PLANNING GEOTHERMAL ELECTRICITY PLANTS:
CASE STUDY “CASTELNUOVO”
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In 2010, the Legislative Decree No. 22 was issued to promote the geothermal development:
- opening the geothermal market to new players
- simplifying the authorization processes

In 2012 the Law No. 134 classified the geothermal energy as National strategic energy sources.

By 2030, MITE (Ministry of Ecological Transition) allocated + 200 MW of geothermal electrical power capacity to reach the renewable power targets outlined in the EU "fit for 55"
The development of geothermal energy in Italy has slowed down because of the poor social acceptance mainly related to aeriform emissions from the power plants.

**Italian Government**
(Legislative Decree 11 February 2010, n.22)
promoted the development of “pilot” projects able to accomplish the total reinjection of the geothermal fluid, without emissions of steam and gas into the atmosphere.

**MAIN IMPROVEMENTS**
- LOW PRODUCTION DEPLETION
  (100% of fluid produced is reinjected into the reservoir)
- ZERO AERIFORM EMISSIONS DURING PLANT OPERATION
- INTEGRATION IN THE LANDSCAPE

**MAIN ISSUES**
- LARGE PRODUCTION DEPLETION
  (< 50% of total fluid produced is reinjected into the reservoir)
- AERIFORM EMISSIONS DURING POWER PLANT OPERATION
- LARGE VISUAL IMPACT ON THE LANDSCAPE
CASTELNUOVO PROJECT

Pilot plant with total reinjection of the geothermal fluid in the same formations of origin
(as per Legislative Decree 11 February 2010, n.22, amended by Legislative Decree 3 March 2011, n.28 and by article 28 of the Decree Law 18 October 2012, n.179)

Location: Tuscany Region, Castelnuovo di Val di Cecina (province of Pisa)
Area: 7.5 km²

Reservoir characteristics
- Geology: metamorphic rocks
- Depth range: 2200 - 3500 m
- Temperature > 250 °C
- Concentration of NCGs: 8%

Fluid characteristics at well head:
- Temperature: 180 - 220 °C
- Pressure: 10 - 15 bar
- Total flow rate: 70 t/h
- Re-injection temperature: 90 °C

GEOLOGICAL MODEL

Power plant
5 MWe net ORC power plant with integrated compression system for the NCGs reinjection into the well

RESERVOIR MODEL

Temperature

GENERAL LAYOUT

WELL FIELD

2 production and 1 reinjection wells from the same drilling pad adjacent to the power plant

POWER PLANT

reinjection of 100% of two-phase geothermal fluid (condensed steam and NGC’s) in a single well
CASTELNUOVO PROJECT
development schedule

**AUTHORIZATION PROCESS**
(ELEGIBILTY, EIA, AUTHORIZATION TO BUILD)

**EXECUTION**
(CIVIL WORKS, DRILLING,
POWER PLANT, GRID CONNECTION)

**OPERATION**
(EXPERIMENTAL PRODUCTION)

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<td>APPLICATION TO MISE</td>
<td>APPROVAL BY C.I.R.M. (Commission for Hydrocarbons and Mineral Resources)</td>
<td>INTEGRATIONS (2-3 ROUNDS)</td>
<td>ENVIRONMENTAL AUTHORIZATION BY MATTIM</td>
<td>LANDSCAPE &amp; CULTURAL HERITAGE BY MIBACT</td>
<td>AGREEMENT WITH THE REGION</td>
<td>CONFERENCE OF SERVICES (MISE)</td>
<td>AUTHORIZATION TO BUILD (MUNICIPALITY)</td>
<td>RELEASE OF PILOT PERMIT DECREES</td>
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**LEASE DURATION 4 YEARS + 2 EXTENSION**

**Current status**

14-20 months according to enforced regulation
Geothermal licensing procedures: current challenges

The authorization procedures to deploy and operate a geothermal project is challenging in many European Countries:

- **Exploration and exploitation permits, or concessions are typically needed to start an industrial project development.**
- **Various other licenses may be required** (environmental permit, permits for power plant construction and operation, ...)
- **Several bureaucratic bodies are involved** and in some cases make the process very long and very slow.
- **The authorization process can last several years** (2-7 years) in some Countries

According to the agenda of European Energy Transition Plan, each Member State shall be in charge of the multi-year implementation of renewable energies, including geothermal energy.

**Simplification and streamlined authorization process become mandatory for the geothermal energy development**
Geothermal licensing procedures: recommendation (1)

The geothermal resources are classified of national/strategic interest in several EU Countries. Then they should be managed by a National Authority, with adequate skill to evaluate the geothermal projects which can delegate some administrative responsibilities to the Regions.

A Geothermal Authority shall act as multi-level governance body, working in partnership with the different levels of government (local, regional, national and European) and involving a range of stakeholders including environmental associations and business (geothermal developers, industry, …) associations, to guarantee the sustainable development of geothermal energy.

Main roles of the Geothermal Authority:
- define the National geothermal development plan
- manage the whole licensing process
- promote the research and innovation
- administer the data and information relevant for geothermal sector

- Outline of the expected potential for geothermal energy in the Country
- Definition of the geothermal energy contribution to the EU decarbonization targets
- Ensure the availability of the energy grid to dispatch heat and power
- Identification of the areas not suitable for geothermal project deployment
- Definition of simplified authorization procedures (One-stop shop)
- Call for competitive bids for Geothermal Licenses
- Evaluation of the application and granting the geothermal Licenses (< 1 year)
- Ensure the compliance with the laws and oversee the safety during the field activities
Geothermal licensing procedures: recommendation (2)

- The Geothermal License is a portion of territory where the Geothermal Authority can grant the exclusive right to conduct geothermal operations (exploration, well drilling, plant construction) to produce and sell electric and/or thermal power as well as inorganic materials (e.g. Lithium) by geothermal resources present in the subsurface at depth > 500 m.

- All the activities (exploration, well drilling, plant construction, overall project operations) shall be authorized and executed in a sole Geothermal License.

- The relicensing of the Geothermal License is subject to the approval by the Geothermal Authority of an overall work program and the related SEA (Strategic Environmental Assessment).

- The overall work plan must be authorized with the declaration of public utility, undeferrable and urgent work with the predetermined constraint for the expropriation of the land and assets. At the same time the variation of the urban planning instruments shall be authorized as well as the energy grid connection and dispatchability shall be guaranteed.

The Geothermal Authority shall complete the evaluation of the application(s) in short time (< 1 year)
Geothermal energy can make a significant contribution to achieving the European Commission's 55% emissions reduction target by 2030. However, the implementation of the new geothermal projects is not progressing as quickly as it would be due to some impediments related to:

- the complexity and slowness of the authorization procedures.
- the overestimation of some environmental impacts which, in some cases, create concerns in the local communities that have to host the plants.
- the lack of adequate support tools (incentives) to promote the development and use of geothermal energy for electricity and heating, such as:
  - premium paid to producers of electricity from renewable sources to supplement the revenues they receive from the sale of their electricity directly on the market.
  - tax credit to reimburse the costs for the wells as the geothermal resources are state-owned and once the geothermal lease contract has expired, the wells and all related infrastructure will return to the state's availability.
  - suitable fund to cover the risk of failure in the exploration phase of new areas.
THANK YOU FOR THE ATTENTION

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