



# El Salvador Geothermal

Barbados  
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**José Antonio Rodríguez**  
**LaGeo S.A. de C.V.**



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# Geothermal in the world

- Mature technology
- 8,900 MW total installed capacity worldwide 2005
- 58 TWh generated 2005
  - Third renewable after hydro and biomass (more than wind!!!)
- Clean & Green
  - Sustainable if managed properly
- Can be used for other purposes
  - Heating, cooling, irrigation, crop drying, etc.
  - In countries like Iceland, over 50% of primary energy comes from geothermal sources
- Part of popular culture
  - “We come from the land of the ice and snow, of the midnight sun where the hot springs blow” – Led Zeppelin



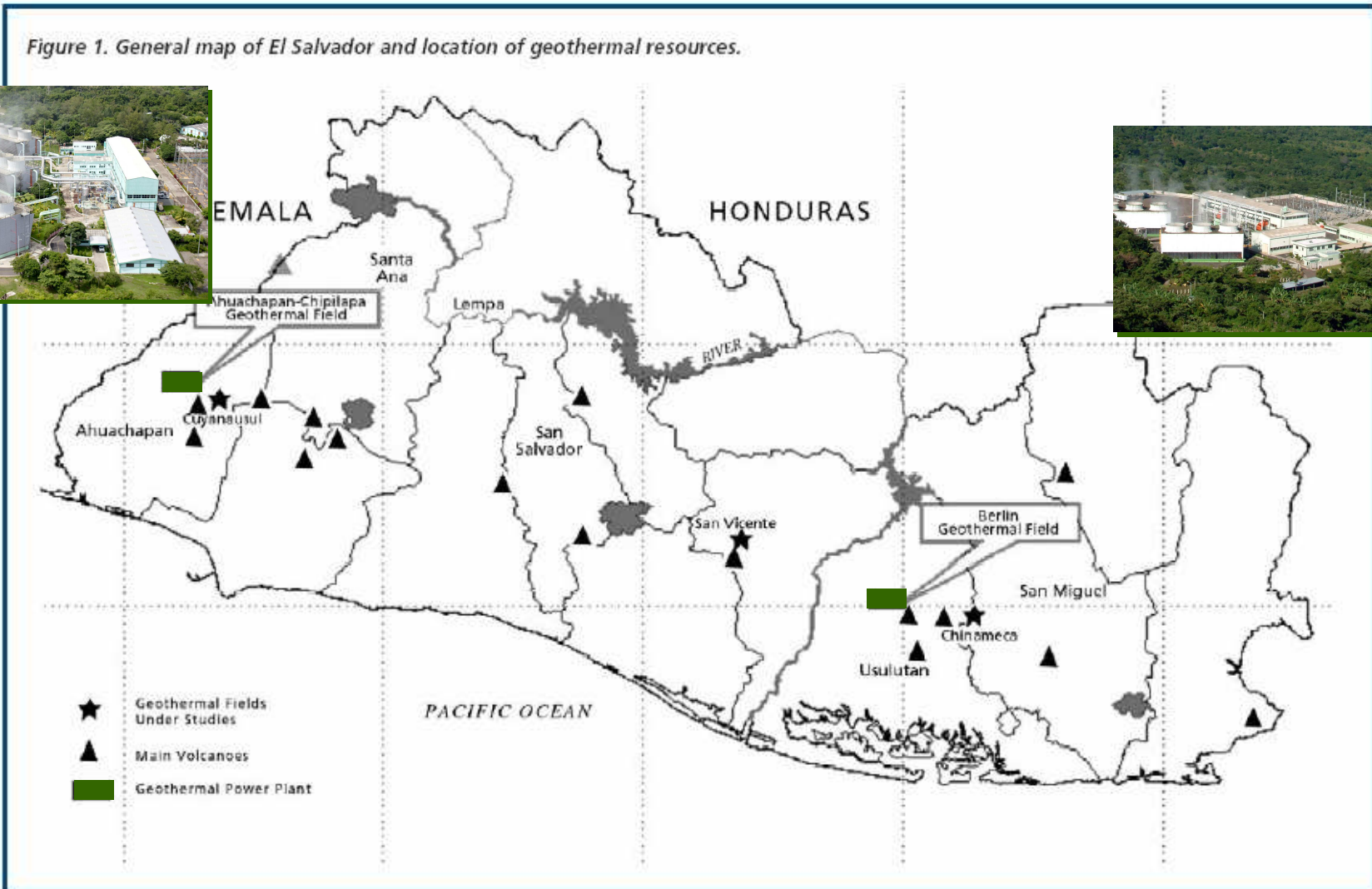
# LaGeo

- Owners: CEL, Enel (since 2002)
- 4 concession areas in El Salvador: Ahuachapán (95 MW), Berlín (109 MW), San Vicente, Chinameca
- Installed capacity: 204 MW (190 MW running)
- 2007 electricity production: 1,293 GWh, 24.4% of demand (highest in the world), second largest generator in E.S. after CEL
- Subsidiaries
  - PSB – drilling contractor (3 rigs)
  - LaGeo Nicaragua – O&M for San Jacinto Tizate, other geothermal services in Nicaragua
- Other business
  - 40% share of GeoNica: 2 concession areas in Nicaragua (El Hoyo-Monte Galán, Managua-Chiltepe)



# Location of Geothermal Projects

Figure 1. General map of El Salvador and location of geothermal resources.



# Geothermal in E.S.

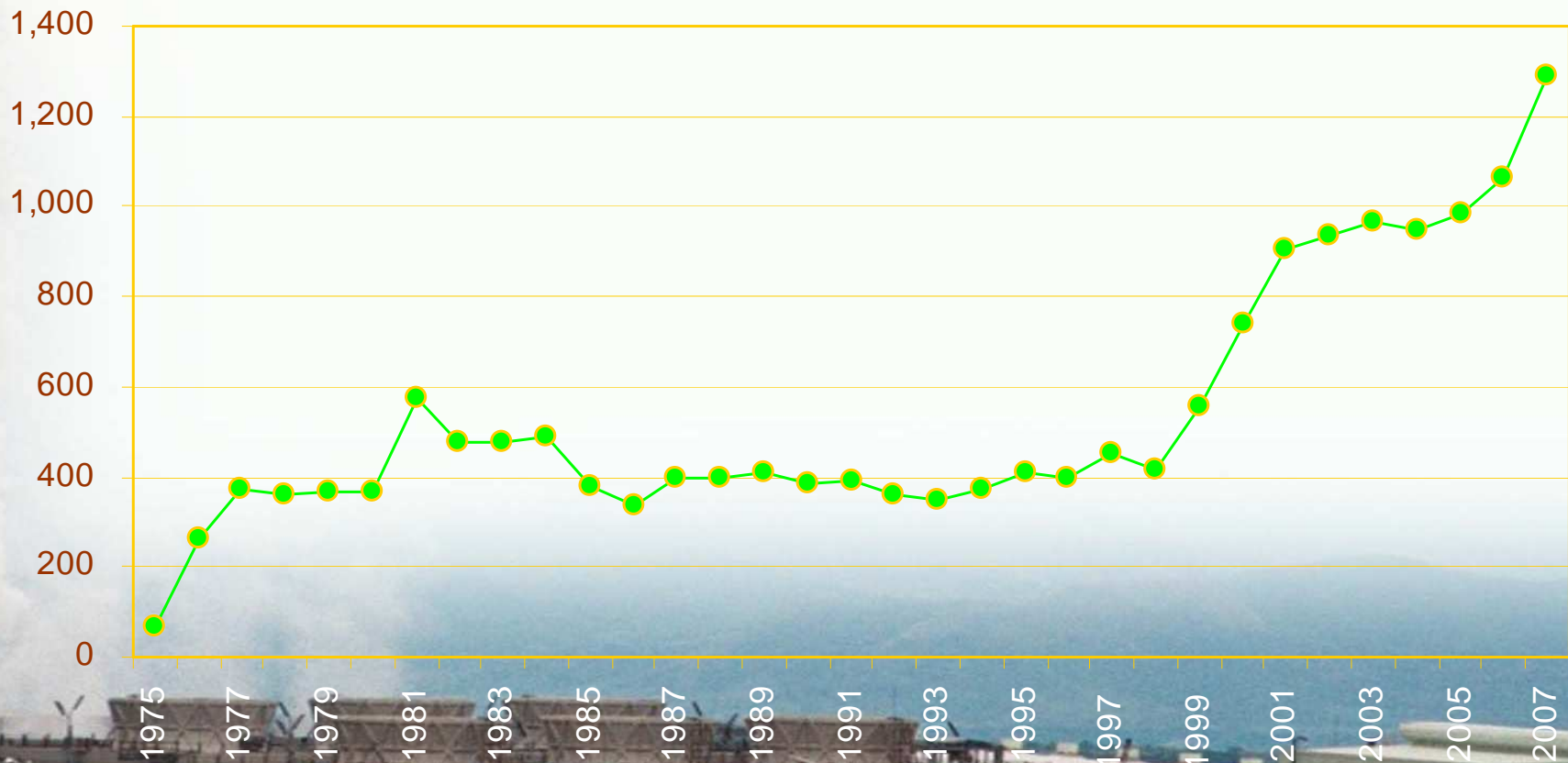
- Initial reconnaissance: 1958
- First deep wells: U.N., 1968
- Ahuachapán Unit 1 first synchronisation: 1975
- Berlín wellhead plant: 1992
- Berlín first condensing plant: 1999
- Enel becomes strategic partner: 2002
- Ahuachapán optimisation: 2003 – today
- Berlín Unit 3, binary cycle – 2007

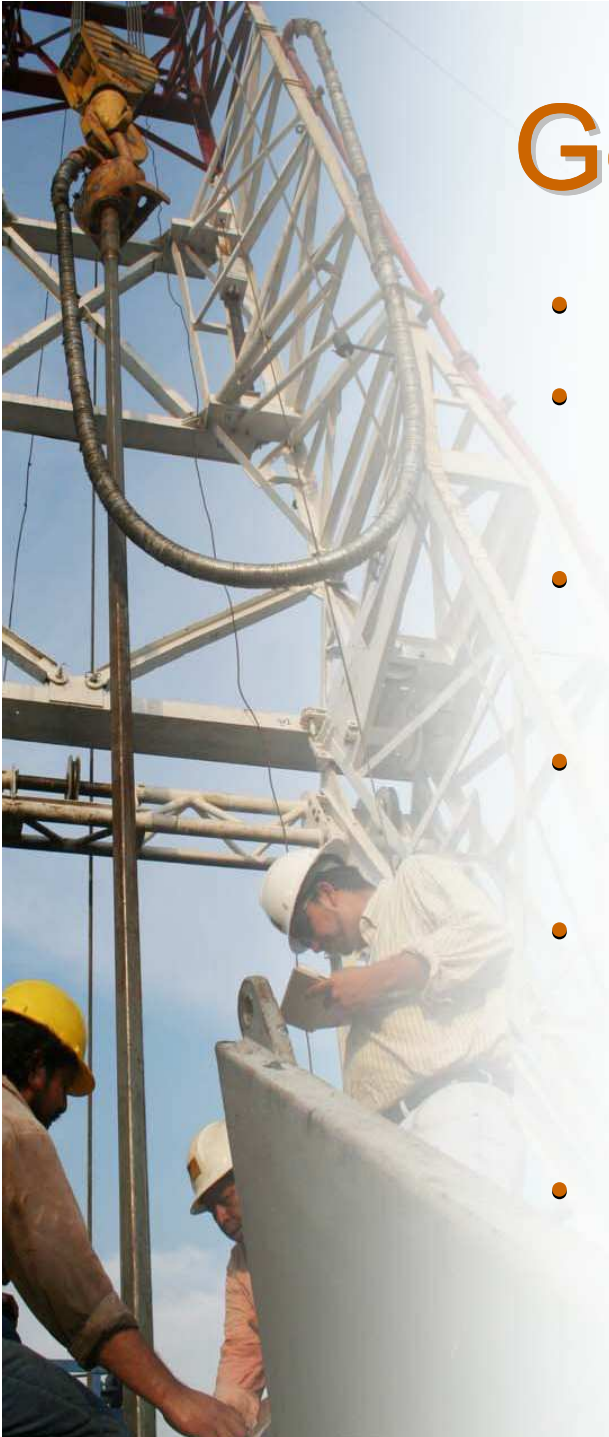


# Geothermal generation history

## LaGeo Generation EL SALVADOR (1975-2007)

GWh



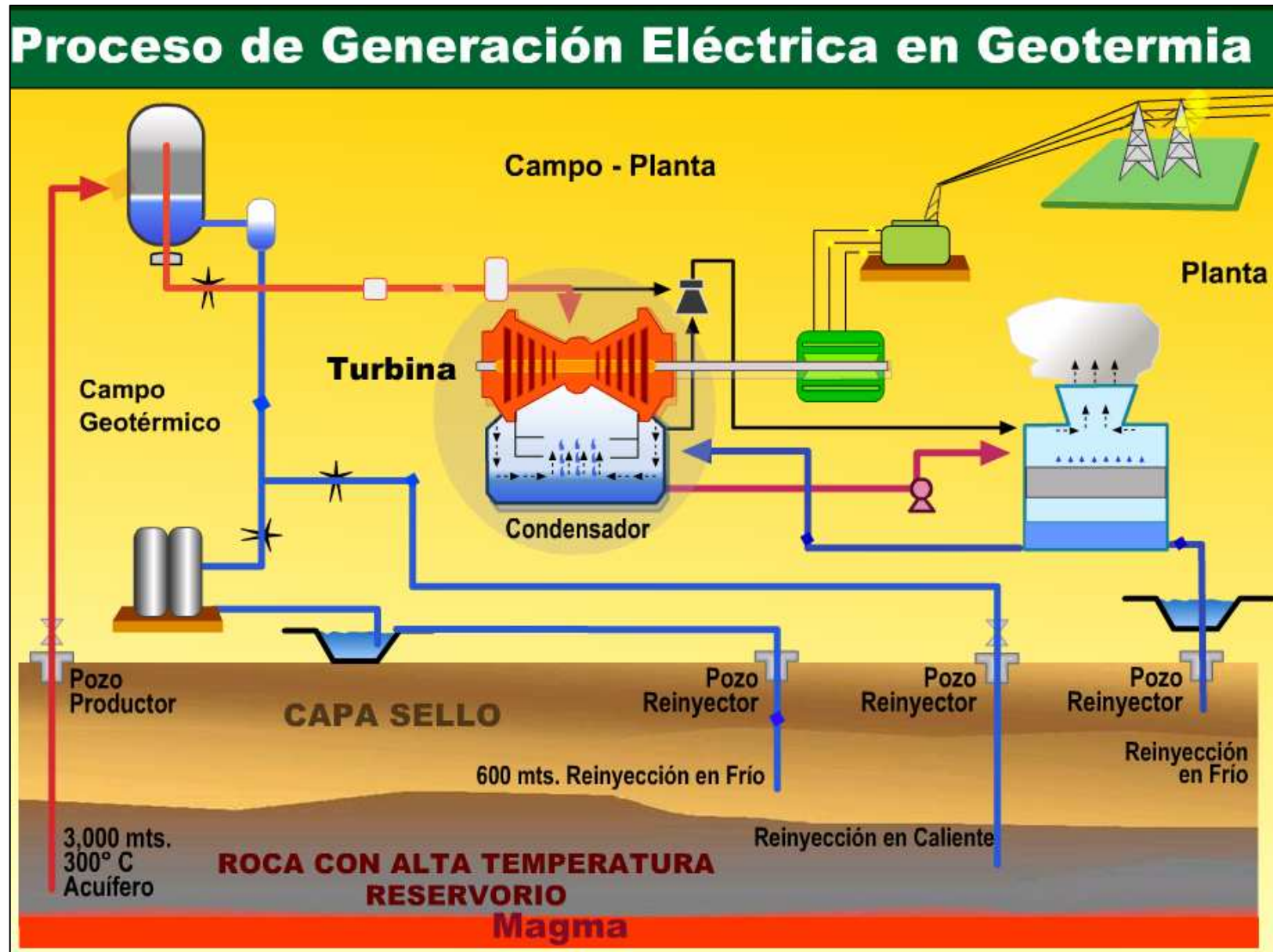


# Geothermal process

- Reconnaissance
- Surface exploration (1 year)
  - Geology, geochemistry, geophysics
- Deep exploration (1 year)
  - 2-4 wells, 1,000 – 3,000 m depth
- Powerplant design, contracting, financing (1-2 years)
- Construction (2 years)
  - Powerplant, wells, pipelines, transmission line
- Operation (30 years for powerplant, field: indefinitely)



# Single-flash production process (2)



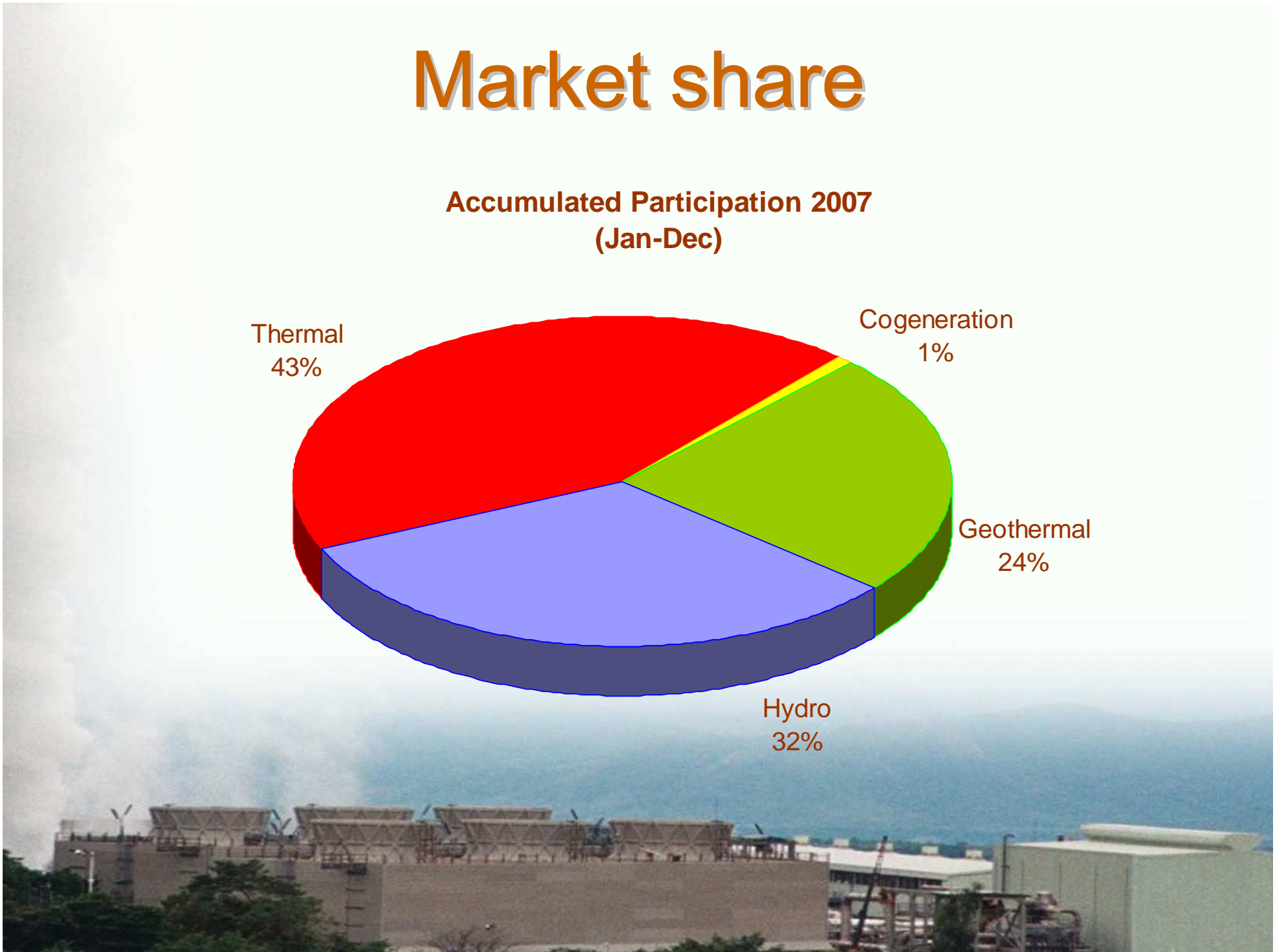
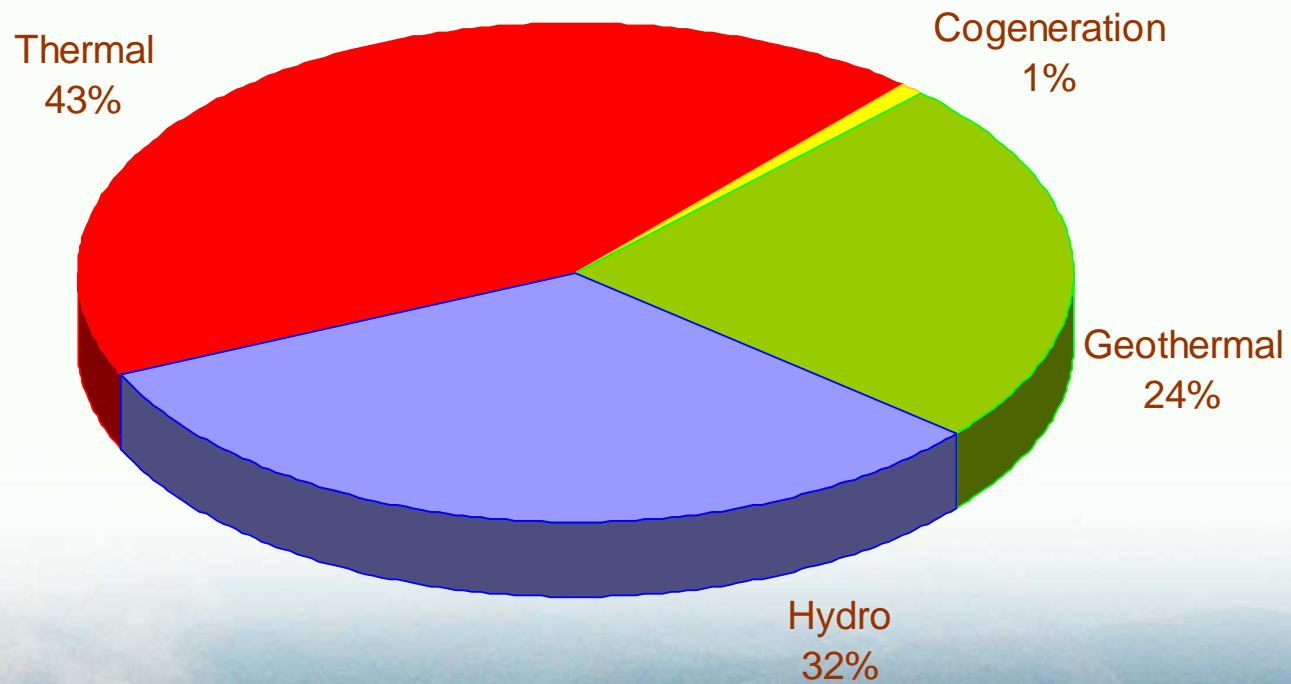


# Geothermal in the marketplace

- Baseload price-taker
- Low variable cost, high fixed cost
- Must be cost-competitive with alternatives
  - Once installed, very stable and competitive
- Bilateral contracts at fixed or variable price (~80% of production)
- Practically impossible to contract long-term in E.S.
- Risky
  - NOT for the faint-hearted
  - Sales of CER's helps the economics

# Market share

Accumulated Participation 2007  
(Jan-Dec)



# Direct use and other benefits

- Condensates – irrigation, fish farming
- Space heating
- Space cooling (??)
- Crop drying
- Stimulus for local economy



# LaGeo's future plans

- Increase generation in Ahuachapán, Berlín
- Develop concession areas
  - San Vicente, Chinameca
  - El Hoyo-Monte Galán, Managua-Chiltepe jointly with Enel
- Research and develop other clean energy technologies, hybrids (solar thermal, etc.)
- Export know-how to other countries in the region



# Geothermal training

- Geothermal Research Institute – Pisa, Italy (**Closed**)
- Geothermal Institute, University of Auckland – New Zealand (**Closed**)
- University of Kyushu – Fukuoka, Japan (**Closed**)
- United Nations University – Geothermal Training Programme – Reykjavik, Iceland
- Need to develop own, local training programmes – with international support





# La Geo

**Energía limpia para un planeta mejor**

