

Policy makers' awareness and
public acceptance on geothermal projects in
Larderello (ITALY)

Ruggero Bertani – International Division - Geothermal Business Development
Paolo Romagnoli - Renewable Energy Business Area - Geothermal Generation Dept.

Athens, September 13rd, 2007

Key operational highlights (2006)

Generation (MWh)

Net installed capacity (MW)	52.358
<i>Domestic</i>	42.216
<i>International</i>	10.142
Power plants	
<i>Hydro (616 pp)</i>	17.894
<i>Thermal (53 pp)</i>	30.629
<i>Wind (46 pp)</i>	689
<i>Geothermal (31 pp)</i>	671
<i>Other Renewables (6 pp)</i>	78
<i>Nuclear (2 pp)</i>	2.398

Production (TWh)

Total Production	125,7
<i>Domestic</i>	112,1
<i>International</i>	13,6

Electricity Distribution & Sales

Enel distribution (TWh)	260,7
<i>Domestic</i>	251,0
<i>International</i>	9,7
Enel Sales	156,3
<i>Domestic</i>	148,2
<i>International</i>	8,1
Customers (millions)	32,1
<i>Domestic</i>	30,0
<i>International</i>	2,1
Netz (km/thousands)	1.141,0

Gas Distribution & Sales (TWh)

Enel Sales (bcm)	5,1
Customers (millions)	2,1
Gas Pipeline (km/thousands)	30,0

Enel International presence as of 2006

Europe

SLOVAKIA

66% of Slovenské Elektrárne: net installed capacity 6.356 MW

RUSSIA

Management of a 450 MW CCGT near S. Petersburg (NWTPP)
Joint Venture Trading with RES

SPAIN

Viesgo: net installed capacity 2,264 MW, over 0.6 mn. customers and 29,662 km of distribution network
50% of EUFR: net installed capacity 385 MW

ROMANIA

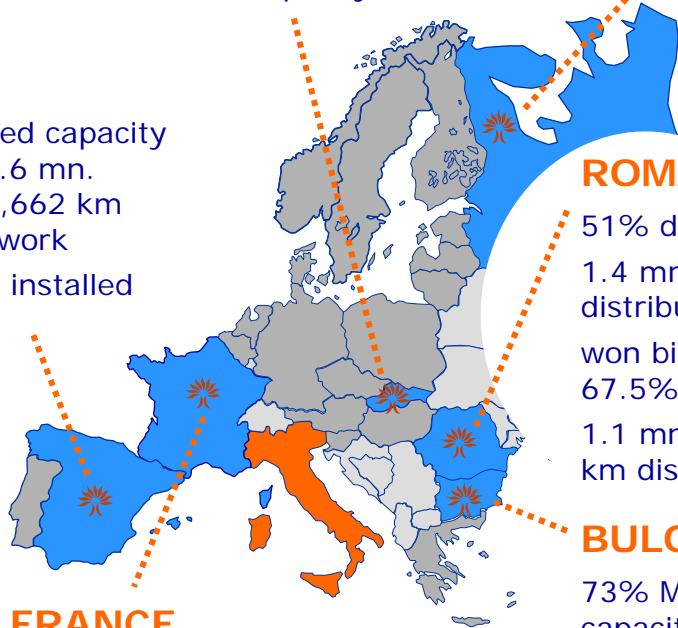
51% discos Banat & Dobrogea
1.4 mn customers, 80,100 km of distribution network
won bid for 67.5% Electrica Muntenia Sud
1.1 mn customers and 43,350 km distribution network

BULGARIA

73% Maritza East III: net installed capacity after refurbishment 798 MW lignite power plant,

FRANCE

5% Powernext
MoU to develop EPR



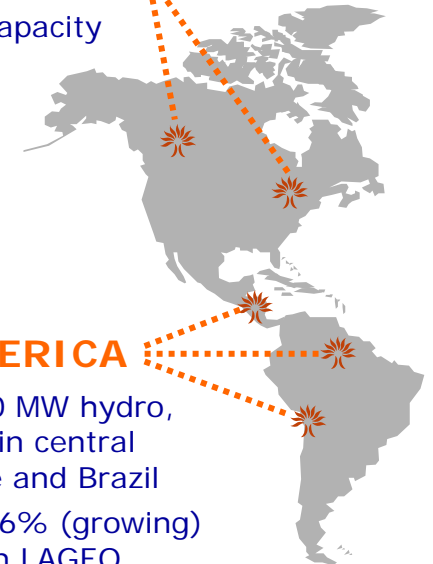
America

NORTH AMERICA

net installed capacity 402 MW

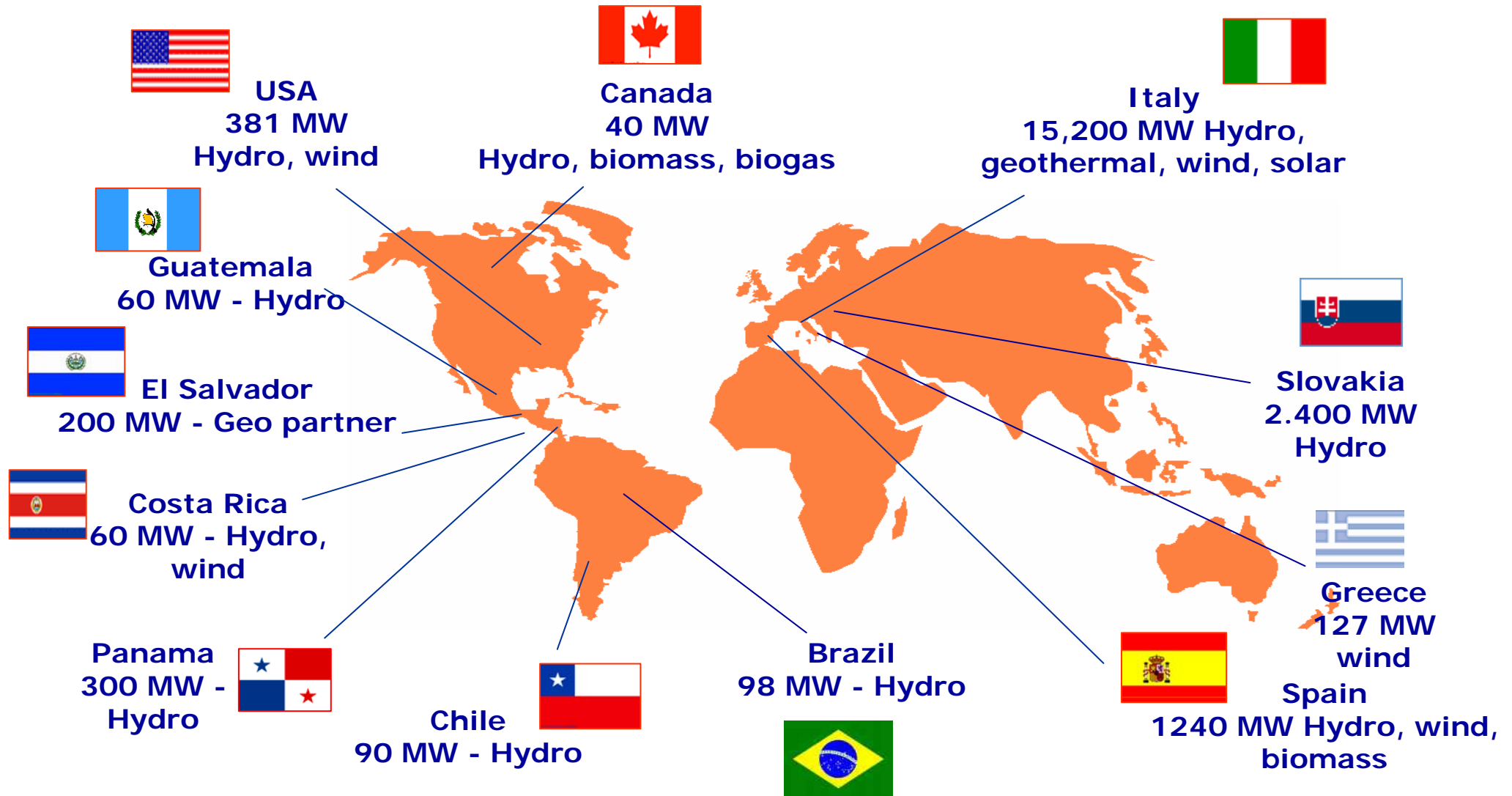
LATIN AMERICA

More than 300 MW hydro, geo and wind in central America, Chile and Brazil
El Salvador: 36% (growing) participation in LAGEO
200 MW geothermal



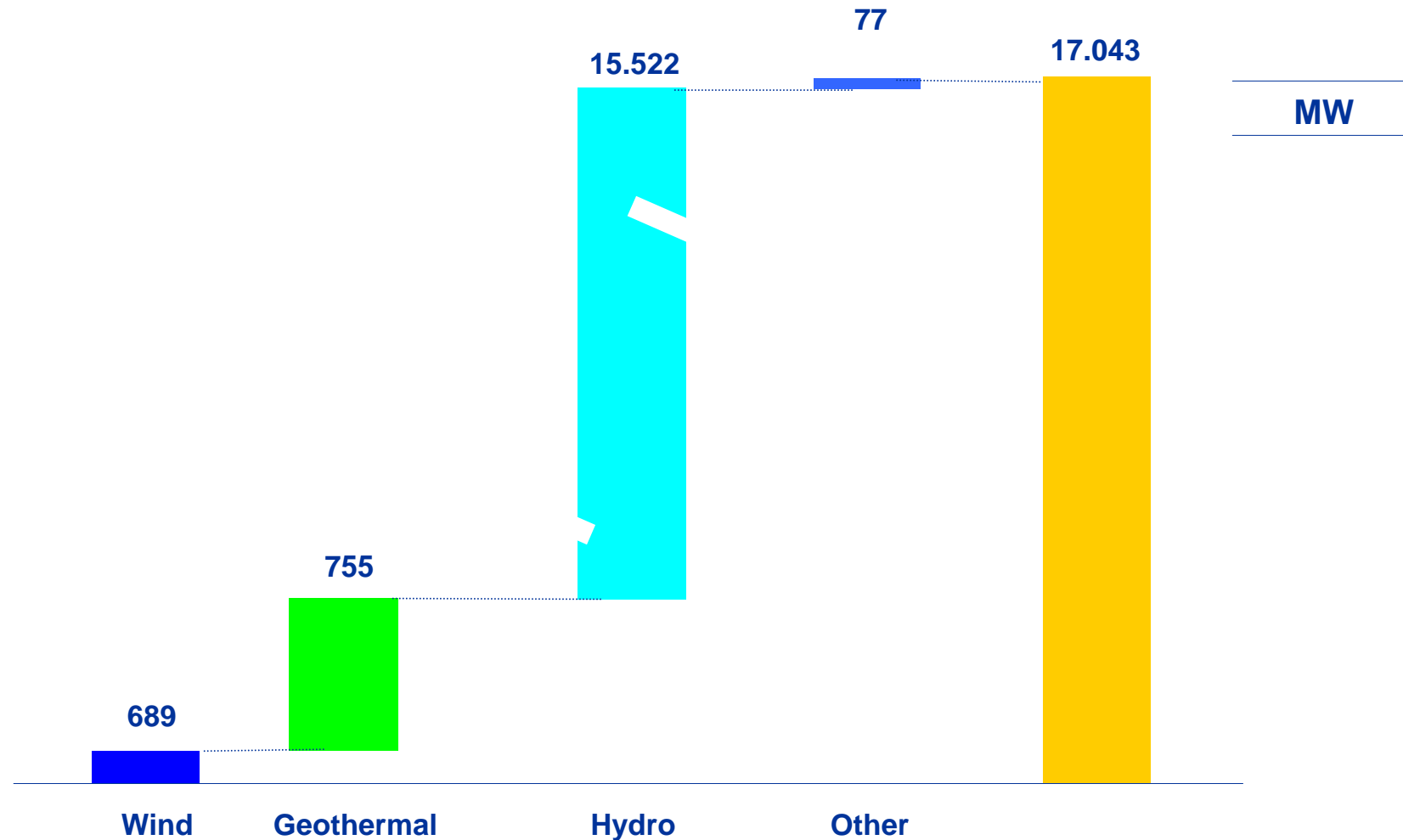
**more than 10 GW of net installed capacity
over 3 million customers**

Worldwide renewable portfolio



Enel a world leader for RE generation

Enel is present in Italy, Europe and in the Americas with an installed capacity of around 17 GW



Enel in the geothermal world

Enel was the first operator in the history of world market



In 1921 at El Tatio, North Chile, *Larderello S.p.A.* made the first exploration of the area drilling two wells.

... Enel made explorations in 15 countries, as technical consultant.



Geothermal activities abroad

Europe

Construction in California, Nevada, Utah (USA) for **120 MW**

Exploration in Nicaragua & Guatemala

Far East



Cile



El Salvador

200 MW at Berlin and Ahuachapán ON LINE

Exploration at Chillán, Calabozo, El Tatio/La Torta, Apacheta.

The values which drive the Enel's development

Care for people

*We aim at growing personnel into **responsible, accountable and performing leaders**, by providing **opportunities** for professional development and by **rewarding** performance*

Focus on performance

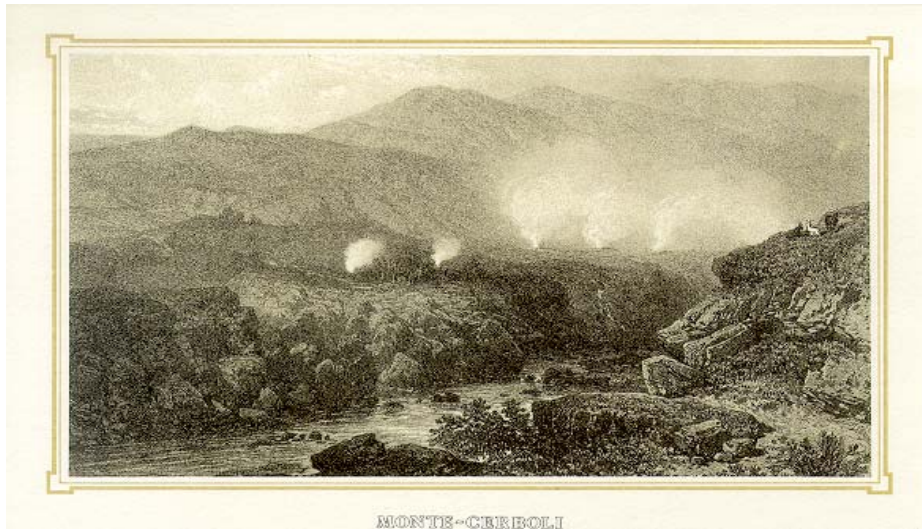
*We will be focused in identifying and capturing all **value creation** opportunities, focusing on **efficiency, productivity and right value of our energy***

Invest in the community

*We will pursue all **profitable** opportunities to **reinforce our leadership** position through **investments and acquisitions**, maintaining a **socially responsible and safety oriented** attitude towards the country and our stakeholders*

People, Performance and Community

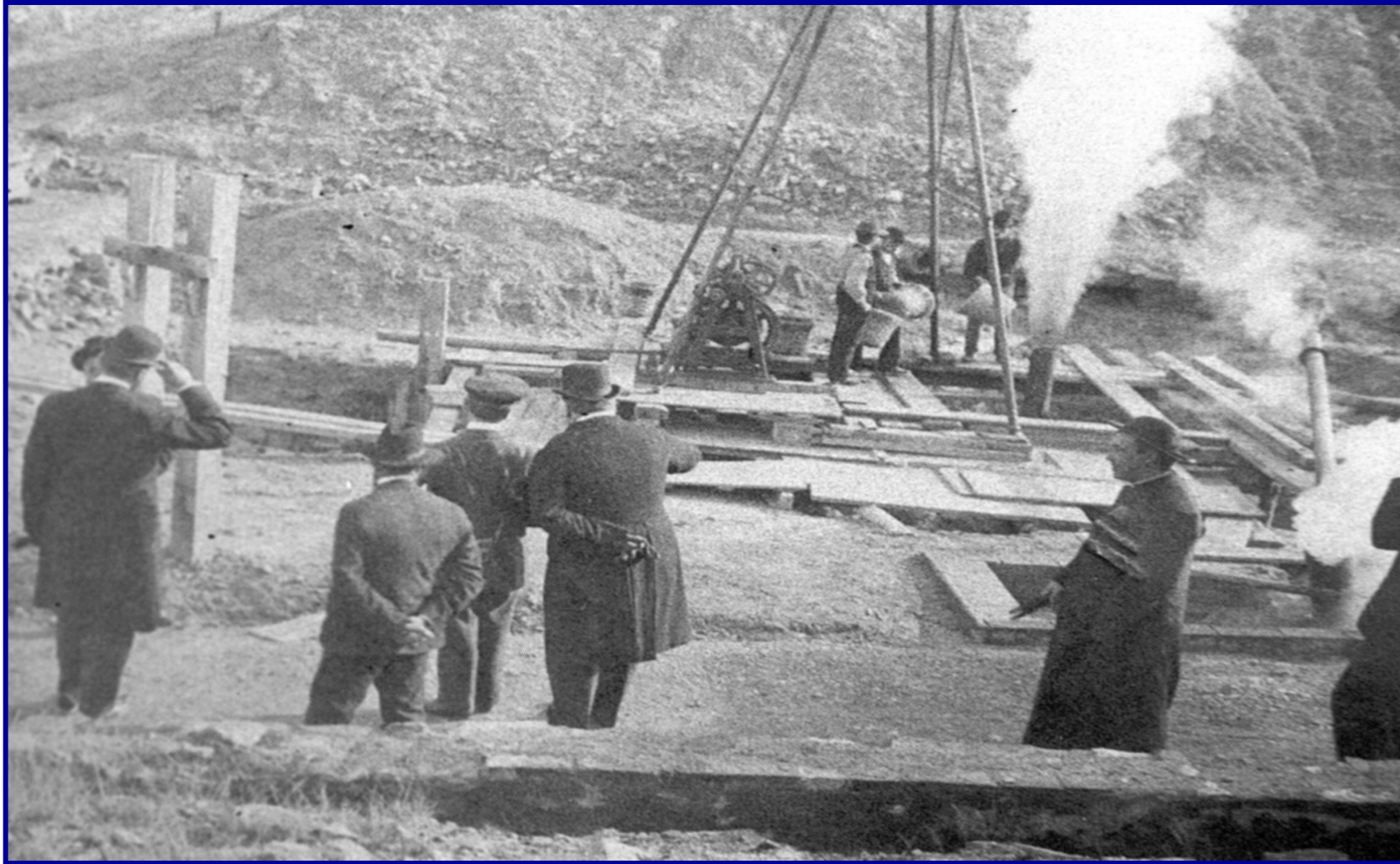
Tuscany is the birthplace of the geothermal industry



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.

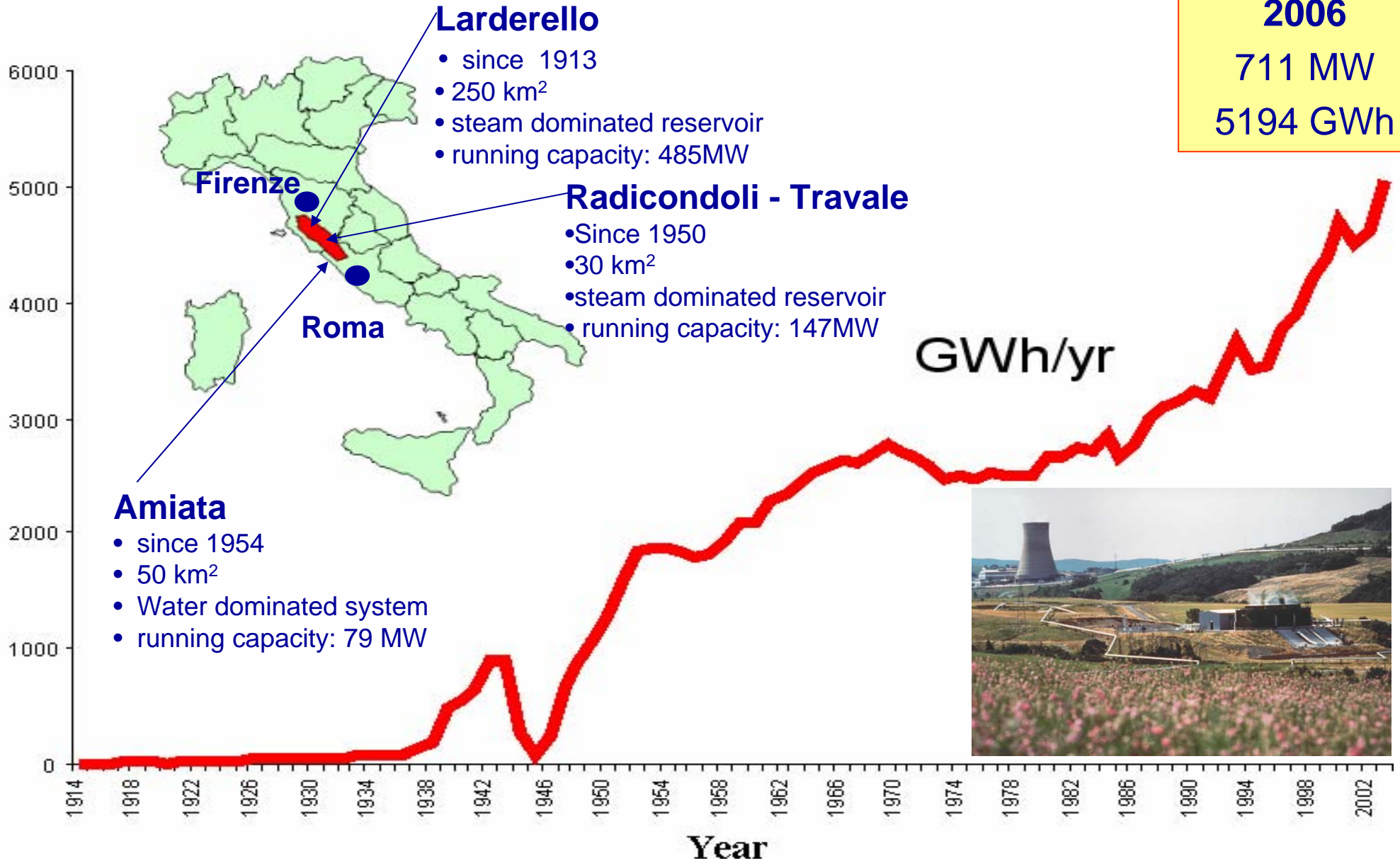
Tuscany is the birthplace of the geothermal industry



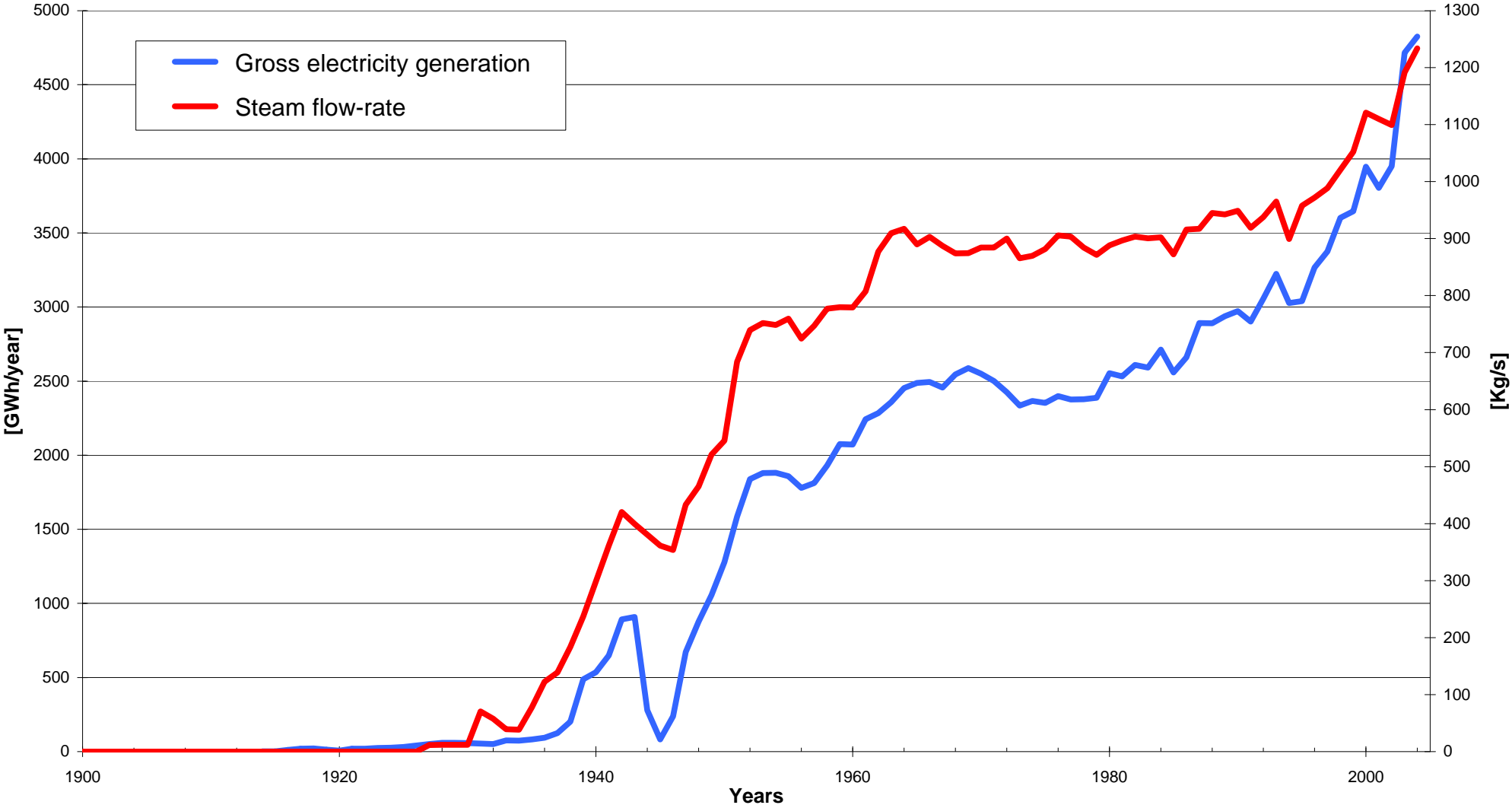
Well testing at the beginning of 1900 ...

Geothermal highlights in Italy

2006
711 MW
5194 GWh

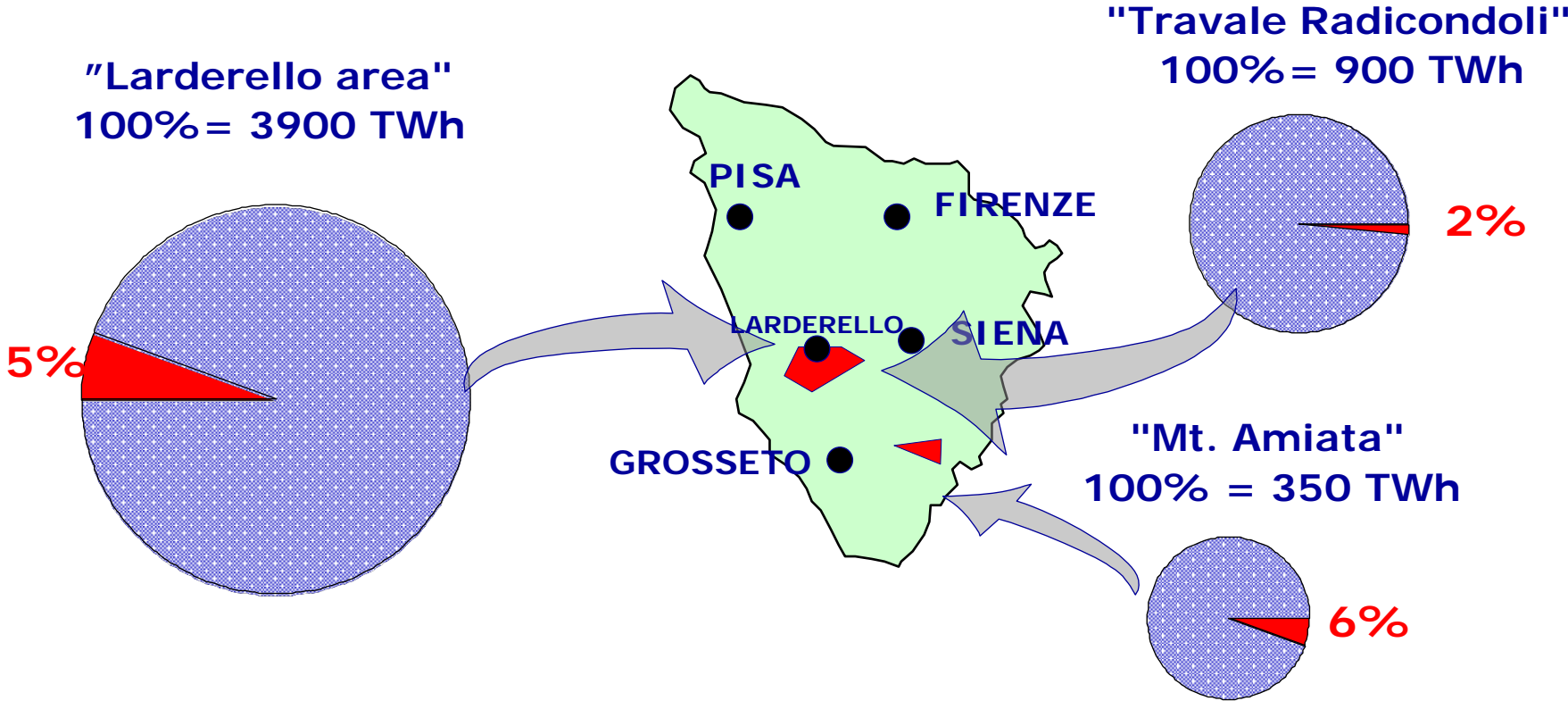


Geothermal highlights in Italy



Geothermal highlights in Italy

The utilized thermal energy is (%) **in red**



Geothermal highlights in Italy

Data updated on 31/12/2005

- **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

Data updated on 31/12/2005

- Generation capacity (MW) **810(711)**
- Power plants **31**
- Units **32**
- Wells **508(280-60)**
- Gathering systems (km) **480**
- District heating systems **26**
- Fluid treatment systems **36**



Geothermal Business Units

Operations

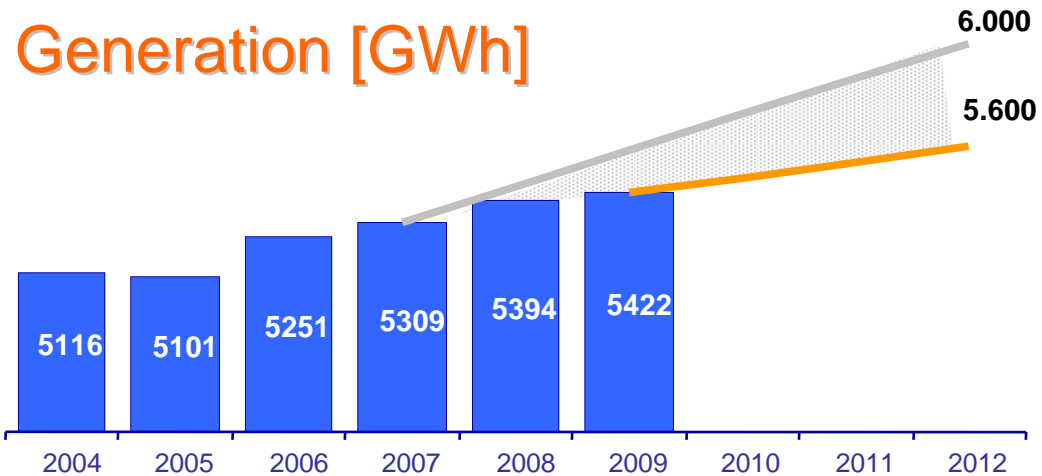
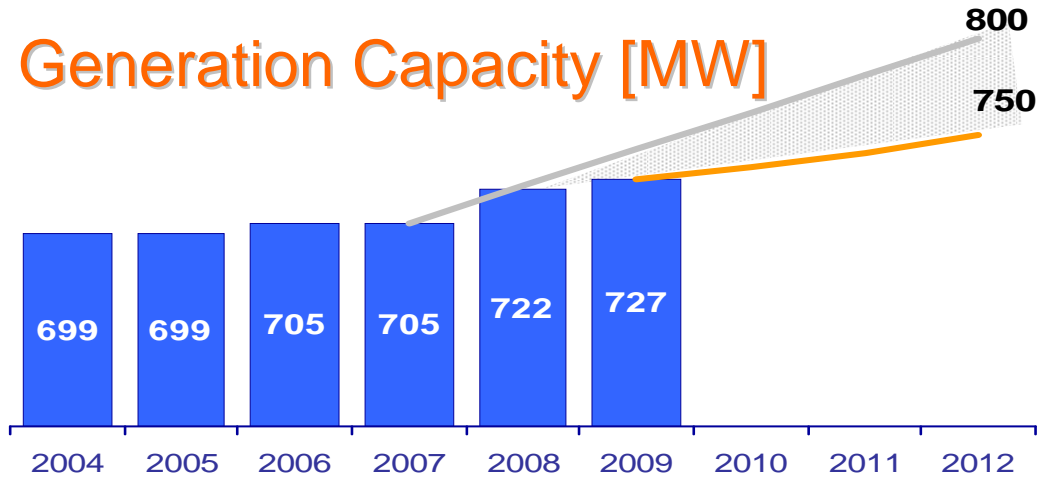
Maintenance Services

Mining Activities

Mining Engineering

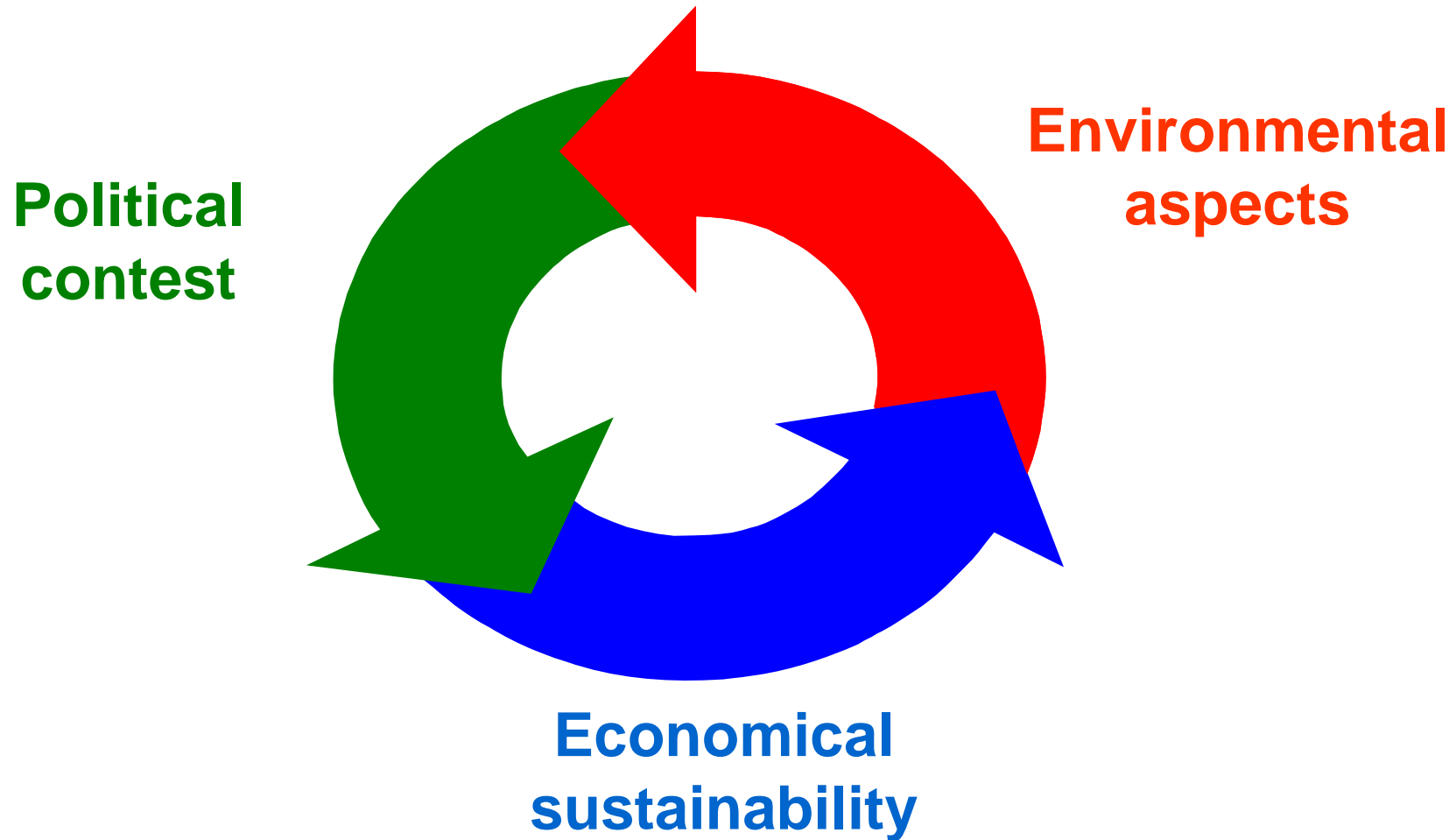
1000 employees

Geothermal highlights in Italy



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 (average selling tariff 95 €/MWh)

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

Environment

The landscape in many geothermal areas



Environment

The landscape in Tuscany



Environment

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

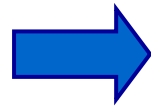
Noise → **From power plants**
From wells during drilling & production tests

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

Environment: the “induced” issues

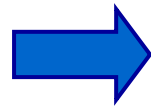
**Statements of some “scientists”
cause unjustified worries**

Induced seismicity



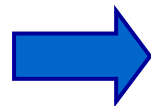
**Geothermal activities increase the
macro-seismicity**

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 storia di 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

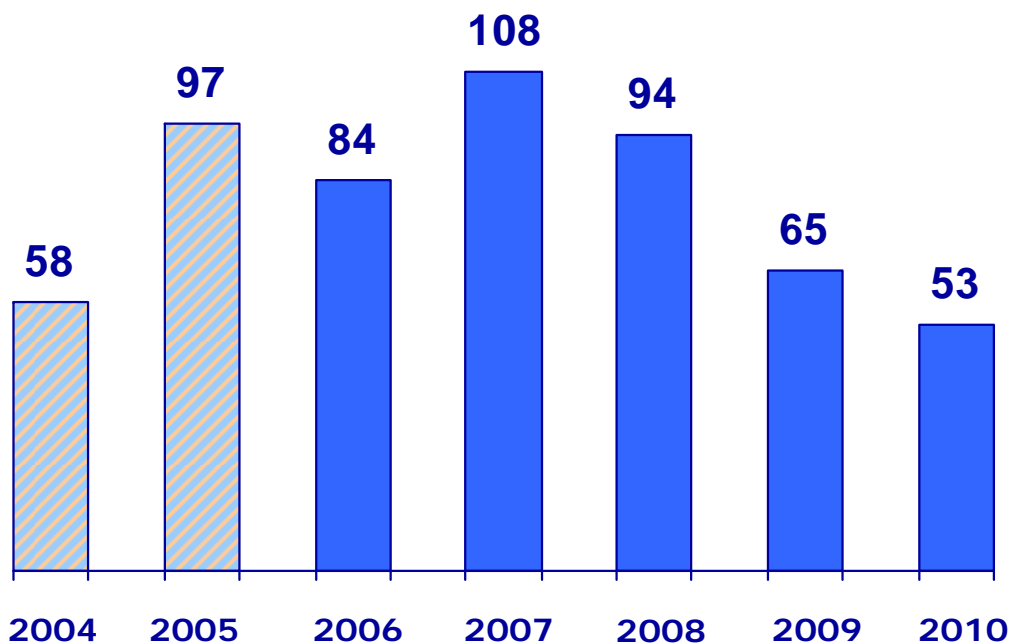
New architectural solutions

Communication & knowledge

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

Planned investments: 2005-2010

About **400 M€** (2006 - 2010)



Main projects planned:

Sasso 2 30 M€
20 MW

Nuova Lagoni Rossi 24 M€
20 MW

Bagnore 4 72 M€
40 MW

Radicondoli gr. 2 23 M€
20 MW

Exploration program 68 M€
12 exploratory wells

Amis plants 40 M€

Environmental 20 M€

AMIS: a technical answer to a non-technical issue



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

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



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

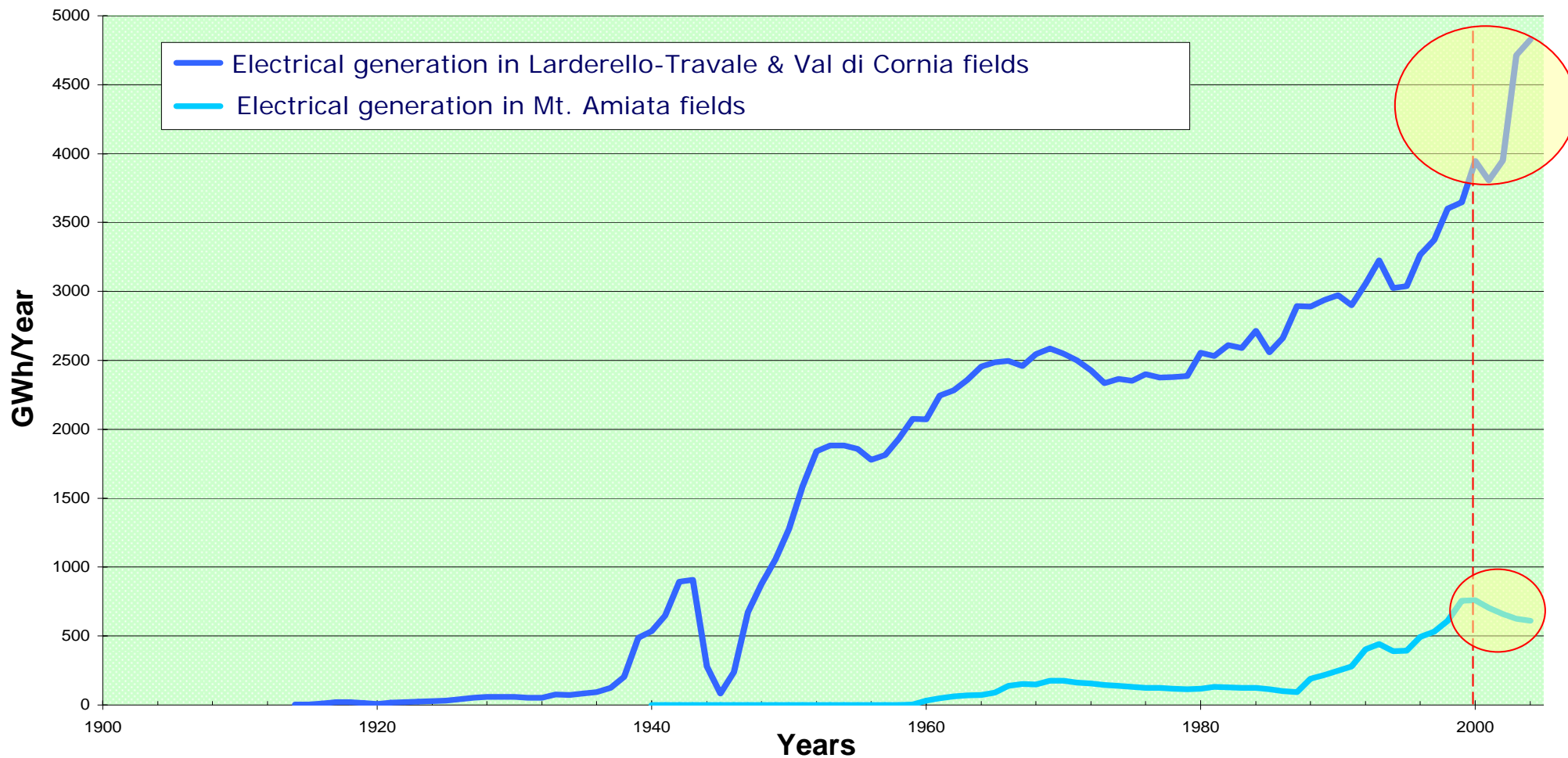


Choice of appropriate colors



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

