

Non-technical barriers in Tuscany

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Renewable Energy Business Area

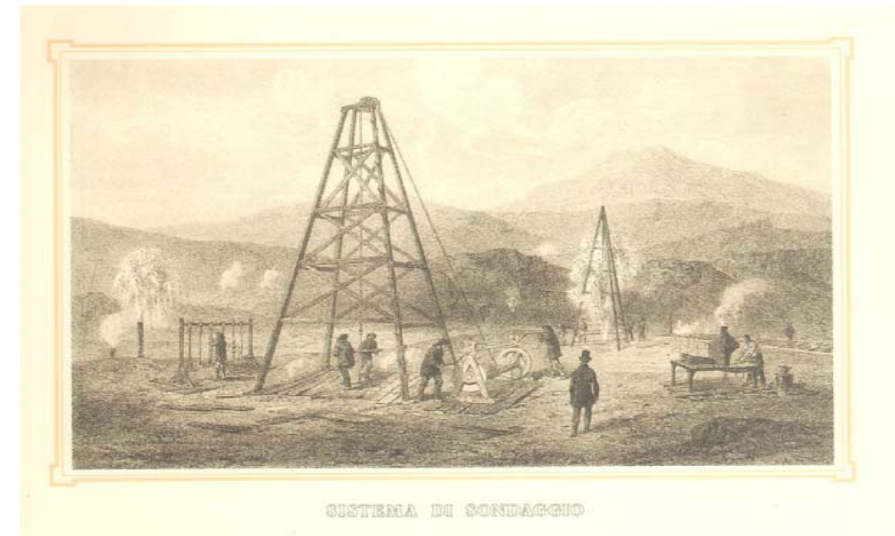
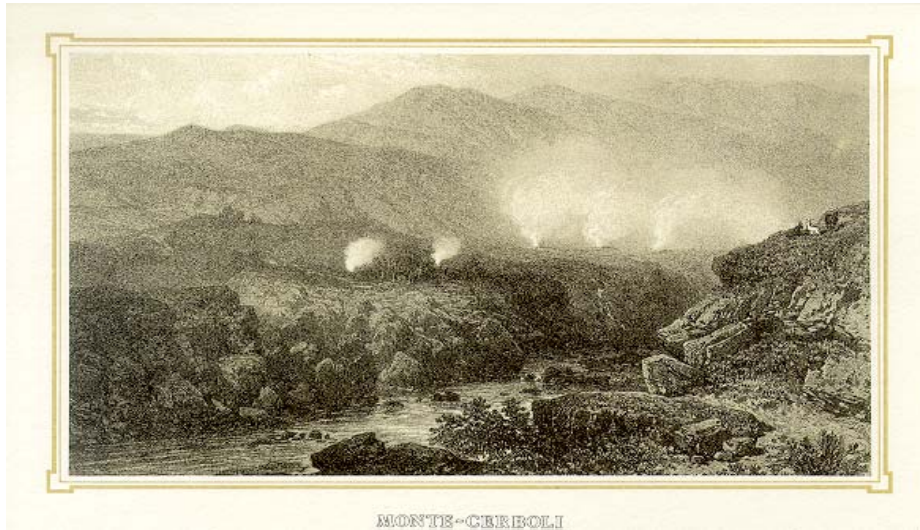
Geothermal Generation Dept.

Potsdam, January 11th, 2007



L'ENERGIA CHE TI ASCOLTA.

Tuscany is the birthplace of the geothermal industry



Geothermal resources utilisation for industrial purposes began in Larderello (Italy):

- in the early 1800 with the boric salts production and the direct use of steam;
- in 1904 the first experiment of electric energy generation;
- in 1913 the first 250 kW unit, marking the beginning of this new industrial activity.

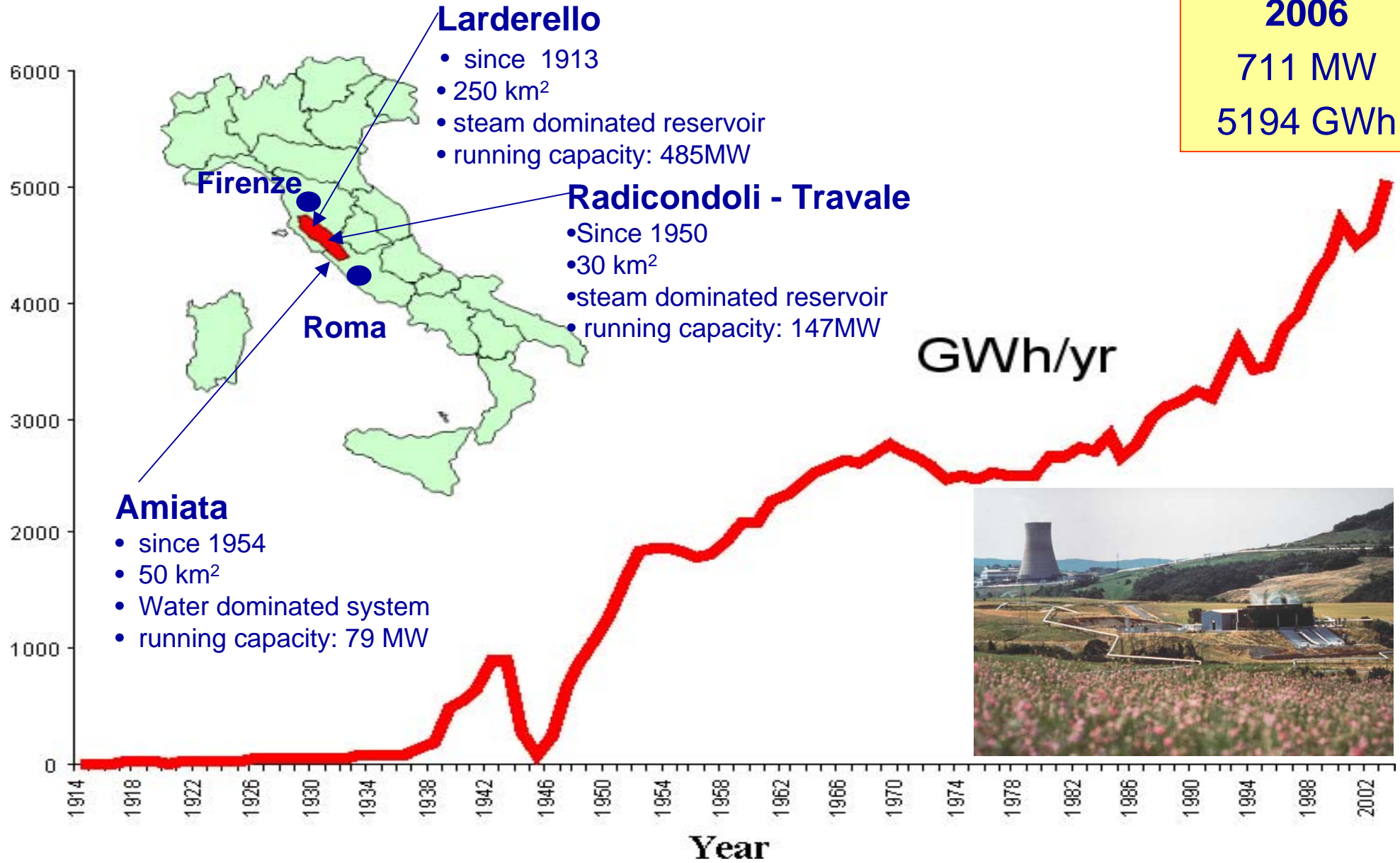
Tuscany is the birthplace of the geothermal industry



Well testing at the beginning of 1900 ...

Geothermal highlights in Italy

2006
711 MW
5194 GWh



Geothermal highlights in Italy

- **GEO Total generation (TWh) 5.0**
- **Supplied Heat (Tcal) 285**
- **Avoided CO₂ emissions (Mt) 3,4**
- **Oil saving (MOET) 1,13**



GEO Generation in Italy

1.7% of total generation

4.5% of ENEL generation

10.4% of Renewable energy generation

Geothermal generation covers

25% of the Tuscany Region consumption

Geothermal highlights in Italy

Uso: Riservato aziendale

Data updated on 31/12/2005

- Generation capacity (MW) **699**
- Power plants **31**
- Units **32**
- Wells **508**
- Gathering systems (km) **480**
- District heating systems **26**
- Fluid treatment systems **36**



Geothermal Business Units

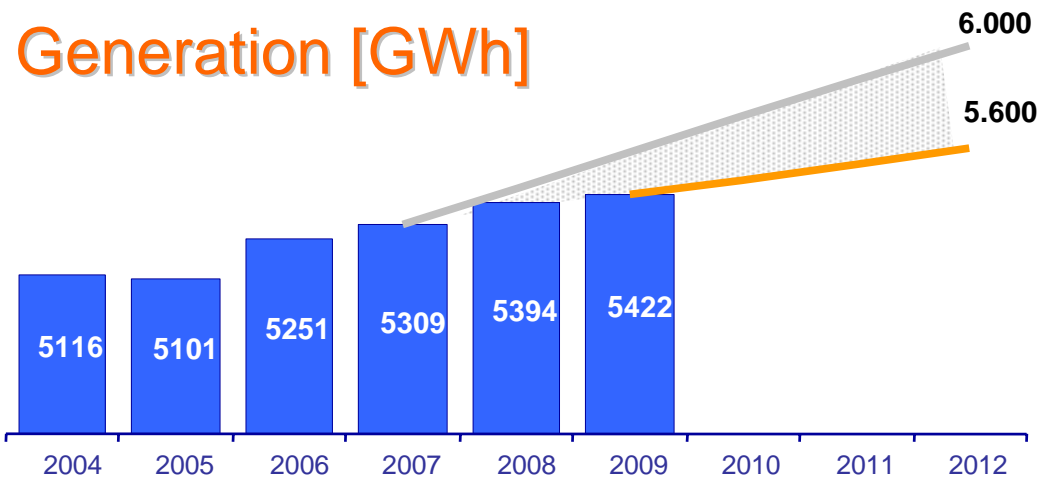
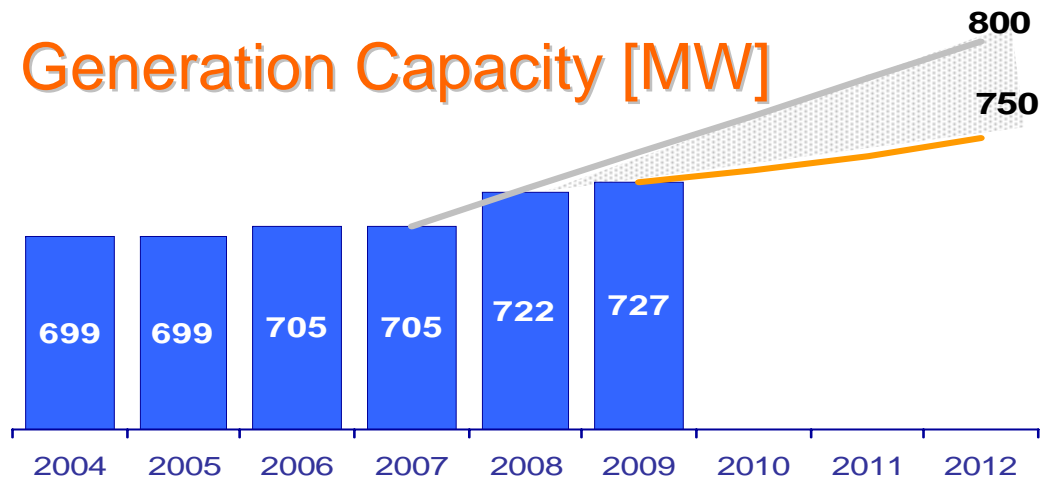
Operations

Maintenance Services

Mining Activities

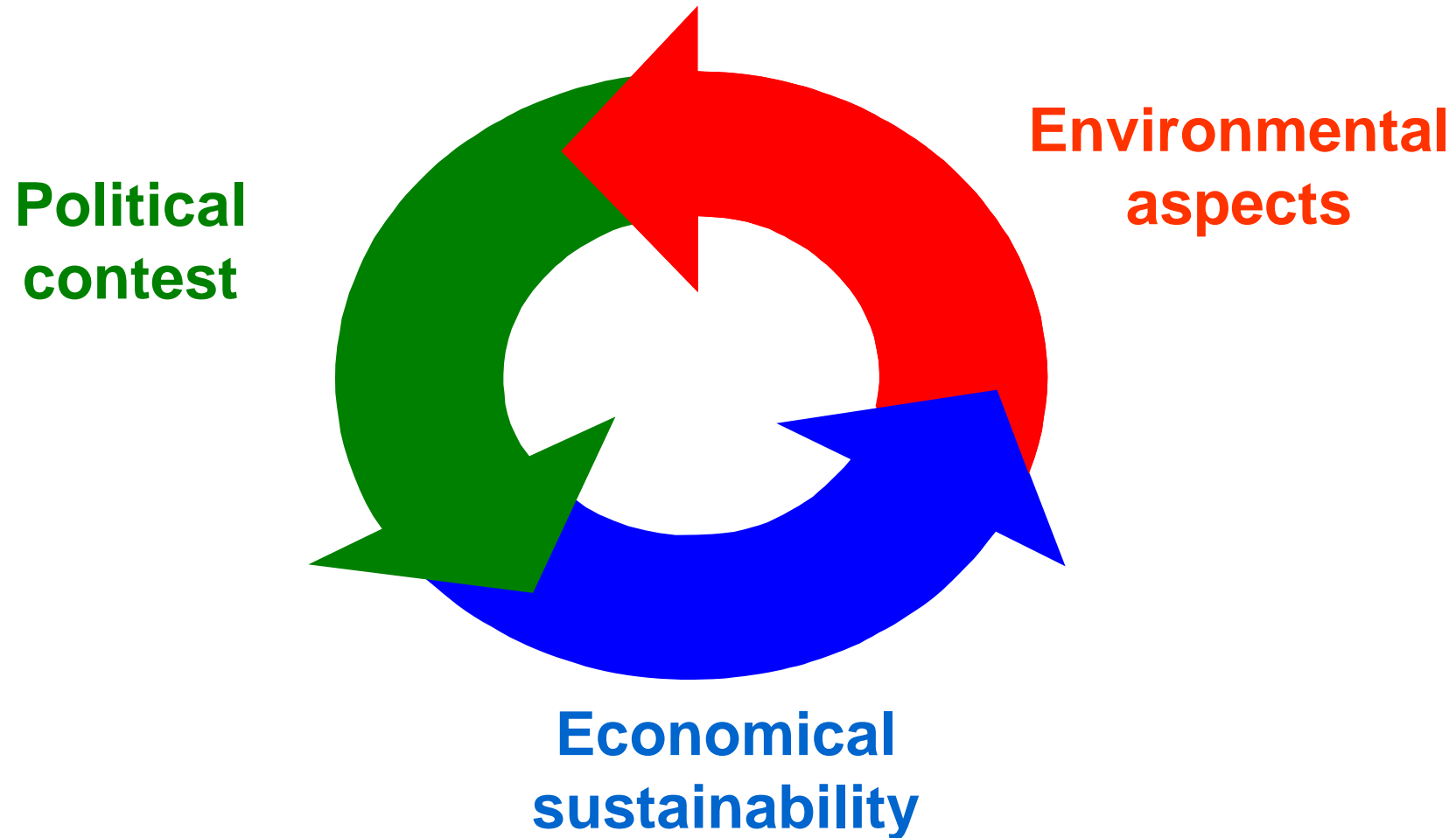
Mining Engineering

1004 employees



For the next few years, Enel has planned an increase of geothermal generation resulting from specific projects, but.....

Non-technical barriers: the main issues



Each issue has a specific weight in different contests

Economical sustainability

Geothermal exploitation is characterized by high investment costs that are required to locate the resource (mining investment) and build gathering systems and power plants

Without incentives there is no possibility to realize a geothermal project

In Italy there are two favourable circumstances:

- Enel background (in terms of experience and exploration techniques) allows the reduction of mining risk and hence of required investment;
- the Italian regulation provides incentives that allow the economical sustainability

At present, economical sustainability is not an issue, but.....

Environment

The landscape in many geothermal areas



The landscape in Tuscany



A geothermal project needs a large land use



Production wells



Steam gathering system



Geothermal power plant

in a regional contest characterized by:

- high population density
- historical, artistic and landscape peculiarities

Environment: real main issues

Landscape → **Land use**
Visual impact

Noise → **From power plants**
From wells during drilling & production tests

Air quality → **Smell nuisance due to H₂S**
emissions

Environment: the “induced” issues

Statements of some “scientists” cause unjustified worries

- Induced seismicity** → **Geothermal activities increase the macro-seismicity**
- Water consumption** → **Geothermal exploitation causes reduction of the drinking water reserves**
- Effects on health** → **Geothermal activities are dangerous for health**

The political climate: some excerpts from the News



greenreport.it

quotidiano di approfondimento sulle tematiche ambientali

Roggiolani: «La Regione si faccia dare da Enel 65 milioni l'anno»

Intervento del consigliere regionale dei Verdi sulla geotermia
L'ingegner Trivella si augura che non venga dimenticata la
Larderello

“Enel has to give to the local communities 65 M €/yr”

Geotermia Il sindaco di Santa Fiora allontana le polemiche e assicura: “Niente passi avventati”

“Non svenderemo il territorio”

Verdi: “Nuova centrale solo se avremo precise rassicurazioni”

“We are not willing to sell off our lands”

The political climate: some excerpts from the News

Geotermia: oltre 350 firme di protesta

Spopolamento del territorio e crisi del lavoro: i Ds attaccano Enel

More than 350 signatures

Region depopulation and job crisis: Ds party attacks Enel

AMIATA «Comitato» contro la proposta che punta sullo sfruttamento dell'energia endogena

Geotermia, no alla Regione

Amiata

Local committees against geothermal exploitation

Amiata «Allarmante la situazione emersa dallo studio presentato da Macchia Faggeta»

Nessuna mediazione per la geotermia

I comitati: "Si cominci a pensare alla chiusura"

Amiata: no compromise for geothermal energy

The local committees: "It is time to think about the stop of geothermal activities"

What local administrations want

R & D

The regional energy planning forecasts :

- an increase of the use of geothermal resources
- the implementation of research centers.

Both goals shall be achieved with financial resources coming from geothermal activities

Money

The “geothermal law” already provides a share linked to the generation. The value of this share is about 1.7 €/MWh.

The **Regional Administration** has the intention to increase the share up to 15 -20 times

What local administrations want

Job

About 1000 Enel employees are at present involved in the geothermal activities.

Local administrations would like to increase this number up to 1800.

Environmental Care

Reduce the environmental impact (emissions, landscape,.....)

Each request needs a high money consumption.

Accepting all the requests at the same time contrasts with the economical sustainability

What ENEL is already doing

To reduce the environmental impact

- Decrease H₂S and Hg emissions
- Eliminate the typical smell associated with geothermal field exploitation
- More effective landscape and architectural compliance

To increase the social acceptance

- New local communities relationships for a sustainable geothermal development
- Agreement with the Tuscan Council requirements about environmental issues and knowledge diffusion

AMIS[®]

- Innovative Enel technology
- Highly reduces H₂S and Hg emissions

Environmental plan

Over 30 M€ for land recovery issues

New architectural solutions

Communication & knowledge

- All the power plants are ISO 14001 certified
- Diffusion of technical data
- Cooperation with local communities

AMIS: a technical answer to a non-technical issue

*16 power plants from 2005 to 2007 will
be equipped with AMIS*



An Innovative technology entirely designed
and developed by Enel:

AMIS (**A**bbattimento **M**ercurio e **I**drogeno **S**olforato)

Abatement of Mercury and Hydrogen Sulfide



About 40 M€ of investment

80% of the emissions will be treated

Expected abatement Hg > 90%
H₂S 70-80%

Environmental impact mitigation: some examples

Power plant evolution ...



Over 30 M€ for land recovery issues

Environmental impact mitigation: some examples



Lower height above ground level

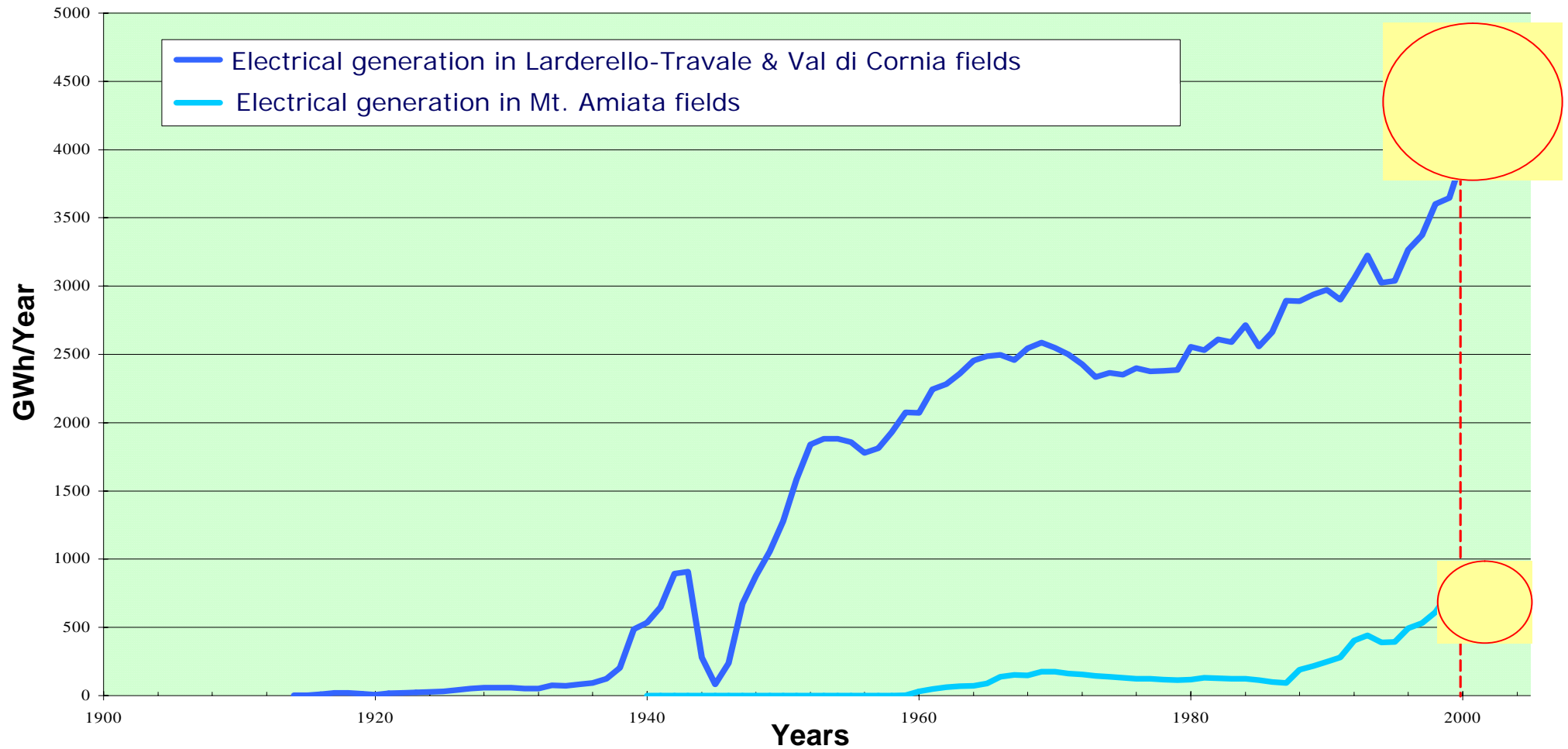


Choice of appropriate colors



Design of gathering system paths using the land morphology to reduce the visual impact

Where the opposition increases...



... energy generation decreases

Conclusions

At present, in Tuscany, the main non-technical barrier in the development of geothermal exploitation is linked to people worries about environmental aspects.

What the scientific community can do

The scientific community can help the geothermal industry to overcome unjustified worries:

- supporting knowledge spreading;
- assuming unambiguous positions, thus avoiding to feed unjustified fears of the populations about negative effects deriving from the presence of geothermal plants in their lands;
- emphasizing the uncertainties of geo-scientific interpretations in order to avoid their incorrect use or ill-exploitation

Thanks for your attention

