

SEISMIC OPERATION IN GREATER FLORENCE: A 100% PUBLICLY FUNDED INITIATIVE TO LOW-ENTHALPY FLUIDS SEARCHING

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KEY WORDS

Surface seismic, energy planning, local development, check list

ABSTRACT

The municipality of Campi Bisenzio, a industrial “borough” of Greater Florence has just kicked-off and will co-fund together with the Tuscan Energy Office a 3D surface seismic investigation campaign for a potential low-enthalpy exploitation

The case for a full State and local commitment lies in a concurrence of characteristics that should probably represents a good practise to any new geothermal initiative globally

In-fact, a concurrence of many heating users of cold Florence area winters and many manufacturing SMEs that could take advantage of the source is matching one of the principles of the Florence Region energy strategy, just drafted, i.e. renewable energy source applications acquire priority where a cascade heat recovery is pre-feasible, either CHP or biomass or geothermal

At the bottom of this possible geothermal supply chain, there is a well-head 38°C evidence of a 640m deep water-well in the attached Prato municipality that enforced reasonable expectations of the Tuscany Energy Plan on this geological basin, although several concerns by Authorities and a by-law environmental impact assessment bottleneck stopped the initial momentum; all the issues have been eventually worked-out and finally it has been obtained a screening-for-approval procedure to by-passing the relevant assessment phase for seismic only

A standard check-list to obtain grants is proposed to possibly speed-up new geothermal initiatives in Europe and all over world where strips and development awareness do co-exist

1. INTRODUCTION

In Tuscany it was started the first industrial geothermal recovery in 1913 and presently about 21% of power production comes from such applications; nevertheless, direct heat recovery seems to have an interesting future in this State either because of geological potentials [1] or because of a development typology based on production clusters SMEs’ based in sectors like textile, tanneries, pulp & paper mills, green nurseries and SPA treatment resorts – each commodity represented at the top in Italy

In the first half of 2002, it was cross-checked industry geographical locations with urban development in order to maximise the probability to possibly set-up an economically viable project by an utilization of the maximum available heat all over the year with use in “cascade”, and the focus came out along the metropolitan axis of GreaterFlorence-Prato-Pistoia, where it was intended to raise interest in low-enthalpy geothermal applications and possibly stimulate public investments on the necessary first phase of surface exploration

This plain, surrounded by the Northern Apennines, scores the highest residential building frequency in Tuscany throughout the textile district and a need of cloth dyeing and drying under

various environmental and social pressures

The Prato Aquifer is the top critical one in Tuscany, as a part of the one of Florence-Prato-Pistoia basin [2], and where an actual hydraulic risk does exist – the mountain basins of the Bisenzio stream, the biggest industry cluster of Europe has been developed since the '50thies: 700 km² for 300,000 inhabitants in 12 municipalities in Grater Florence and the Regions of Prato and (one) Pistoia with 9,000 textile enterprises giving job to 50,000 people

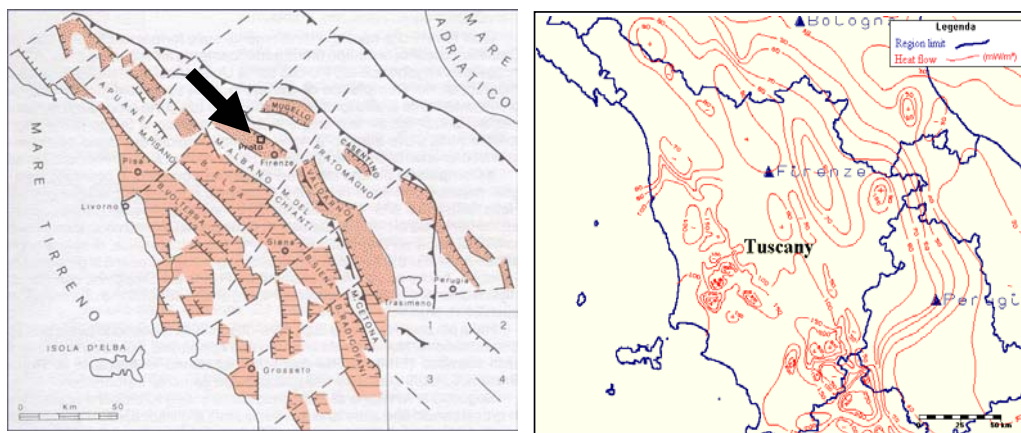


Figure 1 – Position of the principal neo-genic and quaternary basins in the Northern Apennines. 1 Thrusts; 2 Master faults; 3 other tectonic line-actions; 4 minor faults. The arrow is pointed on the Firenze-Prato-Pistoia basin. (from AA.VV. (1992) – Guide Geologiche Regionali Appennino Tosco-Emiliano. BE-MA ed., 4, pp. 328) and iso-lines from the Tuscany Energy Planning

In this general frame, few years ago a water management best-practice has been implemented within Prato, particularly by implementing an industrial aqua-duct able to close the all production process loop, underlying a certain water concern in the area

From records of the “historic” local utility of the area, it was identified a water-well drilled during the 70ths and never in use for the high salinity situated in a green-field of Prato municipality named Mezzana, and 648m deep, where it was measured a temperature of 38°C at well-head, presumably in the out-coming mud

This data together with good logistics, having in-fact residential buildings at about 50m far from the well (where geothermal heat-pump applications might be already feasible with the existing mentioned well), a big industry building about 500m and one industrial park – “Macrolotto-II” – at nearly 2 km from this site, gave momentum to the initiative and the relevant seeking for investors in a seismic exploration campaign of 1 km² in order to quantify reservoir dimensions and drive to a next possible well-logging phase.

Unfortunately, this phase was soon put in a bottle-neck by the mandatory requirement in Tuscany to having evaluated and approved an environmental assessment impact study, an *iter* circa six months long and this issue together with lack of commitment from Prato municipality and local utilities gave a stop to the initiative for a while

Indeed, while Prato represents an optimal testing site for such applications in urban area,

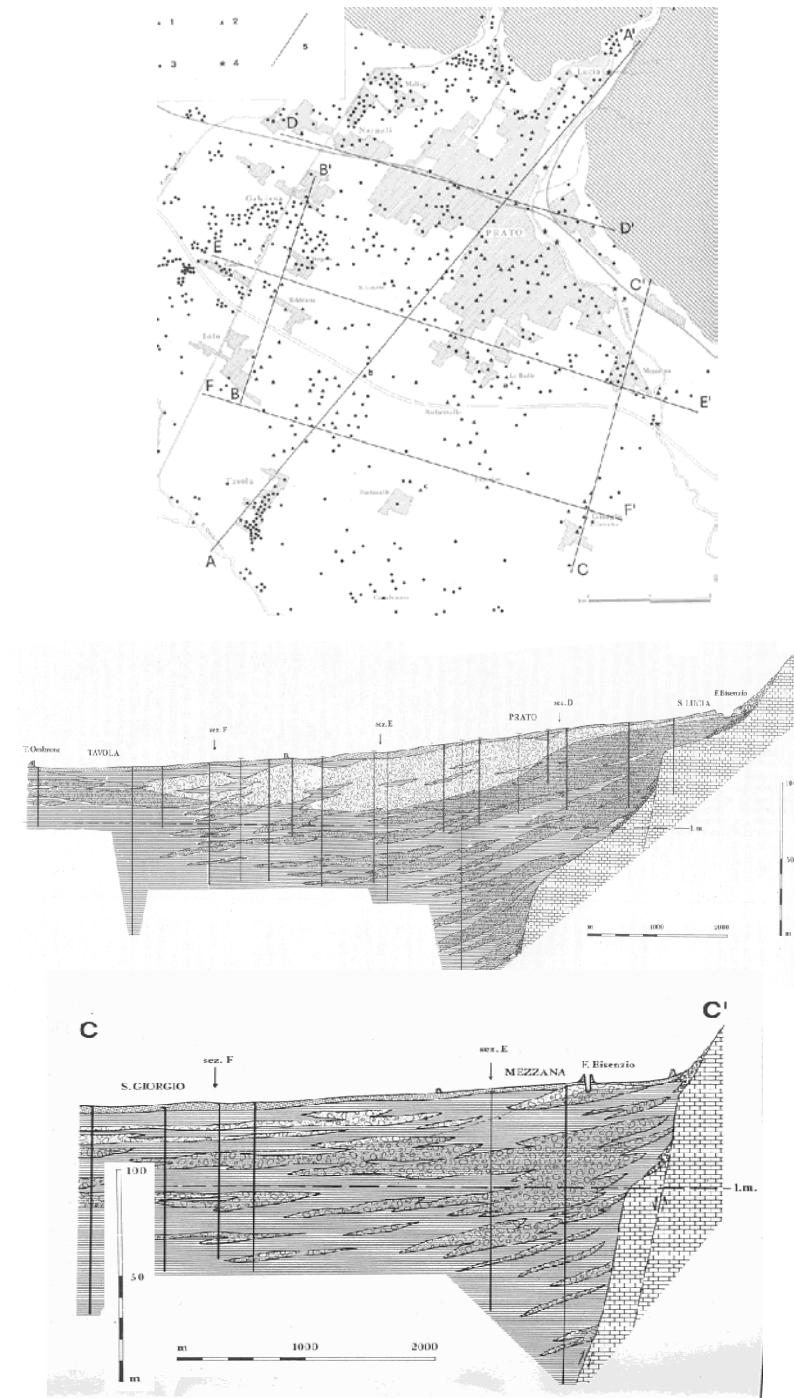


Figure 2 – Geological sections through the Greater Florence-Prato-Pistoia northern basin, east of Prato. Landini F., Pranzini G., Venturucci E. (1990). La Falda idrica della conoide di Prato. Acque Sotterranee, trim. II, 48-70 [4]

starting from heat-pump system, so do other textile district's municipalities and in particular Montemurlo in Prato Region and Campi Bisenzio in Greater Florence [2]

2. THE FLORENCE REGION ENERGY STRATEGY

Drafting a Florence Region energy strategy means to identify appropriate actions to meet the CO₂ equivalent reduction goals of the Tuscany State energy plan, from Kyoto Protocol deadline(s) and within a general regional development programme

Energy balance, socio-economic and environmental statistics Vs regulations and available financial tools constitute a general base to set appropriate policies and draw-up proposals for a further consultation work with all the relevant stakeholders as per an existing draft

The momentum given by this task, which is presently carried-out by Florence Energy Agency, have led to detailed work-out on the territory knowledge, law analysis and trends

Eventually, in concurrence with the Tuscan Energy Department, it has been technically demonstrated that the time-spending standard environmental impact assessment is not necessary for a surface exploration such as seismic and that a kind of simpler and much faster screening-for-approval is fully applicable; and moreover, as per item-24 of the environmental assessment strict # 79/98 State Law, which implements a 85/337/CEE directive as modified by the 97/11 CE and 96/61/CE, Tuscany supports and promote new assessment procedures

The Commitment of the Tuscan Environmental Minister on the matter is currently leading to an *ad-hoc* law-amendment to facilitate this as well as similar initiatives with light environmental impact.

On an urban scale, an energy strategy has to be integrated with the local development structural planning and a more rationale use of energy must imply a change towards a "cascade" of final utilizations from a sole source.

Territory and sector planning give priority to those productive and residential areas with the highest energy consumption and the main potentials for cogeneration, district heating and cooling [3]

Within present available financial tools in Tuscany, the European Social Funds until the year 2006 are managed by the so called DOCUP Programme, where environment/territory matters are priority for "objective-two" and "phasing-out" municipalities (or part of them)

In the building-up of a geo-referenced planning and master phasing schedule of actions, either those areas with structural issues experiencing socio-economic recovery process (so called objective-two), with most of the contribution, or the zones which are at a more advanced stage of recovery (phasing-out, till 2005) are cross-checked with the Regional environmental indicators as well as the possible locations of macro-areas with homogeneous characteristics/issues and/or where industrial districts exist in order to raise the most of awareness about rationale use of energy, identify the recovery possibilities of renewable endogenous sources and possibly join alive momentum given by general local development schemes

Campi Bisenzio is classified as a phasing-out municipality of almost 40,000 people, and being a part of the metropolitan Florentine area with no major mobility issues downtown, a good point in space/district heating, has accepted to concur and co-finance the risk of this surface seismic initiative as an advanced test-action of the energy plan which is to be finalized circa next spring 2004

The task is aiming, given the identification of fracturing and an estimate good success probability, to attract developers for the further phases while having set-up a complete supply-

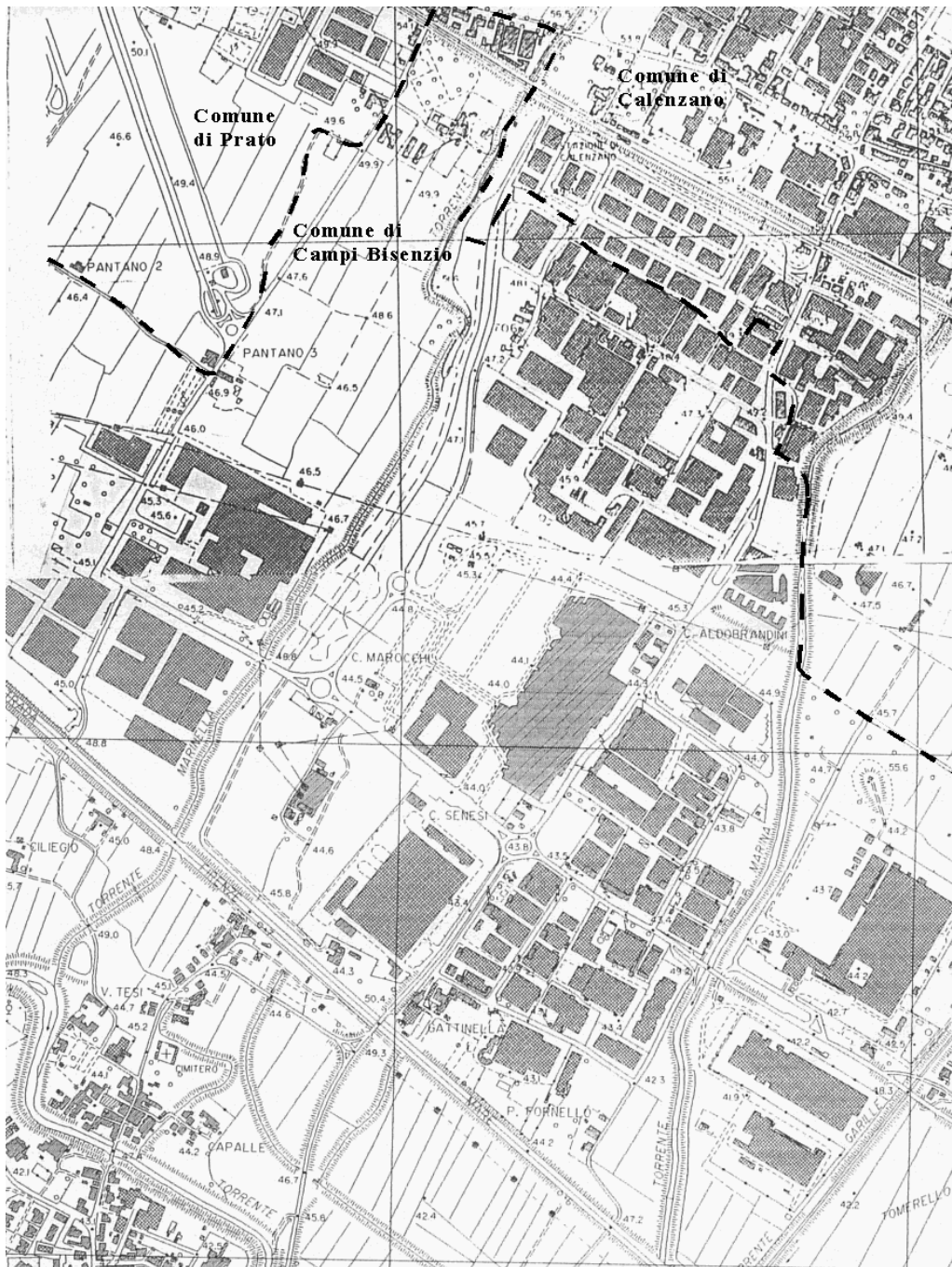


Figure 3 – Cartography of the relevant area of interest; scale reference is given by the net with mesh of one kilometre. (from: C.T.R. 1/10.000 Regione Toscana-volo 1998) [4]



**Figure 4 – Ref. Page # 106 of “Carta Geologica d’Italia”, 1/100.000.
The arrow shows where a hydrocarbon exploration 574 m deep took place in the past
The ellipse highlights the Campi Bisenzio zone interested in the geothermal surface
exploration [4]**

chain by assessing technical and economical viability of relevant infrastructures with the concurrence of one public utility

The prospect area has been carefully chosen since globally it is recorded an actual high successful rate of well-drilling upon good exploration surveys, as examples exist in Indonesia, New Zealand and The Philippine, with a success rate of over 80% [5]

In terms of final use, heat-pump applications for heating and cooling utilizing geothermal source appears to be one of the most consistent option due to remarkably warm temperatures in summer time (actually the area is the summer hottest spot in Tuscany), and a growing demand for air-conditioning, together with actual cold continental winters

Heat-pump is a mature technology whose further diffusion is one of Florence Energy Agency priority versus the expected electricity consumption growth of next years, and in-fact a training and certification scheme for relevant installers has been recently built-up and is to be implemented together with the Energy Department of Florence University and the local SMEs lobby

This is an appreciated convergence of initiatives that further supports the decision making on a geothermal initiative as a renewable source that could be integrated with a low-consumption applications, all strengthening an appropriate energy strategy

3. SURFACE SEISMIC GEOTHERMAL INITIATIVES

Summarizing, the Campi Bisenzio initiative was justified not only by an actual well-water evidence at 36°C just few kilometres away and localized in a basin which is mentioned in the Tuscan energy planning, but moreover in a green-field area where cascade recovery both industrial and residential is foreseeable while this municipality enjoys a special status as a privileged spot for investment until the year 2005 and is identified as environmentally sensitive indeed

Generally, the future challenge of low enthalpy lies anyhow, beside health and leisure applications, in the agriculture and forests sectors with various drying applications, the dairy and fish farming, and the brick industry in order to facilitate new business development and employment while saving fossil fuel utilization [6]

In Europe, such as areas in Southern Poland as well as the traditional high-enthalpy geothermal regions of Southern Tuscany, there have been recently recorded signals of interest in assessing potential synergies between the geothermal and biomass sectors in possible integrate renewables projects for rural areas; this sounds quite interesting since, in a local sustainable development frame, initiatives of these integrated RES could actually drive to the set-up of appropriate local energy policy and environmental qualification

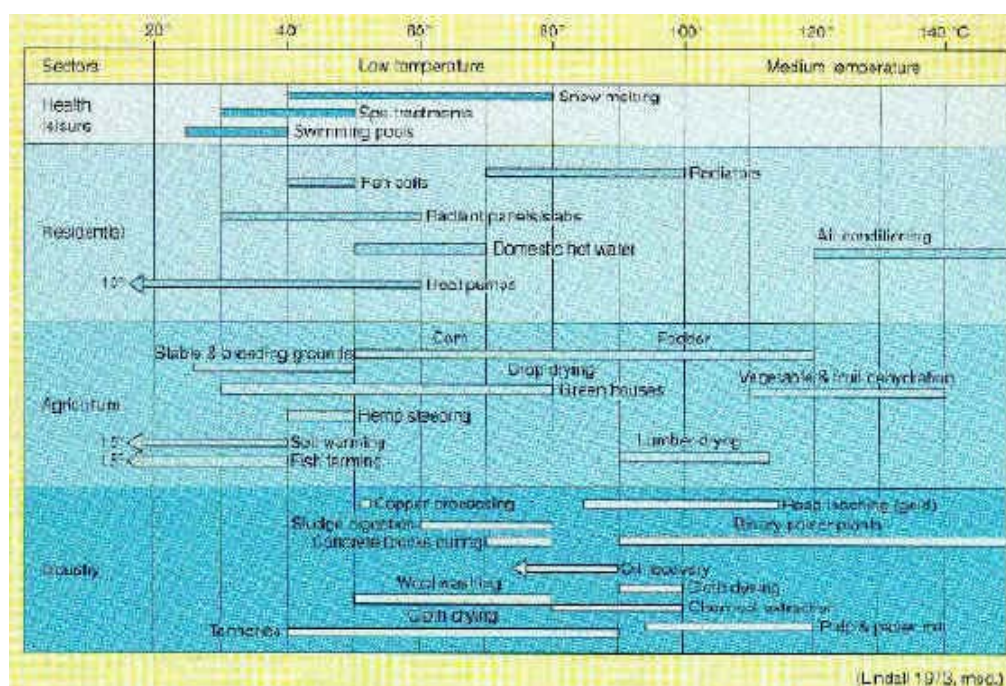


Figure 5. Table of major use of low-enthalpy geothermal fluids.
Lindall 1973 mod. by Co.Svi.G. Srl

On the occasion of the mentioned seismic initiative in Campi Bisenzio, it is believed that, when certain conditions exist, the fully public investment in a necessary surface exploration is absolutely justified, either from local and national governments or from international donor agencies to developing Countries

Herein below it is the relevant *check-list* with ticked items in the Campi Bisenzio case; three items have actually been weighted since this table aim is to be applicable, as a draft reference, on a global basis

The criteria is to give the highest priority to international development issues and thus supporting any general renewable energy investment as an additional “tool” towards small endogenous enterprise start-ups either rural or industrial or within an eco-tourism initiative and with territorial marketing fall-outs. The two second highest priorities are instead related to an increased success probability of the surface seismic exploration and to areas where there is a measured poor or very bad air quality basically due to local source of emissions. Considering the Campi Bisenzio practise as a possible base for a seismic operation to heat recovery, and this is the assumption, it is suggested to proceed with a total financing when the final score equals or overtakes “10”

<i>In the surface seismic selected area there, tick the following items</i>		
1	there is a geological mapping of potential sites in the State Energy Plan	1✓
2	there are additional area geology studies robustly supporting the initiative	1✓
3	there is a geologically nearby unexploited hot water evidences	2✓
4	the municipality enjoys special funds as a phasing-out like zone ¹ or...	1✓
5	...as an already started recovery zone ¹ or...	2
6	...as a critical status zone ¹ /located in a “developing Country”	4
7	there are reasonable health/leisure development possibilities	1
8	it is a cold winter climates urban zone	1✓
9	there is agriculture activity in the municipality and/or contiguous zones	1
10	there are forests in the municipalities and/or contiguous zones	1
11	there is low-medium temperature process industry and...	1✓
12	...the municipality belong to an “industrial district” and/or...	1✓
13	...the area is nearby ² an industrial park or...	1
14	...an new industrial park/production development is planned nearby the area	1
15	potentially, there is a minimum of two-cascade recoveries	1✓
16	at least one pollutant is above the health-risk limit in the municipality ³ or...	2
17	...the municipality is classified at risk for one pollutant minimum ²	1✓
18	the selected area is not served by a central heating network	1

Примечание:

This *check-list* should be basically applicable to general geothermal initiatives since so far it appears to be developed circa 5% of the overall world power potentials and to be noted it is the additional gain that each local authority and geology academia can obtain in terms of sub-surfaces knowledge of the territory



Figure 6 – world map of geothermal potentials. Co.Svi.G. Srl

¹ As per the previous mentioned European Social Fund financing criteria; applicable to similar criteria in the “developed Countries”

² usually, a district heating project is feasible in a radius of maximum three kilometres from the production facility though in the case of a low-enthalpy geothermal source this depends on fluid temperature

³ B, C and D classified zones as deliberated by Tuscany Parliament - #1406 of 21/12/2001- and articles 6,7,8,9 of 351/99 Law to acknowledge a EU relevant directive

4. CONCLUSIONS

The practise described above and the attempted to generalize the decision-making intends to be nothing more than a drafted guideline coming from a concurrent analysis of what has been considered key by Campi Bisenzio municipality and Tuscany Energy Office to completely pay for a surface seismic exploration, together with a listing of the technical conditions needed to draw-up a pre-feasibility scenario of low-temperature geothermal fluid recovery

The main scope is to highlight the peculiarity of a surface seismic phase within all the further milestones that mark a geothermal development project

As a very preliminary operation, necessary when no local logs are available and considered mandatory before drilling, it is here supposed to be performed when a certain number of other conditions reported in the check-list do exist, notably an alive momentum in energy planning and local development strategy with robust commitment of relevant local authorities and State/National governments

And these check-listed conditions, not basically enough for a private developer, are expected to be possibly sufficient for a public funding and/or an international donor agency and if the operation is a successful one, ie a reasonable probability of exploitation exists, then private energy companies are expected to take their risks in the further activity of any geothermal development projects, which is certainly more environmentally invasive as well as more expensive

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