POLICIES FOR THE PROMOTION OF GEOTHERMAL ENERGY IN ITALY: OBJECTIVES FOR 2020, REGULATIONS AND INCENTIVES

Giorgio Buonasorte[1], Tommaso Franci[2].

[1] Unione Geotermica Italiana, Pisa Operational Office, Engineering Faculty – DESE, University of Pisa, Largo Lucio Lazzarino 1, 56126 Pisa

giorgiobuona@libero.it

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ABSTRACT

The National Action Plan[1] for renewable sources (PAN) has set the main objectives for 2020, regarding the development of the use of geothermal resources for the electricity generation and for thermal utilizations (especially by GHP). Achieving these goals will be possible only with a definite framework of rules, both from the point of view of incentive systems and authorization schemes.

Geothermal framework is evolving fast in Italy, generating a) strong motivation of important companies in the electricity and investment sectors, b) perspective of utilization of geothermal resources with middle and low capacity geothermal plants, c) technological development of the national geothermal industry, d) significant benefits for the country and then for the regions and the local labour in the fields of environment, economy and employment.

Promotion and incentivisation of district heating from geothermal sources (also with the help of heat pumps; with the use of geothermal probes exchange coupled to HP; if necessary in synergy with other sources).

1. INTRODUCTION

The new National Energy Strategy[2] (SEN) have given a positive recognition to geothermal energy as a renewable source virtuous, as technology has more impact on national economic sectors, compared to all other technologies in the electricity sector.

We would like to highlight that this primacy is also true for thermal use of geothermal resources, either through direct use or through geothermal heat pump systems. In the case of geothermal heat pumps, today 90% of the Italian market for heat pumps water-water is covered by domestic production, and that about 50% of the national production of this technology is exported; evident symptom of excellence and competitiveness of Italian industry in this sector.

It is hoped that these skills are recognized in the industrial incentive policies that until now have preferred less virtuous technologies instead, such as photovoltaics in an abnormal way, reducing the resources available today for the continuation of policies to encourage renewable electrical and thermal geothermal sources.

The Italian Action Plan for renewable sources (PAN) has set important goals for 2020 for the development and use of geothermal resources in both sectors of the electricity and of the thermal utilizations (especially by heat pump systems). However the achievement of these objectives will be only possible in the presence of a certain framework of rules, both from the point of view of incentive schemes that of authorization one.

The PAN (National Action Plan) estimated a capacity increase of about 170 MW_e, from 2010 to 2020 and an additional annual production of 1,100 GWh. The PAN estimations are substantially coherent with the growth projections formulated by UGI.

The Growth projections by 2020 and 2030 have been formulated, by UGI working Group (Buonasorte et al, 2011), taking into account: a) geological setting, heat flow, temperature maps and types of geothermal resources known or supposed to exist down to 5 km depth; b) likely sharp increase of fossil fuel prices in the coming years; and c) expected technological improvements in the utilization of the Earth's heat. Based on this analysis, two growth scenarios have been considered, starting from the present situation (Cappetti et al., 2010): 882 MW_e - 5,4 TWh/y (Fig.1).

The UGI more conservative growth forecast by 2020 considers an increase of 200 MW_e (total 1080 MW_e) with a generation of 6.9 TWh/y and by 2030 a total

[1] Ministero dello Sviluppo Economico, Piano di azione nazionale per le energie rinnovabili dell'Italia, 30 giugno 2010

[2] Decreto Ministeriale 8 marzo 2013 "Strategia energetica nazionale: per un energia più competitiva e sostenibile"

installed capacity of 1500 MW_e with a total generation of 7.3 TWh/y.

This year celebrates the 100th anniversary of geo thermo electric generation: about the first fifty years were marked by local private companies (Boracifera - Larderello - La Centrale), the second fifty years have been characterized by the strong expansion of the geothermal exploitation by Enel Group (State owned and now listed as Enel Green Power Utility). The near future will be marked by the recent market liberalization and entry of several new players.

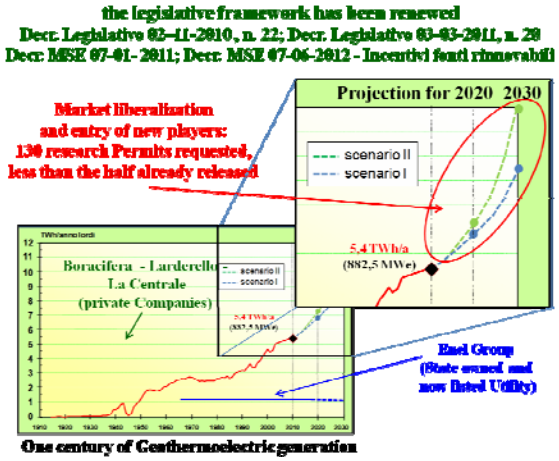


Fig. 1 - Framework of the future development of the geothermo-electric generation in Italy.

The foreseen growth until 2020 will be supported by the mature technologies for the exploitation of "hydrothermal systems", the targets for 2030 will require an increasing contribution of deep geothermal resources (Unconventional Geothermal Systems).

The PAN (National Action Plan) estimated also an increase for thermal utilizations of geothermal resources (Fig. 2).

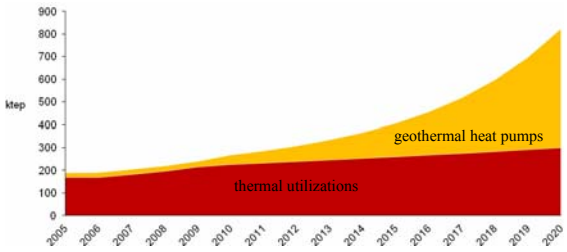


Fig. 2 - PAN estimations for thermal utilizations of geothermal resources 2010- 2020.

For direct uses the PAN estimations show a slow increase of 50% in ten years. Instead for geothermal heat pump systems the PAN foresees a strong development in energy consumption, from 40 ktoe in 2010 to 522 ktoe in 2020 (an increase of 1200% in ten years).

2. ELECTRICAL USES OF GEOTHERMAL RESOURCES

2.1 Regulation and incentives

Italian policies for the promotion of geothermal energy have already achieved important results for regulation and support. Indeed, the legislative framework has been strongly renewed with a) Decreto Legislativo 11 febbraio 2010, n. 22, b)Decreto Legislativo 3 marzo 2011, n. 28, c) Direttiva Direttoriale MSE 1 luglio 2011, d) Decreto ministeriale 6 luglio 2012-Incentivi fonti rinnovabili.

The full liberalization of the exploration and production of geothermal resources has urged many new national and international players to submit research permits applications. This scenario with so many "Research Permit"requests, being virtuous for the economy and the environment, requires clear and definite choices concerning the incentive and regulation.

Within three years (2009-2012), about 130 requests for new research permits of geothermal resources for electricity generation have been submitted in Italy (Fig. 3), including ten applications for the demonstrative geothermal pilot plants.

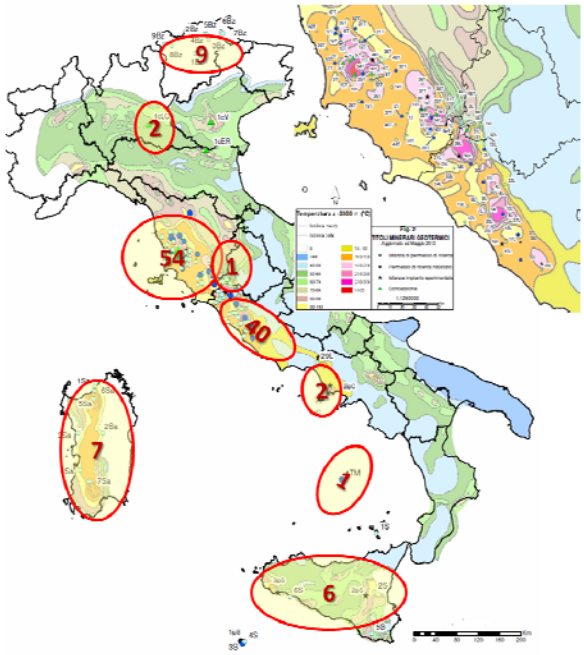


Fig. 3 - Distribution of the requests of the Research Permits in Italy - UGI elaboration.

These last experimental pilot projects, with possible maximum capacity of 5 MW_e each and for a maximum total capacity of 50 MW_e, will be authorized by the Ministry of Economic Development. These experimental projects have been introduced to help the entry of binary cycle technology (zero emissions) in the national geothermal framework. It is noteworthy that almost all proposals refer to the to generation technologies connected to the binary groups and zero emissions. The demonstrative

geothermal pilot plants receive a maximum incentive all comprehensive of 200 €/MWh, plus a premium of 30 €/MWh for the first 10 MW_e in each new area. The current renewal incentives for the other geothermal plants are illustrated in Tab. 1.

The new system of incentives (electric generation - DM July 12, 2012), met some market needs, although the levels of incentives for geothermal energy remain under those provided in the most important European countries.

Table 1: Incentives for geothermal power plants as the last Decreto ministeriale 6 luglio 2012- Incentivi fonti rinnovabili.

Capacity kW_e	Plant life (Years)	Base tariff (€/MWh)
$1 < C \leq 1000$	20	135
$1000 < C \leq 20000$	25	99
>20000	25	85
Additional premiums are foreseen: • 30 €/MWh for the first 10 MW_e in each new area • 30 €/MWh in case of total reinjection and zero emission • 15 €/MWh for plants with gas treatment (H_2S and Hg abatement equipment)		

The increase of the possible costs due to the uncertainty deriving from the mining risk, mainly linked to the discontinuous permeability inside the geothermal reservoir, has been not sufficiently considered. Among the renewables the geothermal exploration require a huge preliminary investment for the first exploration well that can result not profitable.

2.2 Current activities

The finding of geothermal fluids for power generation, and sometimes also for further recovery of heat for direct use, is the declared objective of the required research permits. The exploration programs will have to verify the presence of geothermal fluids inside the in the Mesozoic carbonate rocks, already known especially in Tuscany (and Latium), and even at greater depth in a hottest "second reservoir", hosted in rocks of the Paleozoic metamorphic basement.

Of particular interest are also the research that will be carried out in totally different environments such as volcanic areas of Campania (Campi Flegrei and Ischia) and of the Sicilian Aeolian Islands and Pantelleria.

Of particular relevance the offshore research permit in the Southern Tyrrhenian Sea, with the innovative purpose of identifying and exploiting geothermal fluids inside an active volcanic complex (Marsili), present at a depth approximately 800 m of depth.

Finally, the preliminary initiatives for drilling and findings of geothermal fluids for energy purposes in South Tyrol at depths greater than 3000 m are equally significant.

Currently, less than half the required Research Permits have been released; several of these applications are in competition because of the overlapping of the requested areas. Many were issued more than one year ago, several others after a long period of procedure are still in the preliminary phase of the authorization, and hopefully will be issued in short period of time.

The total surface of the all the released permits can be estimated at about 10,000 km^2: a large amount of work in progress that will allow a development of the Italian geothermal operative and economic framework, with the investigation of existing resources, possible development prospects for hundreds of MW and huge consequent investments (considering at least 5 to 6 M€ / MW_e).

Glancing through the characteristics of the projects, in addition to the power plants with direct steam in turbine (high enthalpy), many companies often refer to the possibility of exploitation for electric generation of medium- enthalpy fluids (T = 90 to 150 ° C), due to the technological consolidation of the binary cycle plants (present in 11% of world geothermal power plants).

The upcoming projects will have to overcome some technical, authorizative and environmental difficulties: the italian geothermal systems appear to be gas rich water-dominated systems; long times of authorization steps, dispersed decision-making levels (Fig. 4); strong environment constraints, strictly mandatory, not drawn for temporary exploration activities.

Fig. 4 - Competent authorities for "Reserch permit" - UGI elaboration.

The expected benefits in Italy from the development of geothermal energy for electrical purposes derive from using national resources and reduction in the import and use of fossil fuels, and from containment of CO2 emission.

The activities related to the italian geothermal framework, environmental controls and monitoring included, can give a strong impulse to the national employment in a virtuous sector, among the renewable energy sources.

Exploration (geology, geochemistry and geophysics) with the involvement of national research institutes and prospecting companies may give rise to important implications for national employment.

Resources for management and exploration surveys have already been activated for more than hundred man/year, which could strongly increase over the next 10 years.

Drilling is one of the main items of expenditure in investments; in light of the ongoing or planned in the short term activities, the first exploration wells may be drilled within one year, to which a second phase of drilling development wells will follow. These activities can require a large amount of the additional employment.

The design, supply and construction of surface facilities and power stations will require an additional human resources within few years.

3. THERMAL USES OF GEOTHERMAL RESOURCES

3.1 Regulation

The current arrangement of competences for the exercise of administrative functions of authorization regimes for the direct uses of geothermal resources is derived from a process of administrative decentralization by the State to the regions, occurred in two phases; regions then in many cases opted for a additional degree of decentralization giving new functions to the provinces and in some cases even to the municipalities.

The first phase of decentralization (70 ') have transferred to the ordinary statute regions the release of small captations of groundwater (and thus also of those for small local uses) and for research permits and concessions for mineral and thermal waters.

Thereafter in a second phase, at the end of the 90 ', also the administrative parts of the processes for large captations of groundwater (and therefore also those related to "small local uses"), and those relating to permits and exploitation leases of geothermal resources for energy purposes have been given to the regions.

Always in the same period, the related requirements for the EIA were also transferred to the regions.

The second level of decentralization of functions, from the regions to the provinces, was particularly significant in the case of small captations of groundwater, covering also the procedures for mineral and thermal waters, those for research permits of geothermal resources, and procedures related to EIA.

The result of this process is that the institutional governance of administrative procedures of direct uses of geothermal resources become very different from region to region, depending on the type of authorization regime considered (geothermal resources in the mining framework, small local uses or mineral and thermal waters).

The result ranges from cases of total regional centralization, in which all the administrative procedures and environmental assessment for granting and use of the resource is responsibility of the region, to cases where all the administrative functions have been delegated to the provinces, as well as to cases in which they both region and province can act as competent authorities (Fig. 5).

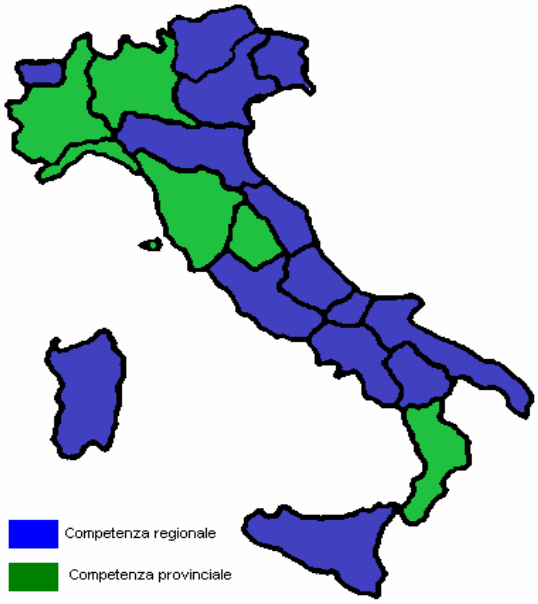


Fig. 5 - Competent authorities for large captations of groundwater (> 100 l/s) - UGI elaboration.

3.2 Current activities

The Table 2 shows the values of the consumption of geothermal energy for direct uses in Italy referred to 2010[3].

The data refer to the current state of progress of the surveys that UGI is conducting each two years, in order to have a periodic homogeneous update consistent to the current geothermal consumption.

In the absence of an official collector authority at the national level in a systematic manner this survey is innovative and important because it is carried out for the first time, to collect documents and information relating to all direct uses of geothermal resources in Italy with the goal of a periodic update.

As a consequence, the acquisition of data on the technologies of exploitation and the definition of their processing methods provide an updated overview of the type of working plants, aggregating the information dispersed in the periphery between the authorization institution and users of the same geothermal source.

Table 2: Summary of the results of the collection of each thermal use related to 2010.

2010	Plants number	Capacity (MW_{th})	Energy (TJ/a)	Capacity factor
Teleheating	15	67,85	588,71	0,28
Greenhouses heating	15	68,67	573,62	0,26
Fish farming	9	82,58	1321,42	0,51
Domestic heating	52	63,37	1064,74	0,5
Industrial processes	11	14,49	106,88	0,23
Thermal and balneology	-	-	2175,86	-
Total	**102**	**296,96**	**5831,22**	

Source: UGI

The aim of the monitoring is to quantify the values on energy consumption from direct use of geothermal resources to be used for official statistics. This allow to provide a framework for information consistent with the standards required by Community and national legislation and, in addition, the identification of the country potential further sectors of development of direct geothermal uses.

4. GEOTHERMAL HEAT PUMPS

4.1 Regulation and Incentives

As far as the geothermal heat pumps, according to the italian PAN in 2010 the consumption of renewable energy would have been equal to 40 kTOE and it is estimated that in 2020 can get to 522 kTOE, an increase of 1200% in ten years at a rate average annual growth of almost 30%.

The national legislation establishes the enactment, at ministerial level, of guide lines for the installation of geothermal production facilities (ie geothermal ground heat pumps) for heating and air conditioning of buildings, in order to achieve a new simplified procedure, necessary to avoid a proliferation of regional or provincial regulations.

These regional measures without a lowest common denominator at the national level, could lead to a legal uncertainty situation for operators.

To encourage the development of the uses of geothermal resources for heating and cooling it is necessary to introduce targeted incentive schemes, which is lacking at the moment. With this context until today only tools designed for energy efficiency have been introduced, such as tax allowances and white certificates that have not proved especially effective in promoting the uses of geothermal resources at low temperatures. The new Thermal Energy Account (Decr. 12- 12-2012) does not offer significant incentives for the development of geothermal heat pumps. In addition, in the case of electric heat pumps, the progressive tariff structure hinders the diffusion of this technology in major market segments such as that of the existing residential buildings.

4.2 Current activities

The main indicator available for the dissemination of geothermal heat pumps is that of sales in the Italian market of water-water heat pumps. The COAER (Costruttori Apperacchiature ed impianti Aeraulici) statistics indicate finally in about 1000 water-water heat pumps sold on the Italian market in 2011.

Fig. 6: Number of the water - water heat pumps yearly installated in Italy - UGI elaboration on COAER data

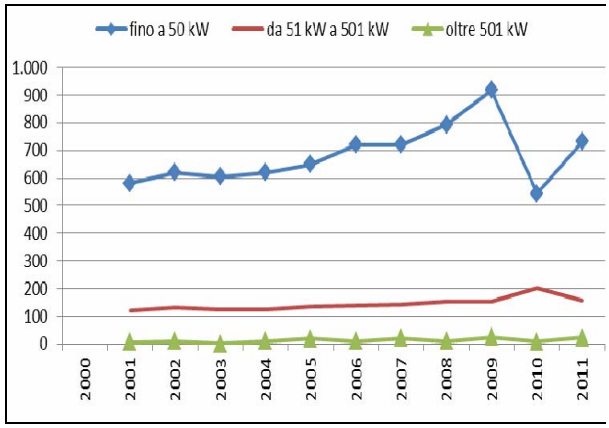
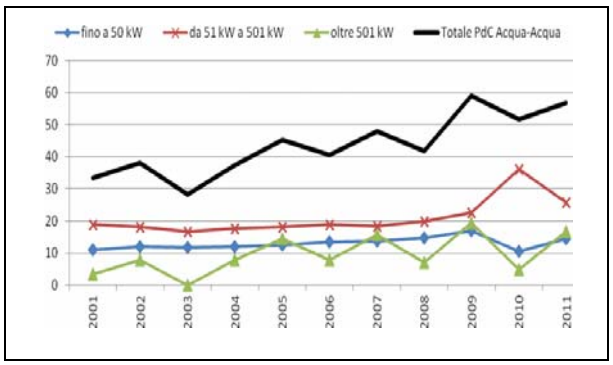


Fig. 7: Capacity of the water - water heat pumps installated in Italy (MWt) on annual basis - UGI elaboration on COAER data

[3] The data in Table 2 for the activities of spas have been elaborated by UGI with the approach followed by the official statistics compiled by the GSE for the report on the implementation of Directive 2009/28/EC. UGI considers restrictive this criterion and looks forward to the review.



The heat pumps water-water total sold in 2011 are attributed to approximately 24% for plants with a capacity up to 50 kW_{th}, around 18% for plants with a capacity between 51 and 501 kWth and less than 1% to facilities with a capacity greater than 501 kW_{th}.

Overall, the new installed capacity for heat pumps water-water in 2011 was approximately 63 MW_{th} compared with about 52 MW_{th} of new installed capacity in 2010.

The new capacity for water-water heat pumps installed in 2011 a total of about 34% is attributed for plants with a capacity up to 50 kW_{th}, about 50% for plants with a capacity between 51 and 501 kW_{th} and less than 26% to plants with a power of 501 kW_{th}.

This sales trend will not lead to achieve the capacity of geothermal heat pumps expected by the PAN.

UGI estimates in 600 MW_{th} the actual installated capacity for geothermal heat pump systems in Italy.

5. CONCLUSIONS

For the geothermal medium high temperature resources, in addition to the incentives, there are other issues to be considered in order to give appropriate responses for their full development, and in particular:

- to overcome the uncertainty of the reference panorama after 2015 (Decreto ministeriale 6 luglio 2012-Incentivi fonti rinnovabili), a continuity of action will be required to maintain quotas, for registery entries (max capacity 20 MW_e each plant) and for downward auctions (> 20 MW_e), which has to be sufficient for receiving all the projects from the research activities currently in progress;
- in many cases the current framework for the authorization and EIA, delegated to the Regions, remains uncertain for the times and for realizing the possibility of construction of future plants, as a result of the current investments for exploration activities;
- the restrictions of territorial planning, sometimes hostile to geothermal energy, have to be overcome, promoting the sustainable use of geothermal resources consistent with the environmental protection, the social acceptability, encouraging the dissemination of accurate information on the actual characteristics of the geothermal source
- the lack of specific tools to support the mining risk in the drilling geothermal exploration activity should be considered.

The following actions will be crucial for the development of geothermal heating - cooling:

- Adoption of consistent instruments in the regional policies for renewable energy sources in terms of programming (with regional estimates of the geothermal sources), authorization regimes and incentives; issuing of DM implementation of Legislative Decree n.28/2011 on the update of the national incentive system about the renewable thermal sources (thermal energy bill, TEE and guarantee fund for DH).
- Promotion and incentivisation of district heating from geothermal sources (also with the help of heat pumps; with the use of geothermal probes exchange coupled to HP; if necessary in synergy with other sources).
- Introduction of standard UNI for geothermal heat pumps; national implementation of Article n. 14, p. 3, Directive 2009/28/EC that provides no later than 31/12/2012 the availability of certification schemes for small-scale installers of geothermal shallow and heat pumps systems.
- Implementation of monitoring the development and the use of geothermal resources at the national level, with the support of State and the Regions, under the Decree n.22/2010. Developing cognitive frameworks on geothermal resources at regional and national levels.

Strengthening the cooperation between the State and the Regions policies that are promoting geothermal resources is essential for UGI. In addition, the introduction of national guidelines is critical for authorization procedures for all types of geothermal uses, that is now under responsibility of the regions or local authorities.

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