



**IEA GEOTHERMAL**



# Italy Country Report 2012

**IEA Geothermal  
Implementing Agreement**

# National Activities

## Chapter 13 of Draft 2012 GIA Annual Report

### Italy



**Figure 13.1** 90 MW in a snapshot: Carboli, San Martino & Monte Rotondo and a new well in drilling phase.  
(Photo courtesy of ENEL Green Power)

### 13.0 Introduction & Overview

In Italy the electricity generation is only in Tuscany, whereas direct uses are scattered all along the country, mainly for bathing and district heating purposes. An overview of the activity carried out in 2012 will be presented in this chapter (Cappetti et al., 2010; Cappetti et al., 2005).

The total installed capacity reached the historical maximum of 875 MW<sub>e</sub>, with 34 units and a production of 5,235 GWh<sub>e</sub>. The heat delivered to direct uses is 3,500 GWh<sub>th</sub> from 1,000 MW<sub>th</sub>, half of the installed capacity being used by heat pumps.

A new Incentive Law has been approved for the remuneration of the geothermal electricity.

The status of geothermal energy use in Italy for 2012 is presented in Table 13.1.

**Table 13.1** Geothermal energy use in Italy for 2012.

Electricity	
<b>Total Installed Capacity (MW<sub>e</sub>)</b>	874.5
<b>Contribution to National Capacity (%)</b>	1%
<b>Total Generation (GWh)</b>	5,235
<b>Contribution to National Demand (%)</b>	2%
Direct Use	
<b>Total Installed Direct Use (MW<sub>th</sub>)</b>	1000
<b>Total Heat Used (PJ/yr)</b>	12.6
<b>Total Installed Capacity for Heat Pumps (MW<sub>th</sub>)</b>	500
<b>Total Net Heat Pump Use (PJ/yr)</b>	1.7

### 13.1 Highlights and Achievements

All the plants in operation are located in Tuscany, in the two productive poles of Larderello/Travale and Mount Amiata (see Figure 13.2); all the plants are owned and operated by Enel Green Power.

As of 31 December 2012, the following figures have been achieved:

- Wells in Operation: 308 for production, 69 for reinjection and 107 as reserve or field control; 96 wells have depths greater than 3 km.
- Gathering Systems: 207 km of steam lines, 298 km of reinjection pipes.
- Power Plants: 34 power units, 4 of 60 MW, 3 in the range 20-40 MW, 3 old units below 15 MW, and the majority (24) is with the standard unified design of 20 MW.
- Capacity: the installed capacity of 875 MW<sub>e</sub> is unevenly split in the two poles: Larderello/Travale with 795 MW<sub>e</sub> of dry steam units, and Mount Amiata, where in the water dominated field 80 MW<sub>e</sub> of flash plants have been installed. The total operating capacity is 766 MW<sub>e</sub>, achieving a production of 5235 GWh<sub>e</sub> in 2012.

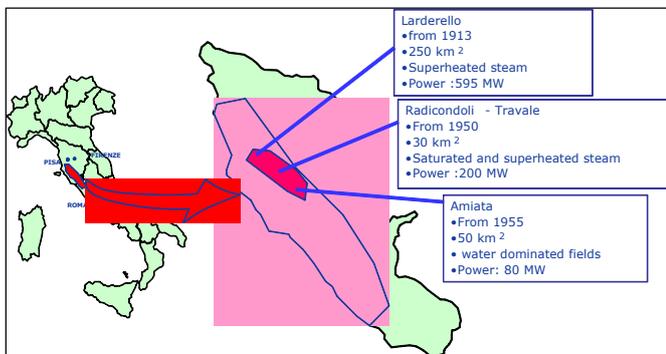


Figure 13.2 Geothermal areas in Italy

In 2012, important renovation activities have been carried out on three plants, and one old 8 MW unit (Piancastagnaio 2) has been retired.

A new small additional binary unit (commissioned in early 2013) on the separated water stream for Bagnore 3 has been completed.

After more than 100 years of exploitation, the Larderello field is still able to provide a sustainable development (see Figure 13.3).



Figure 13.3 Historical trend of electricity production in Italy.

The Enel Green Power business plan for Italy is strongly focused on the geothermal development on Tuscany, with several new projects, as highlighted in Figure 13.4: a new 40 MW plant in Bagnore; and exploration in the new leases surrounding the Larderello and Mount Amiata areas, aimed to identify an exploitable geothermal fluid with temperature suitable for binary power plant.

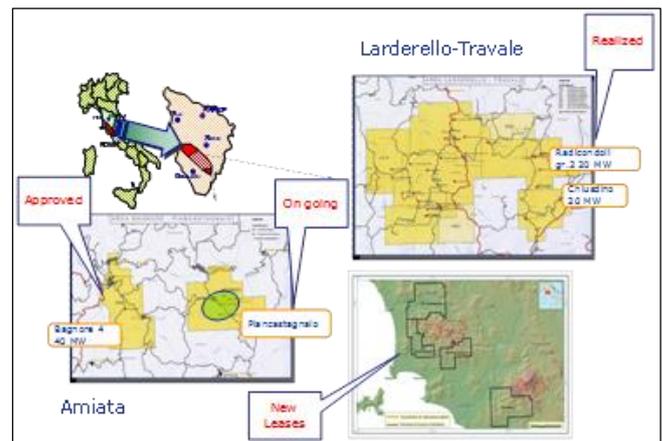


Figure 13.4 Planned Enel Green Power activities

In the year 2012, the following drilling activities have been carried out in Tuscany by Enel Green Power drilling unit:

- Four new wells, with depths 2.1 km, 3.9 km, 4.3 km and 4,4 km.
- Two piezometric wells of 200 m each.
- Seven work-over/deepening.
- The total number of meters drilled in 2012 in all the wells reached the value of 16 km.

## 13.2 Industry Status & Market Development

Geothermal energy is included in the national energy strategy to reduce greenhouse gas emission.

The Italian policy gives support to the development of renewable resources using a different approach, in terms of tariff, accordingly to the size of the plants, through a new law on incentives for renewable electricity, in force since July 2012.

The incentives will apply only to a limited number of plants, to be officially shortlisted. It is possible to bid for lower incentives in order to enter into the RES quota. This process can be penalizing in case of a great number of plants asking for incentives, but it is unlikely to foresee some problem in the near future, because the quota high enough for geothermal.

A plant acknowledged as fully innovative, with a non-commercial technology, is recognized an all-inclusive tariff of 200 €/MWh up to the fluid temperature of 150°C; the incentive will be reduced using a linear formula from 200 €/MWh at 151°C down to 137 €/MWh at 235°C.

The standard tariff is in three levels, for:

- Plants below 1 MW, it is 135 €/MWh.
- Plants between 1 MW and 20 MW, it is 99 €/MWh.
- Other plants, it is 85 €/MWh.

An additional premium is due to plants with special characteristics:

- 30 €/MWh for total reinjection plant (zero emission).
- 30 €/MWh for the first 10 MW installed in a new area, without existing plants.
- 15 €/MWh for plants with H<sub>2</sub>S and Mercury abatement of at least 95% of the emission.

### Royalties

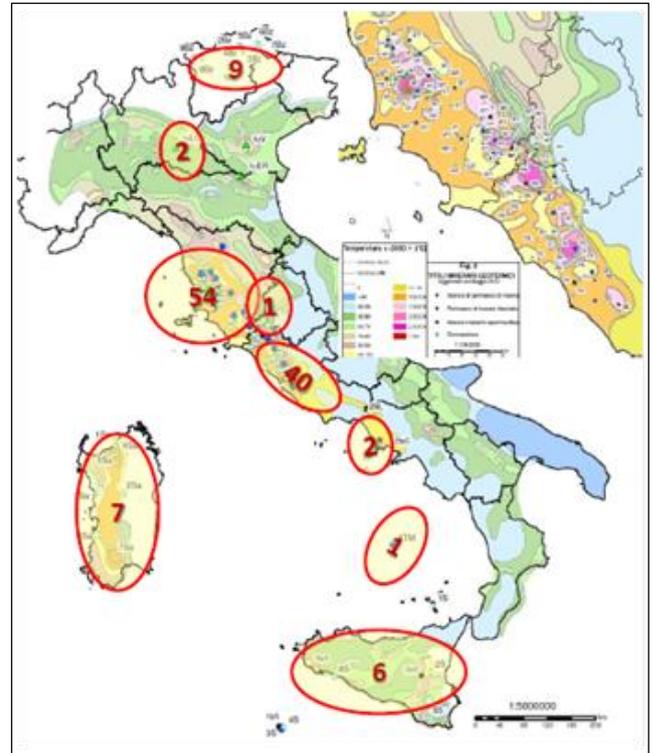
The “Exploration Permit” holder must pay 325 €/km<sup>2</sup> of annual lease. The “Mining Lease” holder must pay 650 €/ km<sup>2</sup> of annual lease. In case of medium-low enthalpy resources, the above-mentioned values are the maximum (they could be lower).

For electrical power generation, the “Mining Lease” holder must pay out (only for plants greater than 3 MW power)

- 13 € for each MWh generated to Municipalities on whose territory the “Lease” are included.
- 19.5 € for each MWh generated to Regions on whose territory the “Lease” is included.

### Liberalization

A new Law liberalized the access to the geothermal market, opening the possibilities for new players to enter into the geothermal business, asking the concession of an “exploration lease” from the regional authority. In a couple of years only several new leases have been requested, in many different Italian regions, as shown in Figure 13.5.



**Figure 13.5** Geothermal licences, applications and gazettal areas as at 31 December 2012.

The total number of new requests is around 120. It is foreseeable an impressive development and increase of the geothermal electricity in Italy in the near future.

## 13.3 Environmental Acceptance

The strong interaction occurring between geothermal activities and the territory of Tuscany, a region so important for its landscape and tourist attractions, has placed a serious hindrance to developing new high enthalpy projects, especially in the Mount Amiata area.

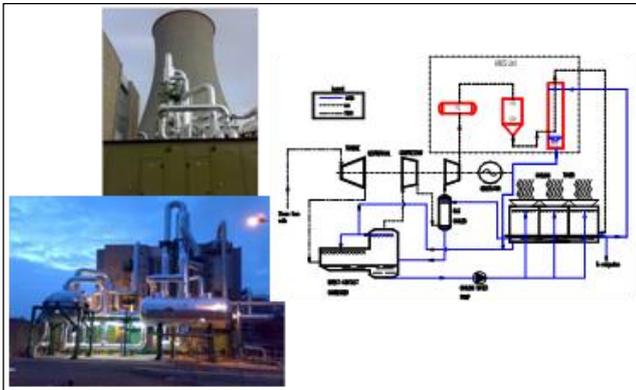
As an important investment for reducing the odour emissions in H<sub>2</sub>S of the Italian power plants, Enel Green Power installed 20 abatement systems (AMIS plant, Figure 13.6), of patented original design, with very good results in improving the local acceptance of the geothermal development.

**Table 13.2** Saving factor of geothermal energy in Italy.

Geothermal energy produced	GWh/yr	Savings factor [toe/ GWh]	Fossil fuel savings [toe]
Geothermal power produced	5.235	253	1.324.455
Geothermal heat produced	3.500	127	443.437
<b>TOTAL</b>	<b>8.815</b>		<b>1.767.892</b>

**Table 13.3** Geothermal energy use in Italy for 2012.

Description	GWh/yr	Total CO <sub>2</sub> savings by substitution of gas/ oil/ coal in tonnes [t CO <sub>2</sub> ]
Geothermal power produced	<b>5,235</b>	
CO <sub>2</sub> savings for natural gas [kg/MWh]	193	<b>1,010,355</b>
CO <sub>2</sub> savings for oil [kg/MWh]	817	<b>4,276,995</b>
CO <sub>2</sub> savings for coal kg/MWh]	953	<b>4,988,955</b>
Geothermal heat produced in 2011	<b>3,500</b>	
CO <sub>2</sub> savings for natural gas [kg/MWh]	97	<b>339,490</b>
CO <sub>2</sub> savings for oil [kg/MWh]	409	<b>1,431,459</b>
CO <sub>2</sub> savings for coal kg/MWh]	477	<b>1,669,452</b>



**Figure 13.6** The Enel Green Power AMIS system.

Aiming at the retrieval of a constructive and mutually beneficial relation with the territory, Enel has begun a number of initiatives with the intent of achieving a reduction of environmental drawbacks and an increase of acceptability. New design solutions have been envisaged to reduce the noise and visual impact of drilling pads, gathering systems and power plants.

The contribution of geothermal energy to the fossil fuel saving (in toe) in Italy is not negligible, as shown in the following Table 13.2. The avoided emissions of carbon dioxide is highlighted in Table 13.3.

### 13.4 Future Outlook

After more than 100 years of exploitation, Larderello is still alive and able to keep a sustainable production, through the deep drilling and reinjection programs.

In the second productive pole on Mt. Amiata, the local opposition from committees against geothermal energy is slowing down the large potential development of the Bagnore area, despite the indirect benefit of district heating and greenhouses system of Floramiata, one of the largest complexes in Europe. However, the entire approval process is finally completed, and the construction of the new plant is ready to start.

New zones have been opened to geothermal research in Tuscany and other regions, targeting fluids suitable for electricity production through binary cycles, in the medium enthalpy levels.

The new incentive law is not enough for sustaining an important investment in the geothermal sector, even if the Italian resource is much more generous than other countries.

Without a modification of the present incentive scheme, it is unlikely to have good prospects for development in the medium-long term, even if the geothermal energy, due to its

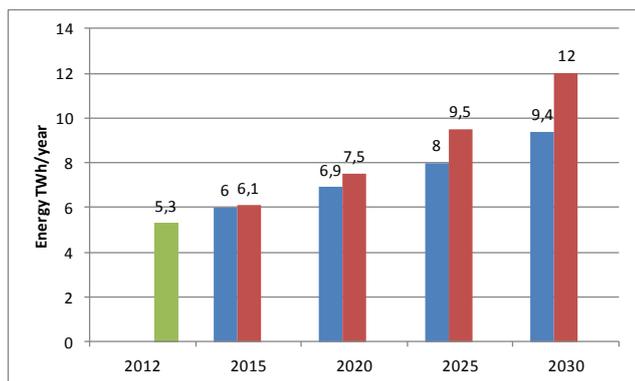
base-load capability, can be considered as a highly valuable resource for the electricity system in any country, but especially in Italy, where solar PV and wind are strongly increasing their market segment.

The targets for 2020 are summarized in Table 13.4.

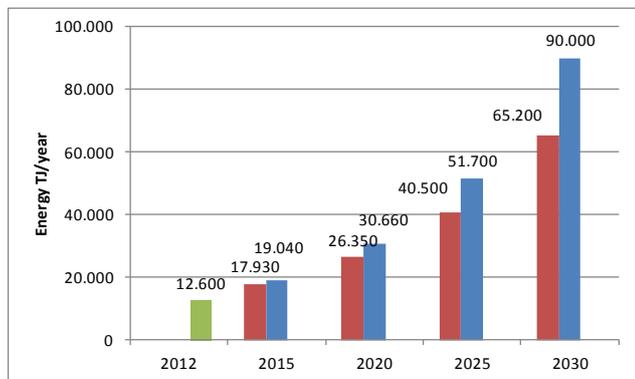
**Table 13.4** Geothermal targets for Italy.

Electricity	
Total Installed Capacity 2012 (MW <sub>e</sub> )	874.5
Forecasting for 2015 (MW <sub>e</sub> )	915
Target Capacity 2020 (MW <sub>e</sub> )	1,080
Direct Use	
Total Installed Direct Use 2012 (MW <sub>th</sub> )	1,000
Target Capacity 2020 (MW <sub>th</sub> )	2,500

With an increase as in Figures 13.7 and 13.8, as from Unione Geotermica Italiana (UGI) evaluations in two different scenarios (minimum/maximum), extending to long term forecasting (year 2030).



**Figure 13.7** Geothermal electricity gross production forecasting in Italy.



**Figure 13.8** Direct geothermal heat utilization growing in Italy.

## 13.5 Publications

Buonasorte G., Cataldi R., Franci T., Grassi W., Manzella A., Meccheri M. and Passaleva G. (2011) Previsioni di crescita della geotermia in Italia fino al 2030 - Per un Nuovo Manifesto della Geotermia Italiana -, Ed. Pacini, Pisa, , 108 pp.

Cappetti, G. Romagnoli, P. and Sabatelli, F. (2010) Geothermal electricity: country update report. Proceedings World Geothermal Congress, Bali, Indonesia, April 25-30.

Montemaggi, M., Romagnoli, P. and Bertani, R. (2013) Geothermal power generation for Italy. Proceedings European Geothermal Conference, Pisa, Italy, June 3-7.

Sabatelli, F., Mannari, M. and Parri, R. (2009) Hydrogen sulphide and mercury abatement: development and successful operation of AMIS technology. Transactions GRC.

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