
316.9 TWh

Share of Total RES
106.1 TWh, 33.5%

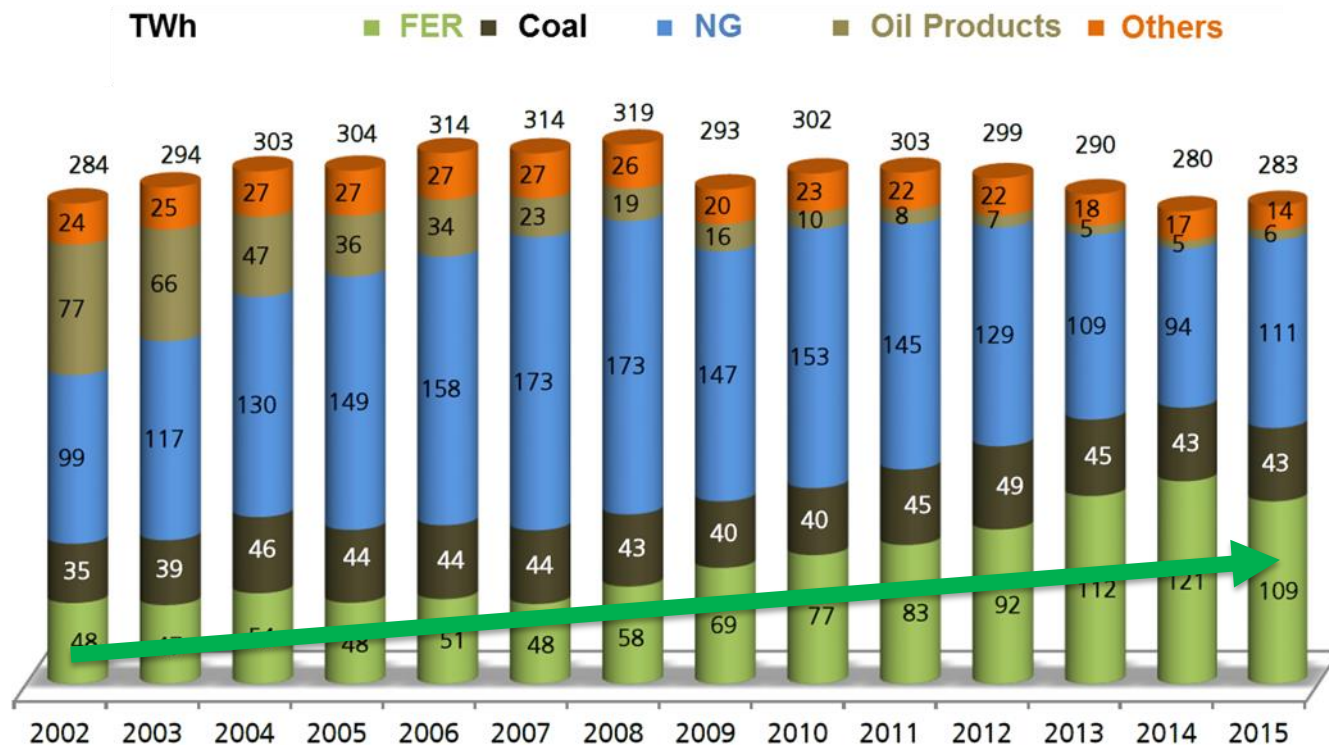
Share of Bioenergy
17.9 TWh, 5.7%

Share of Biomass
5.6 TWh, 1.8%

(A) Net production: gross production net of auxiliary services; (B) Includes the biodegradable part of MSW; (C) Net of the non-biodegradable fraction of MSW accounted in other fuels; (D) Coal + Lignite; (E) The energy used for pumping is conventionally subtracted from the non-renewable thermal production.

Source: Energia da fonti rinnovabili in Italia - Rapporto Statistico 2015, available at: <http://www.gse.it/it/Statistiche/RapportiStatistici/Pagine/default.aspx>

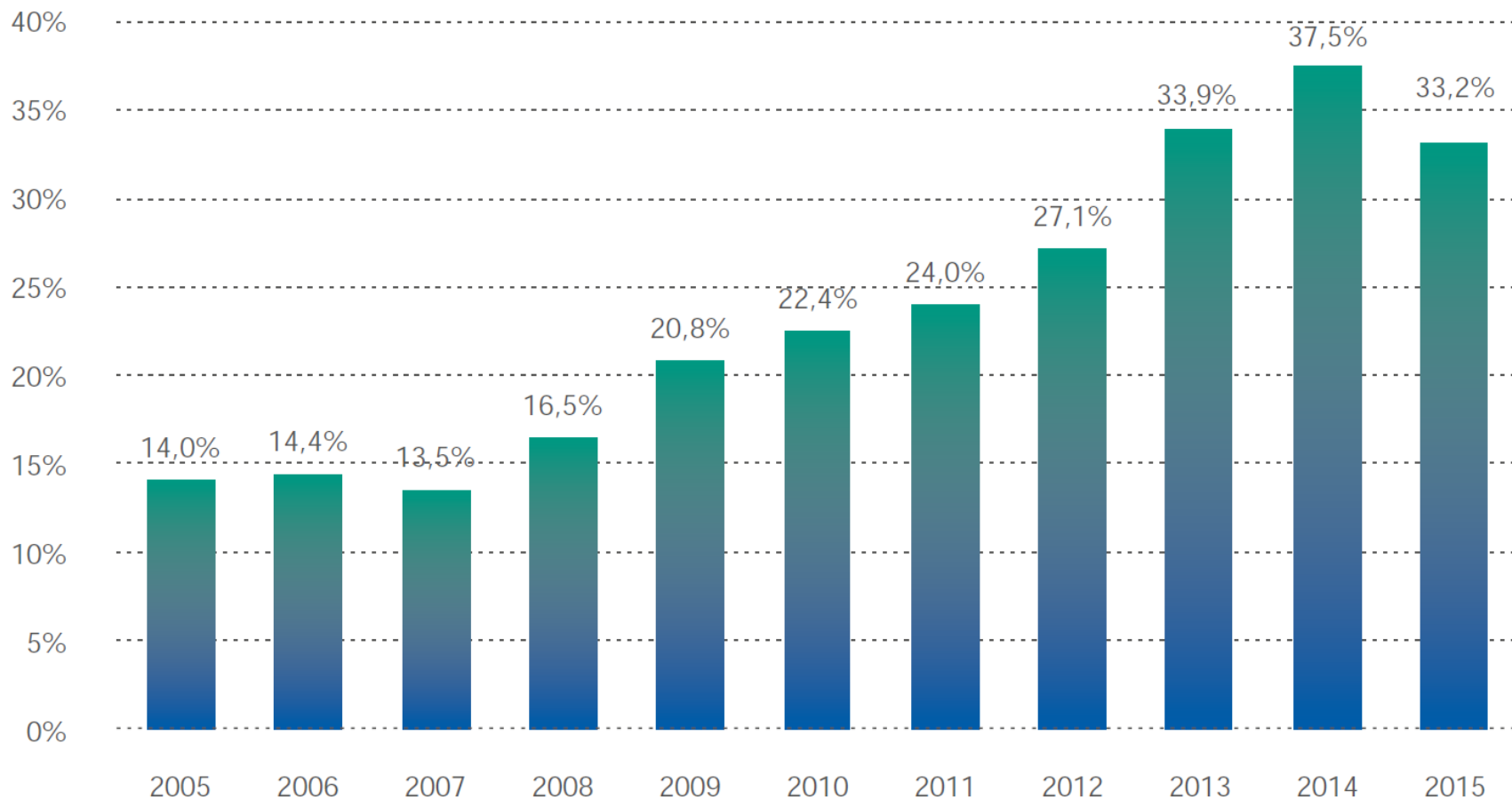
Total Gross Electrical Power Production (RES, fossil fuels et al.)



Source: Energia da fonti rinnovabili in Italia - Rapporto Statistico 2015, GSE

In Italy, in the time frame 2002-2015 the power production from RES progressively increased, passing from 48 to 109 TWh.

Share of RES on gross domestic consumption over time




 Source: Sintesi del sistema elettrico dell'anno 2015 - Terna S.p.A. e Gruppo Terna. Available at: <http://download.terna.it/terna/0000/0908/62.PDF>

In 2015 the weight of renewables on gross domestic consumption electricity production has achieved 33.2%, significantly higher than the equivalent share observed in 2005.

Share of energy from RES in gross final consumption of energy in the EU area

Table 1: Share of energy from renewable sources in gross final consumption of energy, 2004-2015 %

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2011-2012 average	2013-2014 average	S ₂₀₀₅	2011-2012	indicative 2013-2014	trajectory 2015-2016	2017-2018	2020 target	
EU-28	8.5	9.0	9.5	10.4	11.0	12.4	12.9	13.2	14.4	15.2	16.1	16.7	13.8	15.6	-	-	-	-	-	-	20
Belgium	1.9	2.3	2.6	3.1	3.6	4.7	5.7	6.3	7.2	7.5	8.0	7.9	6.7	7.8	2.2	4.4	5.4	7.1	9.2	13	
Bulgaria	9.4	9.4	9.6	9.2	10.5	12.1	14.1	14.3	16.0	19.0	18.0	18.2	15.2	18.5	9.4	10.7	11.4	12.4	13.7	16	
Czech Republic	6.8	7.1	7.4	8.0	8.6	9.9	10.5	11.0	12.8	13.8	15.1	15.1	11.9	14.5	6.1	7.5	8.2	9.2	10.6	13	
Denmark	14.9	16.0	16.3	17.8	18.6	20.0	22.1	23.5	25.7	27.4	29.3	30.8	24.6	28.4	17.0	19.6	20.9	22.9	25.5	30	
Germany	5.8	6.7	7.7	9.1	8.6	9.9	10.5	11.4	12.1	12.4	13.8	14.6	11.8	13.1	5.8	8.2	9.5	11.3	13.7	18	
Estonia	18.4	17.5	16.1	17.1	18.9	23.0	24.6	25.5	25.8	25.6	26.3	28.6	25.7	26.0	18.0	19.4	20.1	21.2	22.6	25	
Ireland	2.4	2.9	3.1	3.6	4.1	5.1	5.6	6.6	7.2	7.7	8.7	9.2	6.9	8.2	3.1	5.7	7.0	8.9	11.5	16	
Greece	6.9	7.0	7.2	8.2	8.0	8.5	9.8	10.9	13.5	15.0	15.3	15.4	12.2	15.2	6.9	9.1	10.2	11.9	14.1	18	
Spain	8.3	8.4	9.2	9.7	10.8	13.0	13.8	13.2	14.3	15.3	16.1	16.2	13.8	15.7	8.7	11.0	12.1	13.8	16.0	20	
France	9.4	9.5	9.3	10.1	11.1	12.1	12.5	11.1	13.4	14.1	14.7	15.2	12.3	14.4	10.3	12.8	14.1	16.0	18.6	23	
Croatia	23.5	23.8	22.7	22.2	22.0	23.6	25.1	25.4	26.8	28.0	27.9	29.0	26.1	28.0	12.6	14.1	14.8	15.9	17.4	20	
Italy	6.3	7.5	8.3	9.8	11.5	12.8	13.0	12.9	15.4	16.7	17.1	17.5	14.2	16.9	5.2	7.6	8.7	10.5	12.9	17	
Cyprus	3.1	3.1	3.3	4.0	5.1	5.6	6.0	6.0	6.8	8.1	8.9	9.4	6.4	8.5	2.9	4.9	5.9	7.4	9.5	13	
Latvia	32.8	32.3	31.1	29.6	29.8	34.3	30.4	33.5	35.7	37.1	38.7	37.6	34.6	37.9	32.6	34.1	34.8	35.9	37.4	40	
Lithuania	17.2	16.8	16.9	16.5	17.8	19.8	19.6	19.9	21.4	22.7	23.6	25.8	20.7	23.1	15.0	16.6	17.4	18.6	20.2	23	
Luxembourg	0.9	1.4	1.5	2.7	2.8	2.9	2.9	2.9	3.1	3.5	4.5	5.0	3.0	4.0	0.9	2.9	3.9	5.4	7.5	11	
Hungary	4.4	4.5	5.1	5.9	6.5	8.0	12.8	14.0	15.5	16.2	14.6	14.5	14.8	15.4	4.3	6.0	6.9	8.2	10.0	13	
Malta	0.1	0.2	0.2	0.2	0.2	0.2	1.0	1.9	2.8	3.7	4.7	5.0	2.4	4.2	0.0	2.0	3.0	4.5	6.5	10	
Netherlands	2.1	2.5	2.8	3.3	3.6	4.3	3.9	4.5	4.7	4.8	5.5	5.8	4.6	5.2	2.4	4.7	5.9	7.6	9.9	14	
Austria	22.6	23.9	25.4	27.2	28.1	29.9	30.4	30.6	31.4	32.3	32.8	33.0	31.0	32.5	23.3	25.4	26.5	28.1	30.3	34	
Poland	6.9	6.9	6.9	6.9	7.7	8.7	9.3	10.3	10.9	11.4	11.5	11.8	10.6	11.4	7.2	8.8	9.5	10.7	12.3	15	
Portugal	19.2	19.5	20.8	21.9	23.0	24.4	24.2	24.6	24.6	25.7	27.0	28.0	24.6	26.4	20.5	22.6	23.7	25.2	27.3	31	
Romania	16.3	17.3	17.1	18.3	20.5	22.7	23.4	21.4	22.8	23.9	24.8	24.8	22.1	24.4	17.8	19.0	19.7	20.6	21.8	24	
Slovenia	16.1	16.0	15.6	15.6	15.0	20.1	20.4	20.3	20.8	22.4	21.5	22.0	20.5	22.0	16.0	17.8	18.7	20.1	21.9	25	
Slovak Republic	6.4	6.4	6.6	7.8	7.7	9.4	9.1	10.3	10.4	10.1	11.7	12.9	10.4	10.9	6.7	8.2	8.9	10.0	11.4	14	
Finland	29.2	28.8	30.0	29.6	31.3	31.3	32.4	32.8	34.4	36.7	38.7	39.3	33.6	37.7	28.5	30.4	31.4	32.8	34.7	38	
Sweden	38.7	40.6	42.7	44.2	45.3	48.2	47.2	48.7	51.1	52.0	52.5	53.9	49.9	52.2	39.8	41.6	42.6	43.9	45.8	49	
United Kingdom	1.1	1.3	1.5	1.8	2.7	3.3	3.7	4.2	4.6	5.7	7.1	8.2	4.4	6.4	1.3	4.0	5.4	7.5	10.2	15	
Iceland	58.9	60.1	60.8	71.5	67.5	69.7	70.4	71.6	72.5	71.7	70.5	70.2	72.0	71.1	55.0	56.8	57.7	59.1	60.9	64	
Norway	58.1	59.8	60.2	60.1	61.7	64.8	61.2	64.6	65.6	66.7	69.4	69.4	65.1	68.0	58.2	60.1	61.0	62.4	64.2	67.5	
Albania	28.1	30.7	32.1	32.8	32.9	31.4	32.0	31.4	35.2	33.2	32.0	34.9	33.3	32.6	-	32.6	33.2	34.3	35.6	38	
Montenegro	-	35.7	34.8	32.9	32.3	39.4	40.6	40.7	41.6	43.7	44.1	43.1	41.1	43.9	-	27.6	28.3	29.3	30.7	33	
FYR of Macedonia	15.7	16.5	16.5	15.0	15.6	17.2	16.5	16.4	18.1	18.5	19.6	19.9	17.3	19.0	-	23.1	23.7	24.6	25.9	28	
Turkey	16.2	15.6	14.1	13.3	13.5	14.3	14.2	13.0	13.1	14.0	13.7	13.6	13.0	13.8	-	-	-	-	-	-	

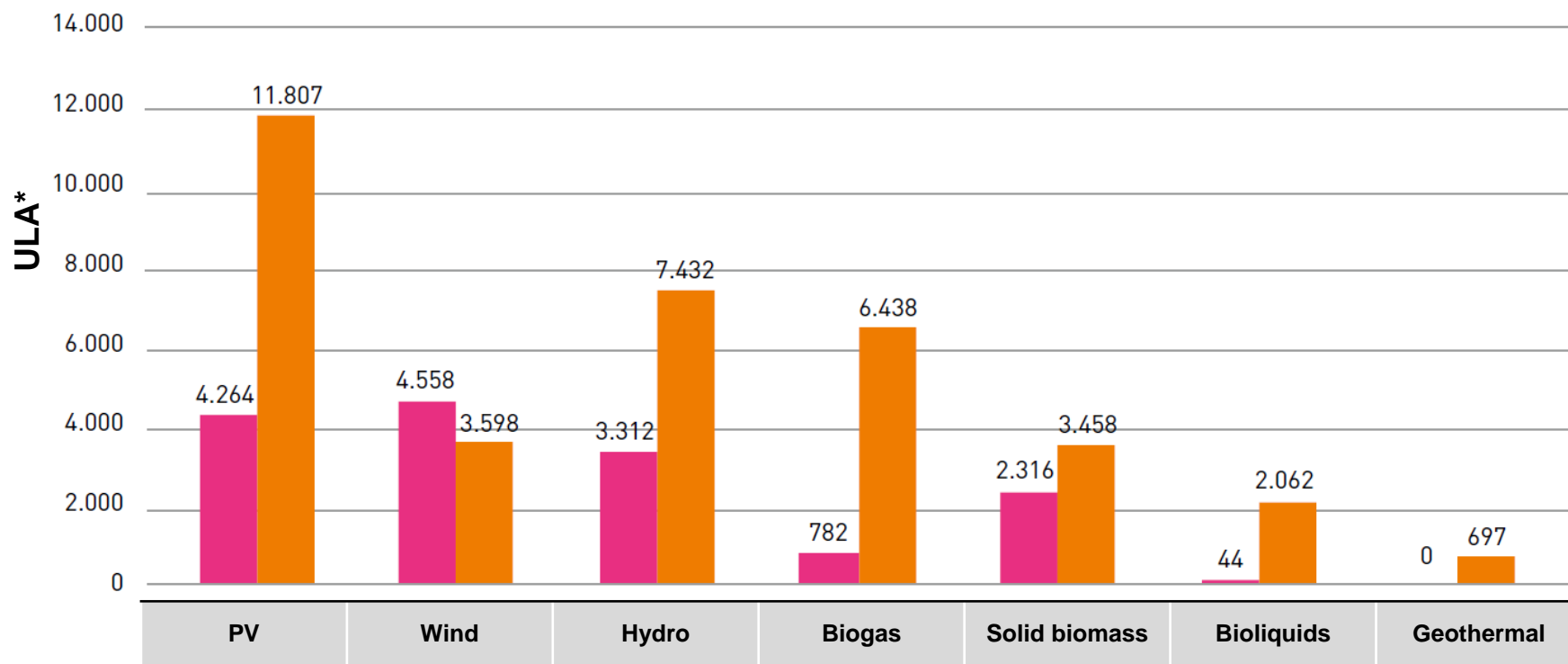
eurostat  Source: http://ec.europa.eu/eurostat/statistics-explained/images/c/ce/Share_of_energy_from_renewable_sources_in_gross_final_consumption_of_energy%2C_2004-2015_%25_T1_Newpng.png

Italy achieved the UE 2020 target of 17% share of FER in gross final consumption (power, heat and transport) already in 2014.

Impact on employment from RES

Estimation of temporary and permanent employment effects in 2016 [annual work unit, considering the sum of direct and indirect ULA.

- Temporary workers (dir + indir)
- Permanent workers (dir + indir)



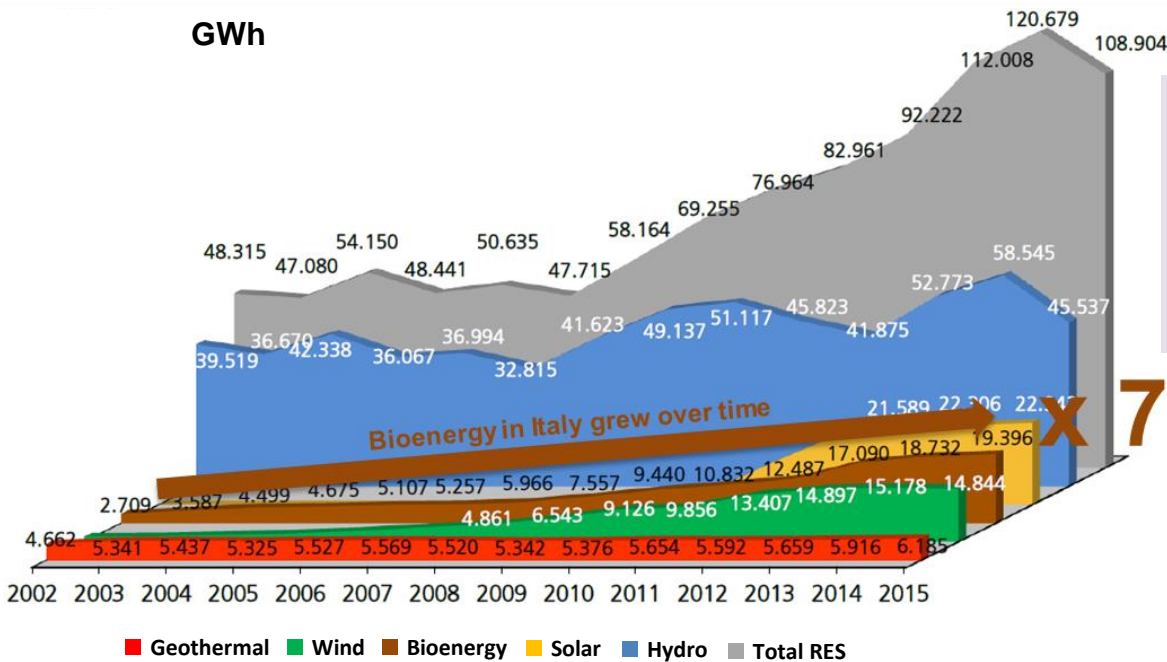
*) ULA represents the amount of work done in the year by a full-time employee, or the equivalent amount of work performed by part-time employees converted into annual work units full time. (ULA (unità-lavorative-anno) = Unit labour per year)

Source: RAPPORTO ATTIVITÀ 2016 – GSE. Available at: <http://www.gse.it/it/Dati%20e%20Bilanci/Rapporti%20delle%20attivit%C3%A0/Pages/default.aspx>



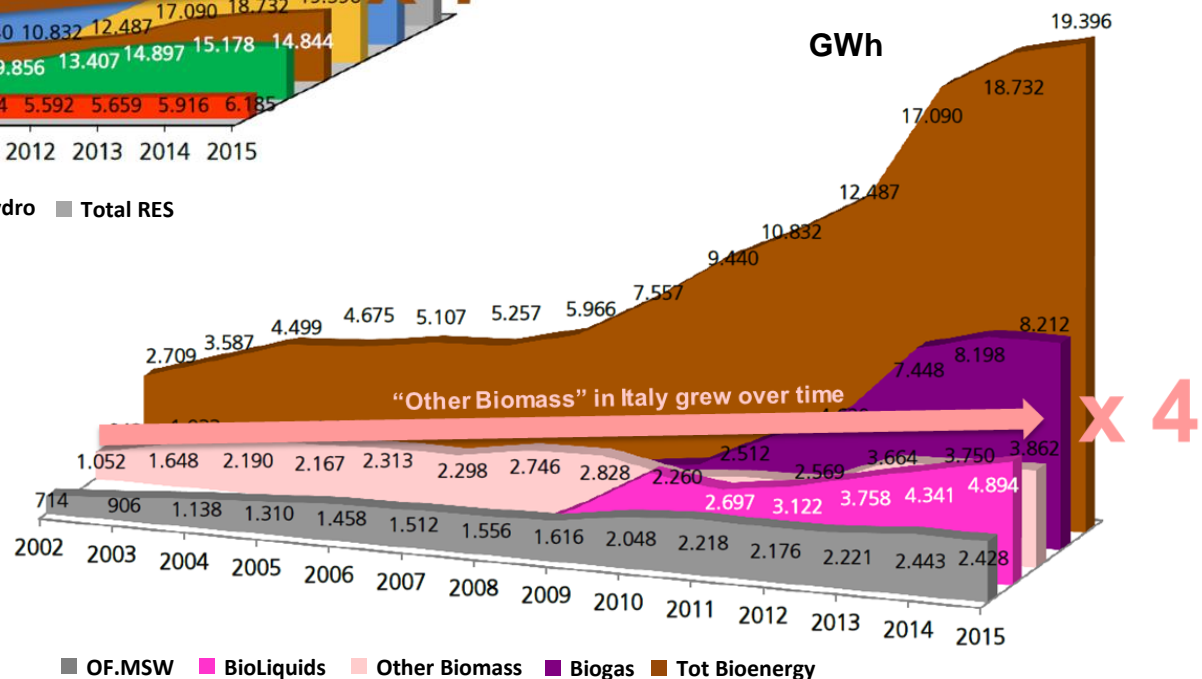
Trends in power production from RES and Bioenergy by sources (solid biomass et al.)

GWh



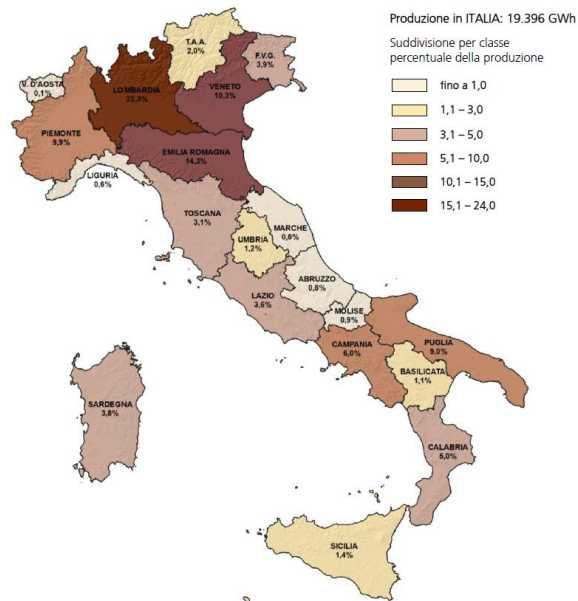
In the time frame 2002-2015 the Italian power production from Bioenergy and biomass in particular grew by a factor of 7 and 4, respectively.

GWh

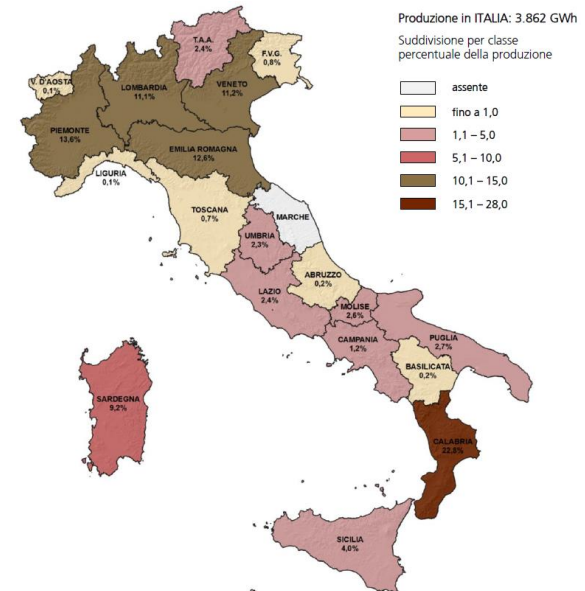


Bioenergy production by region in 2015

Tot Bioenergy production: 19,396 GWh



Bioenergy from «other biomass»*: 3,862 GWh



*Other biomass: solid biomass feedstocks different from OF of MSW

Range of power	N° of Plant	Power (MW)	Produced Energy (GWh)
P ≤ 1 MW	2.270	1.287	8.048
1 MW < P ≤ 10 MW	314	885	3.091
P > 10 MW	63	1.885	8.256
Totale	2.647	4.057	19.396

86 %_{Num}
41 %_{GWh}

Means of support in Italy

Current scheme

- [Feed-in tariff I \(tariffa onnicomprensiva\)](#)
- [Feed-in tariff II \(Ritiro dedicato\)](#)
- [Net-Metering \(scambio sul posto\)](#)
- [Premium tariff I](#)
- [Premium tariff II \(Conto energia per il solare termodinamico\)](#)
- [Tax regulation mechanisms I \(Reduction in value-added tax\)](#)
- [Tax regulation mechanisms II \(Reduction in real estate tax\)](#)
- [Tenders \(Auction Process\)](#)

Updated: 22.02.2017

Author: Dr. Moira Jimeno



Summary of support schemes

- **Feed-in tariff I.** All RES plants, except for PV plants, with an installed capacity between 1 kW and 0.5 MW are entitled to choose feed-in tariff I in alternative to the premium tariff.
- **Feed-in premium.** All RES plants, except for PV plants, with an installed capacity between 1 kW and 5 MW are eligible for receiving this premium tariff. Plants with an installed power between 1 kW and 0.5 MW are entitled to choose the feed-in tariff I in alternative to the premium tariff.
- **Tendering scheme.** All RES plants beyond a certain capacity, except for PV, are eligible for receiving incentives in the form of a premium tariff after undergoing a tendering process. This system is alternative to any other public incentive, to the Ritiro Dedicato and to the Scambio sul Posto
- **Feed-in tariff II.** Photovoltaic installations are promoted through a guaranteed payment so-called "ritiro dedicato".
- **Net-metering.** Interested parties can make use of net-metering
- **Tax regulation mechanisms.** Photovoltaic and wind energy plants are eligible for a reduced VAT of 10% (instead of 20%). This tax benefit applies to enterprises, professionals and private individuals.

Furthermore, Gestore dei Servizi Energetici (GSE) shall manage the sale of renewable energy on request. In addition to these national incentives, Italy provides for a series of regional programmes. The Osservatorio Politiche Energetico-Ambientali Regionali e Locali and FIRE give an overview of regional support schemes (e.g. "tetti fotovoltaici" programme or regional energy programmes).

Technologies

HIDE

In general, all technologies used in renewable electricity generation are promoted; however, they are eligible for different incentives.

Statutory provisions

SHOW

Feed-in tariff I (tariffa omnicomprensiva)

Updated: 22.02.2017

Author: Dr. Moira Jimeno

All plants except for PV plants with an installed capacity between 1 kW and 0.5 MW are entitled to choose this feed-in tariff in alternative to the premium tariff I (Art.3, c.1 and c.4 & 7, c.4 and c.6 DM 23/06/16). Depending on their size, plants may access this scheme directly or after undergoing a listing in a registry with capacity limits set per year.

Eligible technologies

SHOW

Amount

HIDE

The Tarifa omnicomprensiva (T_o) is determined by the following formula:

$$T_o = T_b + P_r$$

- T_b : the tariffs indicated by source in Annex 1 DM 23/06/16 (Annex 1 in conjunction with Art. 7, c. 4 DM 23/06/16).
- P_r : bonuses that may be granted to the plant.

(Annex 1 DM 23/06/16)

• The larger the plant the lower the incentive

• The incentives have to be gradually reduced over time.

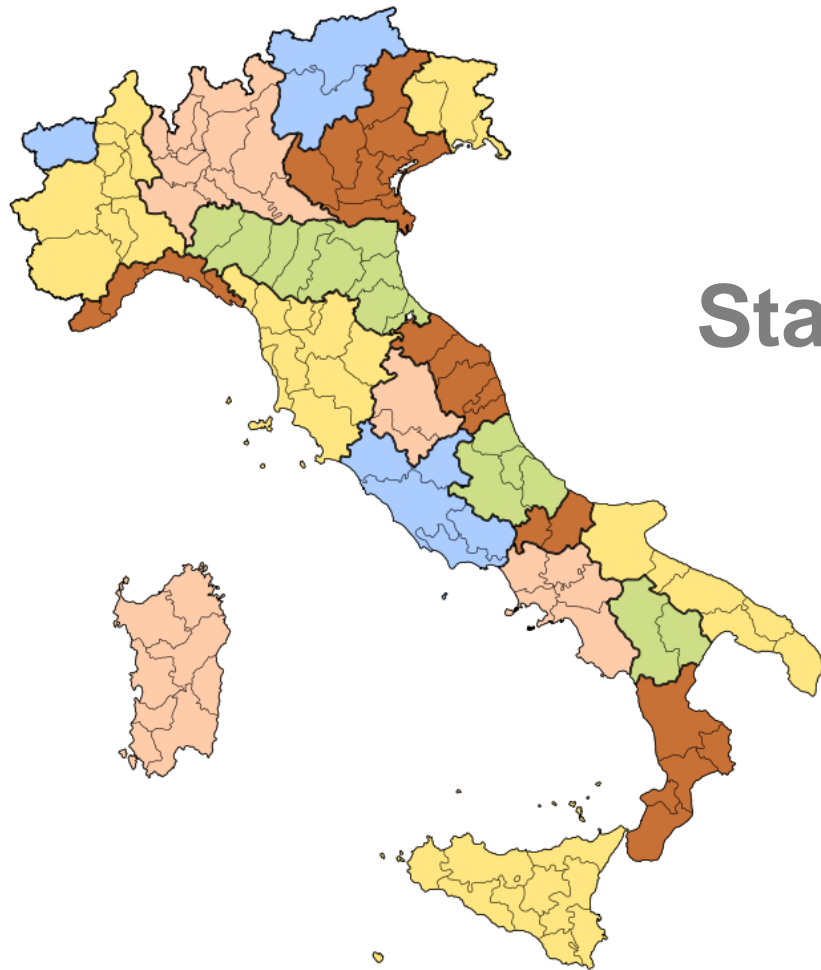
VITA UTILE CONVENZIONALE, TARIFFE INCENTIVANTI E INCENTIVI PER I NUOVI IMPIANTI

Fonte rinnovabile	Tipologia	Potenza	VITA UTILE degli IMPIANTI	Tb	Tb
		kW	anni	€/MWh	
Biomasse	a) prodotti di origine biologica di cui alla Tabella 1-B	1<P≤300	20	210	229
		300<P≤1000	20	150	180
		1000<P≤5000	20	115	133
		P>5000	-	-	122
	b) sottoprodotti di origine biologica di cui alla Tabella 1 A; d) rifiuti non provenienti da raccolta differenziata diversi da quelli di cui alla lettera c)	1<P≤300	20	246	257
		300<P≤1000	20	185	209
		1000<P≤5000	20	140	161
		P>5000	-	-	145
	c) rifiuti per i quali la frazione biodegradabile è determinata forfettariamente con le modalità di cui all'Allegato 2 del decreto 6 luglio 2012	1<P≤5000	-	-	174
		P>5000	20	119	125

23-June-2016

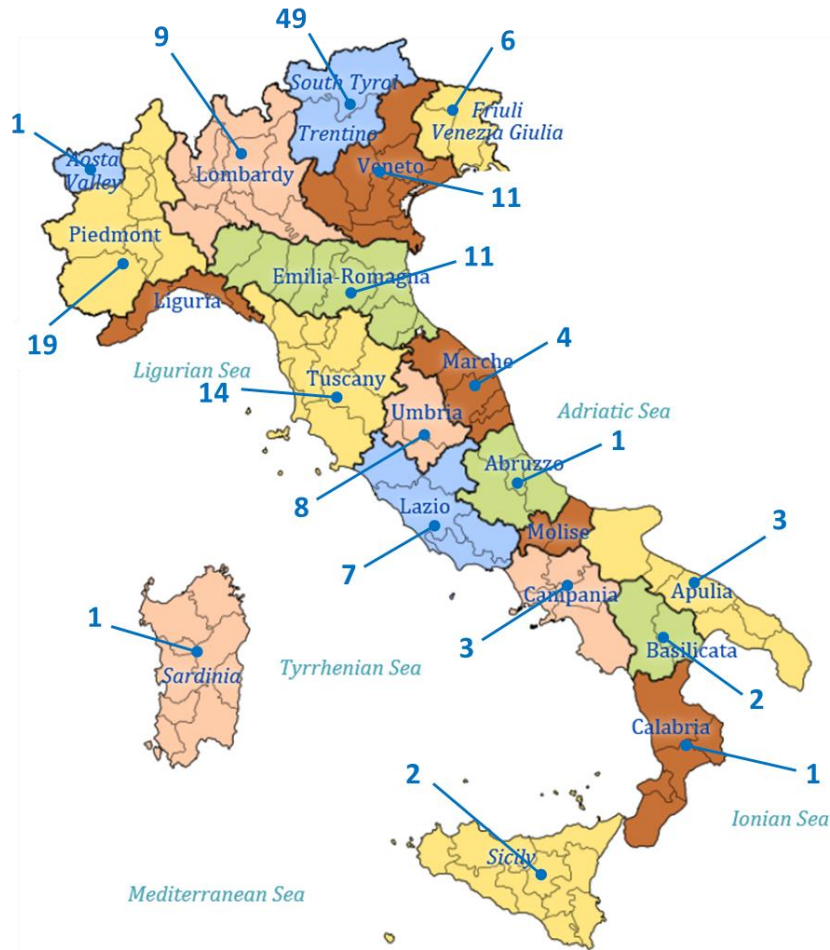
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Status of Gasification in Italy

Gasification plants across the Italian «boot»

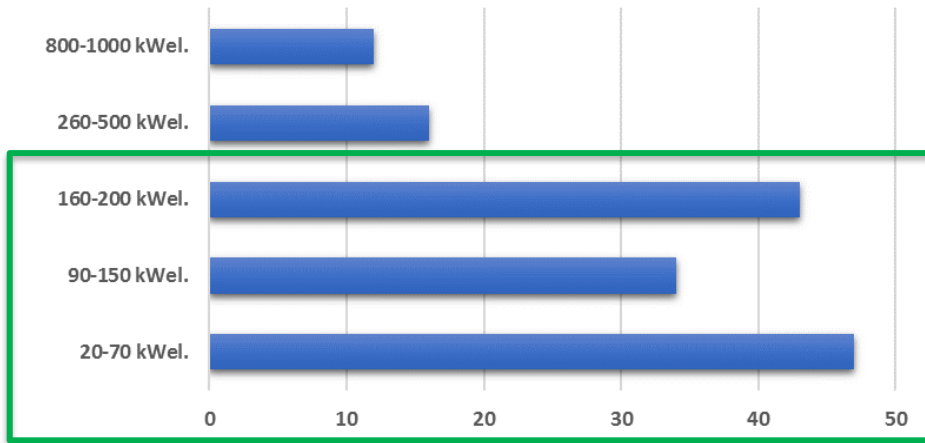


Year 2015-2016	
Total Power: ~ 31 MWel.	
Total Num.: 152	
Region	% el.
TRENTINO SOUTH TYROL	31.6
PIEDMONT	17.5
LOMBARDY	8.4
EMILIA ROMAGNA	8.0
TUSCANY	7.3
FRIULI VENEZIA GIULIA	6.4
VENETO	5.6
UMBRIA	4.7
SICILY	3.4
LAZIO	1.8
APULIA	1.4
BASILICATA	1.3
CAMPANIA	1.1
MARCHE	0.9
SARDINIA	0.3
AOSTA VALLEY	0.2
ABRUZZO	0.1
CALABRIA	0.1

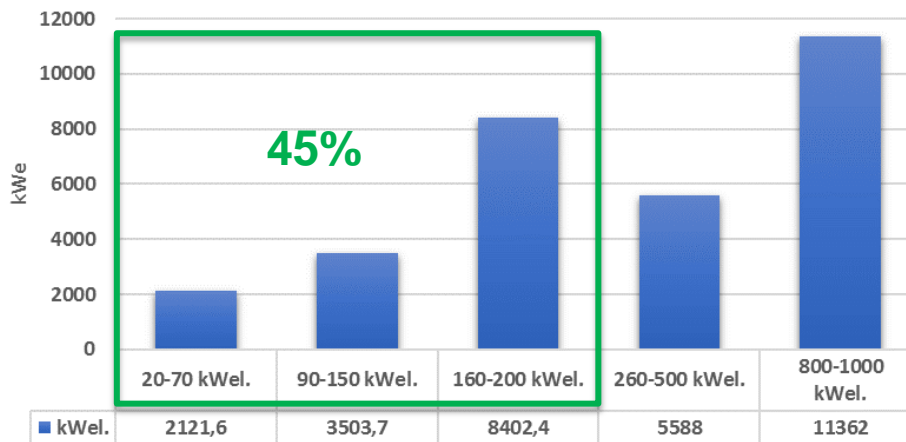
N.B.: the number of gasification plants herein presented was defined by comparing different public sources available on-line (e.g. national database from GSE, maps and references from technologies suppliers, a regional database).

N° of gasification plants and Power distribution

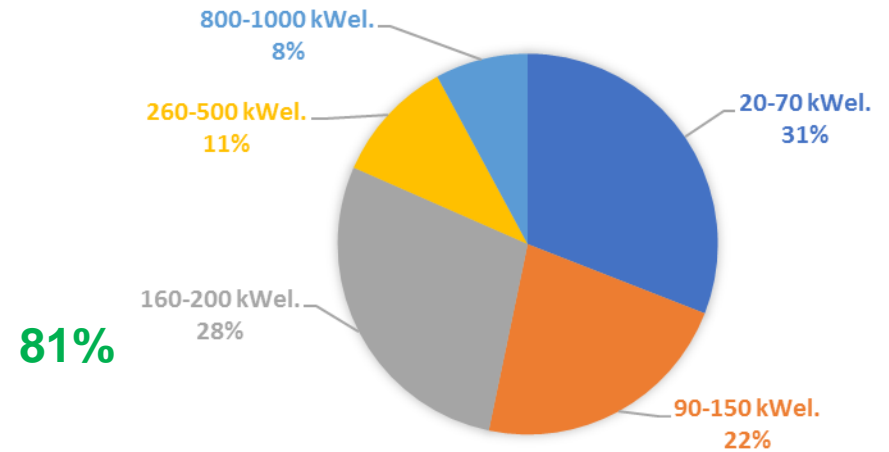
N° of plants by size



Power distribution by size

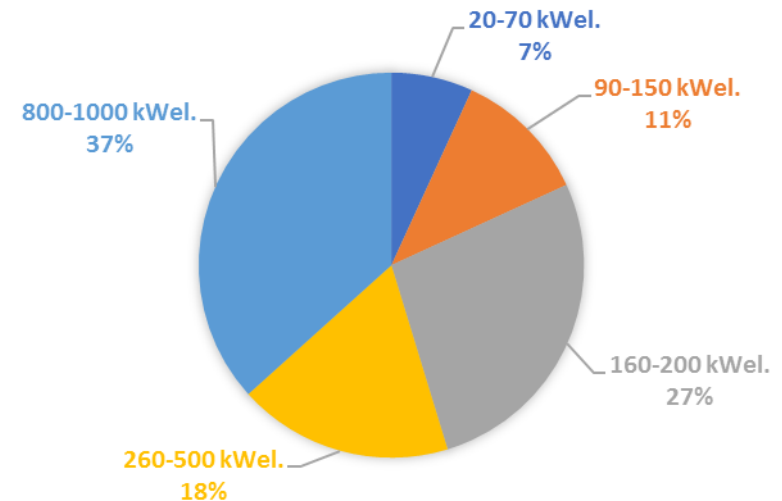


N° of Plants by size (%)

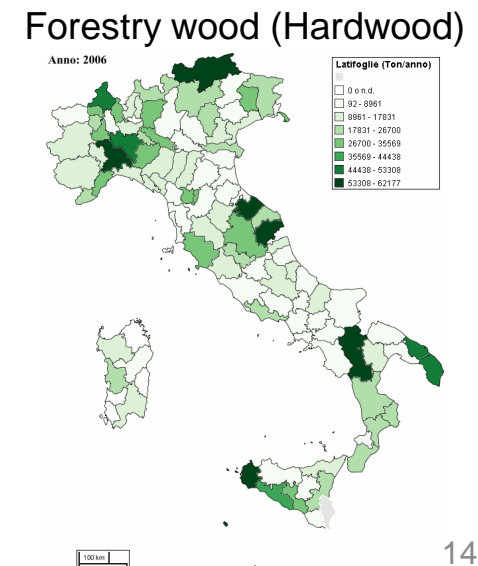
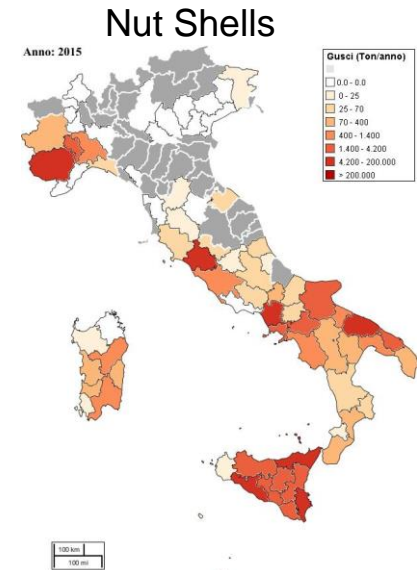
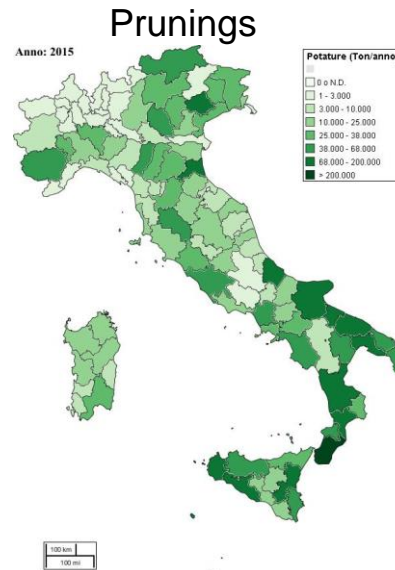
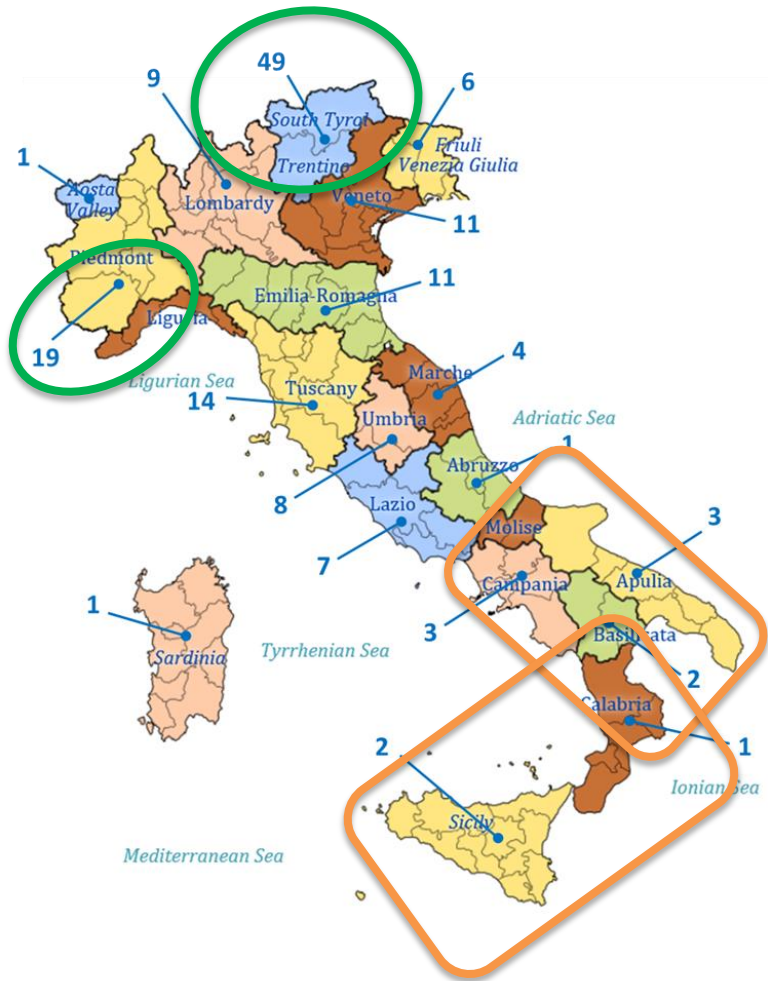


81%

Power distribution by size (%)



Biomass availability in Italy



Based on maps of residual biomass availability (e.g. forest residues, agricultural prunings, et al.) potentiality for the installation of new gasification plants can be figured in some regions of Southern Italy.

Other Initiatives on Gasification: Pilot & Experimental plants, Spin-off

Italian Region	Name	Funding	Aim	Reactor design	Present Status	Ref.
Abruzzo	Gassilora	Regional	To develop and commercialize a small power plant to produce H2 from biomass to be powered to ICE or FC for power production.	Bubbling Fluidized Bed	Ongoing project	http://www.gassilora.it/IndexEN.html
Abruzzo & Lazio	HBF 2.0	National (by MiSE)	Realizing a small scale CHP system (25 kWe, 55 kWth)	Bubbling Fluidized Bed	Starting date: Dec. 2016 End Date: Nov. 2018	
Basilicata	EnerPark	Regional	Power production (ICE) from residual biomass from forest maintenance of the "Gallipoli-Cognato" regional park.	Downdraft Fixed Bed	Startup scheduled by December 2017	
Basilicata & Sicily	Spring G2E	National (by MiSE)	Realizing a preindustrial gasification plant based on the ICBFB reactor with in-situ gas filtration for power production (200 kWe, ICE)	Internally Circulating Bubbling Fluidized Bed	Startup scheduled by December 2017	
Lazio	3Emotion	EU (7 FP)	Hydrogen production by parallel operation of electrolyzers and biomass gasifier	Bubbling Fluidized Bed	Starting date: 01 Jan 2015, End date: 31 Dec 2019	http://www.3emotion.eu/
Lazio & Abruzzo	Ascent	EU (7 FP)	Producing H2 needed for highly efficient low-carbon power production by using sorbents for CO2 removal	Bubbling Fluidized Bed	Starting date: 01 March 2014 End date: 28 Feb 2018	http://www.ascentproject.eu/index.php
Sardinia	Sotacarbo	National (RdS)/ Regional	Cogasification to efficient power production with CCS	Updraft Fixed Bed	In operation	http://www.sotacarbo.it/en/
Trentino South Tyrol & Tuscany	NEXT	Regional	Monitoring of existing plants in the province of Bolzano with evaluation of the characteristics and possible uses of the produced chars .	Downdraft fixed bed and Bubbling Fluidized Bed	Ongoing project	

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