

**Da:** Fausto Batini

**Inviato:** giovedì 23 giugno 2016 13:09

**A:** 'Bjarni.Palsson@landsvirkjun.is'

**Oggetto:** Castelnuovo Geothermal Project

Dear Bjarni

First of all I apologize for being late in writing my remarks to the letter you sent to Montecastelli Viva group regarding Castelnuovo project.

We already discussed in some detail the main issues in our meeting at IGC 2016 conference in Reykjavik, but I send you the attached letter to give you further clarification to your concerns about the feasibility of the project. Attached to this email you will also find some scientific papers that might help you to get more knowledge about our project.

I take this opportunity to inform you that "Montecastelli Viva" group published your letter on its website. It's not my intention to send any comment to your letter directly to Montecastelli Viva, but it seems to me that they are misrepresenting your position trying to demonstrate that our project is not feasible or dangerous.

I will greatly appreciate if you could clarify to them your view on the project after review of the information I provided to you in Reykjavik and in this letter.

Thanks for your attention.

Congratulation for the successes of Islandic football team at European Championship.

With my kind regards

Fausto

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To Mr. Bjarni Palsson  
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Dear Bjarni,

It was a real pleasure to meet you during IGC 2016 conference and have the opportunity to discuss about Magma Energy Italia geothermal projects.

Referring to the "Assessment of the geothermal pilot project Castelnuovo, planned by ToscoGeo, near the village of Montecastelli Pisano, Tuscany" you drafted at request of the environmentalist group "Montecastelli Viva", I would like to provide some insights to allow you to evaluate the project on the basis of more detailed information.

I know that you were not able to receive the Italian to English translation of the all documents submitted to the Ministry of Environment and available on the Ministry's website <http://www.va.minambiente.it/it-IT/Oggetti/Documentazione/1591/2628?pagina=3#form>.

Some of the innovative features of the project are classified as "industrial secret" therefore you could not access it. However I am going to provide you some details.

#### **General Comments on the projects**

- You state that "very limited geothermal exploration has been done in this specific site" and "No exploration well has been drilled at the site and the nearest well is around 4 km away"

This statement is not correct as several wells have been drilled in the surrounding of Castelnuovo project:

- Montecastelli 1 well, 1552 m deep, tapping the so-called "first reservoir" is located at 60 m away from the Castelnuovo lease border.
- Sesta 6 bis cluster of 3 wells, all deeper than 3500 m, tapping the "deep" reservoir into the metamorphic complex is located at 1300 m away from Castelnuovo lease border. Geological and stratigraphic data, geophysical well logging data, temperature and pressure data, and production data, including the chemical composition of the geothermal fluids are available on public domain.

Reservoir thermodynamic conditions are known, including heat flux, and previous 3D large models have been realized for this field.

Geothermal gradient and temperature distribution at certain depths have been reconstructed through well data from public database.

2-D and 3D reflection survey has been performed by Enel Green Power in the area, up to the Castelnuovo southern border and a portion of the 3D survey partially covers the southwestern part of the Castelnuovo project area.

All the above mentioned data have been published and the papers are attached to this letter.

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Moreover, Magma Energy Italia performed extensive geological and geophysical surveys, including detailed field structural survey such as gravity, magnetic and magnetotelluric surveys. All these data allowed the drawing of a detailed geothermal model of Castelnuovo project.

- You affirm *“Architectural drawings also show that than an effort has been made to minimize negative visual impact”*

I’m pleased that you have appreciated the effort we made to minimize the impact on the Tuscan landscape. An important and eclectic architect , Emanuele Svetti, has conceived a shape that could recall the surrounding nature.

- It is correct to assume that *“this would be one of the first closed loop geothermal power station of its kind in the world”* and that the NCGs concentration is substantial.

Also, it must be considered that, according to the Italian Legislative Decree 22/2010, all the Pilot Projects *must be* experimental and they *must be* designed for the total reinjection of the fluids – both brine and NCGs – in the same geological formations from which they are taken. Therefore, the maximum effort has been made to design a power plant capable of realizing the innovation required, which environmental benefits are noticeable.

Magma Energy Italia is involved with a team of experts to design this pilot plant:

- The modeling team within Schlumberger Integrated Solutions (SIS), under the guidance of GeothermEx, has successfully modeled the injection system for the Castelnuovo pilot geothermal project.
  - The power plant design is provided by General Electric
- It is correct that *“The project cost is assumed to be around € 34 million which is almost €7 million/MW which can be considered expensive for geothermal power in international comparison”*

This project is a pilot one and the efforts toward a better environmental compatibility have resulted in a process that is quite complex and could even reduce the company’s profit margin.

#### Concerns - Re-injection and risk related to

I agree that the economic success of a project does highly depend on the success of the wells. The injectivity is critical for any wells and no company avoids analyzing the cases in which the costs are to rise due to mining setbacks.

I would like to make some remarks to your statements:

- *“With only one injection well planned , the injectivity is very critical and in case the injectivity is not sufficient to receive both re-injection fluid and gasses , hydraulic stimulation would be a normal response”*

Castelnuovo drilling program does not include any hydraulic stimulation plan or injection under pressure, unlike the projects in France and Germany, which actually are Enhanced Geothermal Systems type.

Castelnuovo wells will be drilled according to the best – practice used for drilling geothermal wells in the Larderello-Travale area. In case the injectivity will be proven to be not enough, the drilling will be extended toward deeper targets and/or a directional/forked well will be operated.

- *“Re-injection will always cause some seismicity”.*

Castelnuovo project is adjacent to Enel Green Power concessions of Larderello and Travale.

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Larderello and Travale geothermal field belong to a huge hydrothermal system that is characterized by moderate seismicity occurred well in advance the industrial geothermal exploitation started. Prof. Albarello, Seismologist at the University of Siena and Bologna, performed a detailed study of seismicity of the area surrounding Castelnuovo project and he has shown that the maximum expected magnitude of natural seismic events is  $M=5.5-6.0$  within a radius of about 20 km. Maximum magnitude event occurred in 1724 in the Travale area.

The re-injection is underway since 40 years in the Larderello and Travale geothermal field and during this time the recorded magnitude rarely exceeds  $M=2$ , with a couple of events reaching maxima of 3.5-3.8. Re-injection is operated routinely by Enel Green Power, without any concern by local community.

Correlation between micro seismicity and re-injection cannot be excluded, but the magnitude of the events never exceeds the historically recorded magnitude. Re-injection is operated routinely by Enel Green Power, without any concern by local community.

The concerns about the induced seismicity are more related to EGS projects, where the fracturing are artificially induced by high overpressures, but this is not the case of Castelnuovo.

Conversely, Castelnuovo pilot project fully respects the industrial standards used in Tuscany for a long time and foresees atmospheric pressure at wellhead for the brine re-injection.

However micro-earthquake monitoring system is already installed since two years and will be operated during the various phases of the project. The micro-earthquake recorded data will be made available to Public Authority and a proper management procedure will be enabled according to the instruction provided by Ministry of Economic Development to ensure the safety of the communities also on the very remote case that a hazardous seismic event will occur.

#### Concerns – Gas emissions, $H_2S$

Toscogeo doesn't plan to replicate injection strategy applied in Iceland as Tuscany geology is quite different from the Icelandic one and no additional water (aside from the condensed steam) is anticipated to be available for use in NCGs injection. Therefore MEI cannot perform a total dissolution before injection. The technological solution that we intend to use is completely different, as I mentioned when we met during IGC 2016 conference. The complete technical description of the experimental re-injection method and equipment is classified as "industrial secret" therefore cannot be accessed but I would be available to provide you some clarification or further details for proper understanding of this injection scheme upon your request.

As the system is a closed one, there will be no pollutant emissions during normal operations.

Some emission will occur only during well testing but they will be temporary and hydrogen sulfide will be treated with chemicals to minimize bad smell. Nevertheless air quality will be monitored.

In case of short time (few hours) outages of the power plant any emission will be avoided through a suitable circuit that will allow to bypass the power unit and reduce the well flow rate.

The geothermal wells could be shut-in completely if the outage of the power plant will be extended for a long time (days).

#### Concerns – Visibility

You state: *"According to the drawings in the report, effort has been made to minimize the visibility of the project and various novel landscape and architectural approaches are presented" and "The air cooled cooling tower will not be high but will cover significant land and will therefore be quite visible from above. However, this is a very big change from the large concrete cooling towers from the early days of geothermal utilization in the Larderello area"*

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Once again I reiterate my appreciation for your statements, and I assure that we will make any possible improvement according with Ministry of Environment and Ministry of Cultural heritage and landscape conservation to get the best environmental integration.

#### Concerns – Noise

*“However, I believe a simulation of noise distribution and a prediction of the noise level at the nearby Agriturismo or the village is missing from the environmental monitoring chapter”*

A simulation of noise distribution and a prediction of the noise level at the nearby agriturismo and village have been performed (see the report CAS-02-DE-AM-R-005-003). The report includes a simulation of noise distribution and a prediction of the noise level at the noise receptors for the construction, drilling and operating phases, with respect to the background noise, which has been measured at the receptors.

The Village and the agriturismi nearby belong to the “Class 3” area according to the Italian Law, whose exposure limit values are 60 dBA daily and 50 dBA overnight. The noise simulation shows that legal noise limits will be respected everywhere.

Anyhow the noise level will be verified during each stage of the works. In case of exceeding noise during temporary activities, the legislation provides for the possibility of temporary derogations. In case of exceeding during operations, mitigation measures will be put in place.

#### Concerns – Environmental Assessment and Monitoring

You have considered the environmental assessment (chapter 8) and environmental monitoring (chapter 9) too simple.

It seems clear that you only considered the general report (“Relazione Generale” CAS-02-DE-GE-R001), but you did not have access to many documents available on the Ministry of Environment website, such as:

- Quadro ambientale (CAS-02-DE-AM-R-005-002)
- Quadro ambientale - Appendice Valutazione preventiva Impatto Acustico (CAS-02-DE-AM-R-005-003)
- Studio e monitoraggio della sismicità (CAS-02-DE-AM-R-007)
- Rapporto sul monitoraggio delle deformazioni del suolo (CAS-02-DE-AM-R-008)
- Rapporto sulla radioattività delle rocce e da radon (CAS-02-DE-AM-R-009)
- Verifica preventiva interesse archeologico (CAS-02-DE-AM-R-010)
- Piano monitoraggio ambientale (CAS-02-DE-AM-R-005-001)

The general report includes only a summary of the topics covered and if you will be able to access these documents you will be able to evaluate the possible related impacts.

#### Concerns – Liability

As many other geothermal projects, the Castelnuovo project is facing not negligible mining risks both on technical and economic sides. However these risks are well evaluated and mitigation actions are foreseen. In case the productivity/injectivity of the wells would be lower than expected we consider the possibility to make some changes in the drilling program (i.e. deepening the well or drill forked well).

“Castelnuovo Pilot Project” cannot be compared to EGS projects as Landau and Mauerstatten or to the Geretsried one. In EGS projects fractures are artificially created by high overpressure and seismicity could be induced. In hydrothermal systems such as Castelnuovo the fractures are naturally present in the reservoir rocks and no overpressure is required to produce/inject the geothermal fluids. Seismicity is not a critical issue as already explained above in this letter.

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I would like to make some clarifications about what you state: *"The project developer, ToscoGeo, is a limited liability company with a rather complex ownership structure. The company has access to some experienced geothermal experts but has not build and operated a geothermal power plant before"*

ToscoGeo is a subsidiary of Graziella Green Power , that is the company through which the big company Graziella Holding S.r.l. operates in producing electricity from renewable sources. Today, with over 30 sites in operation, it is one of Italy's largest producers of electrical power from solar panel. Graziella Green Power is also involved in the development of geothermal energy, bioenergy and wind power systems.

Magma Energy Italia S.r.l (a subsidiary of Graziella Green Power and Alterra Power Corp. ) has a team of technicians supported by the geothermal staff of Alterra that operates internationally.

I would like to answer your two major questions:

- *"If successful, will there a larger power plant be developed?"*  
If successful, the pilot plant power won't exceed 5 MWel according to Italian Legislative Decree 22/2010;
- *"If unsuccessful, will the developer cancel the project and have access to funds to remove all construction on the site and recover previous landscape?"*  
If unsuccessful, the proponent will execute the environmental restoration as planned, ensured by a special guarantee to be provided prior authorization.

### Conclusions

As far as you concerns stated in your letter and on the base of my notes in this letter I would like highlight the following items:

- The innovative technological solutions (i.e. the total reinjection of geothermal fluid in steam dominated systems with high NCGs content) were well evaluated through a detailed simulation and proper design has been performed to build a power plant that can be operated in safety manner.
- Seismic risk has been carefully evaluated; it is minor and will be properly mitigated through a continuous seismic monitoring.
- Environmental impacts will be minimized since no pollutant emissions will occur during the operations of the power plant and the noise emissions will be in the limits established by law.
- Visual impact of the power plant will be minimized through a "site specific" design to be approved by Ministry of Environment and Ministry of Cultural heritage and landscape conservation.

As we agreed during the meeting we had in Reykjavik, I remain at your disposal for any further information that you might need.

Looking forward to see you soon.

Kind regards



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