



GEOHERMAL ENERGY IN NICARAGUA

Ministry of Energy and Mines



Nicaragua

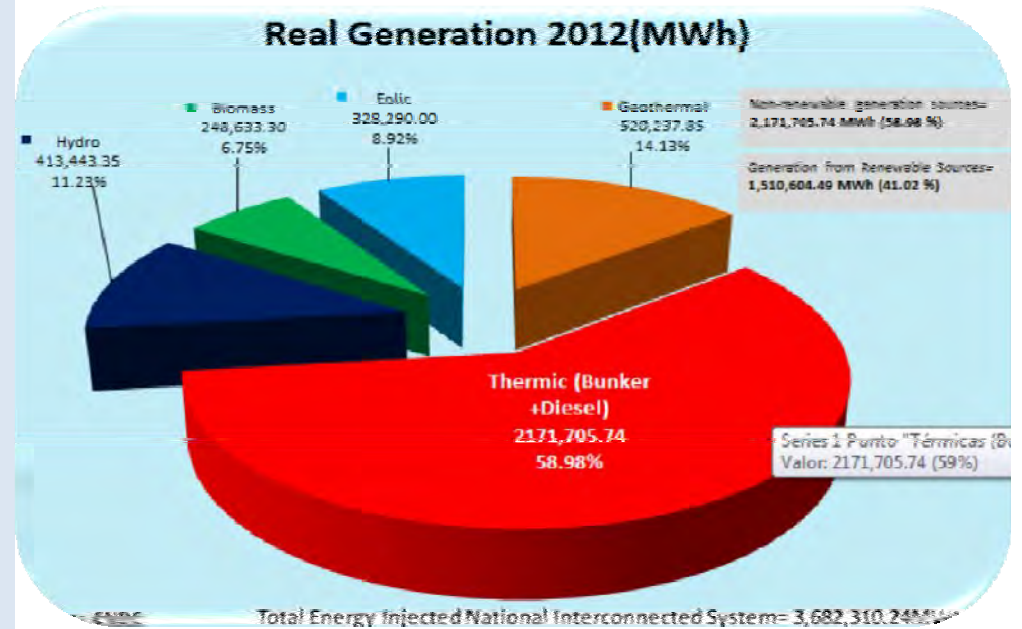
- **Location:** Strategically located in the heart of the Americas
- **Natural Resources :** Abundant.
It has 7% of the world's biodiversity. The second largest rainforest in the Americas (Bosawás Reserve, located Northeast of the country).
- **Capital City:** Managua
- **Languages :** Spanish (Official)
English- Caribbean Coast
- **Population:** 6.51 million of inhabitants.



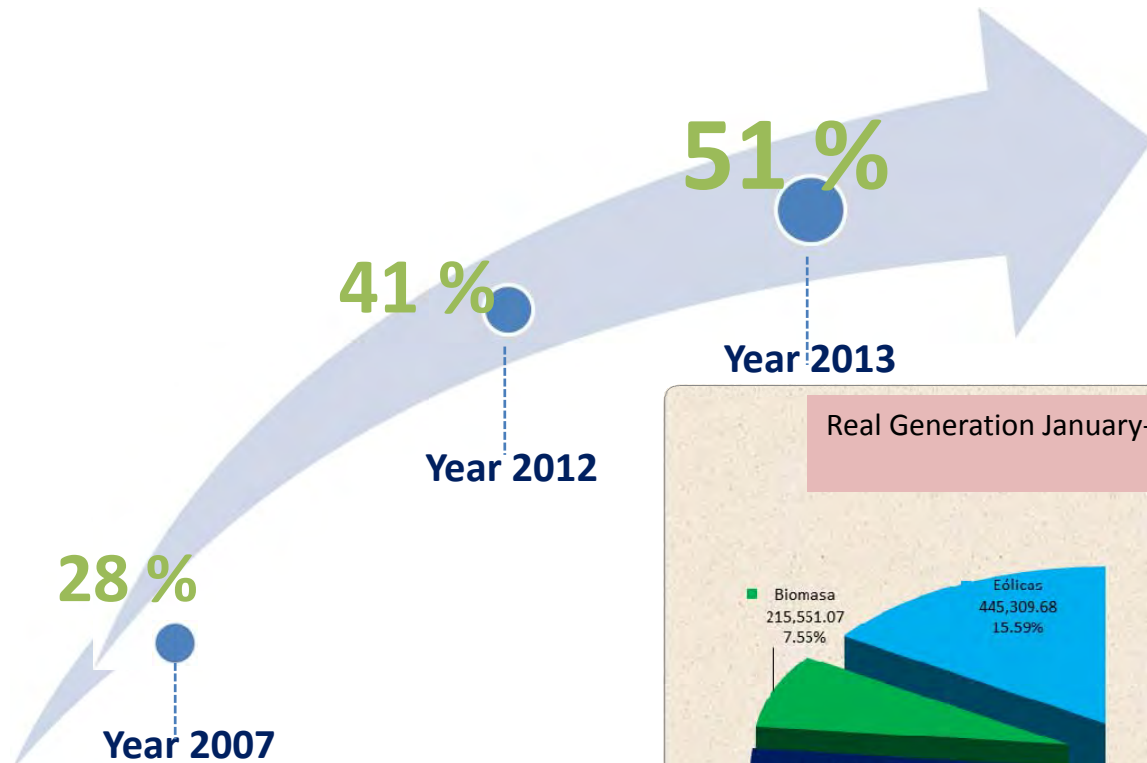
Energy Sector



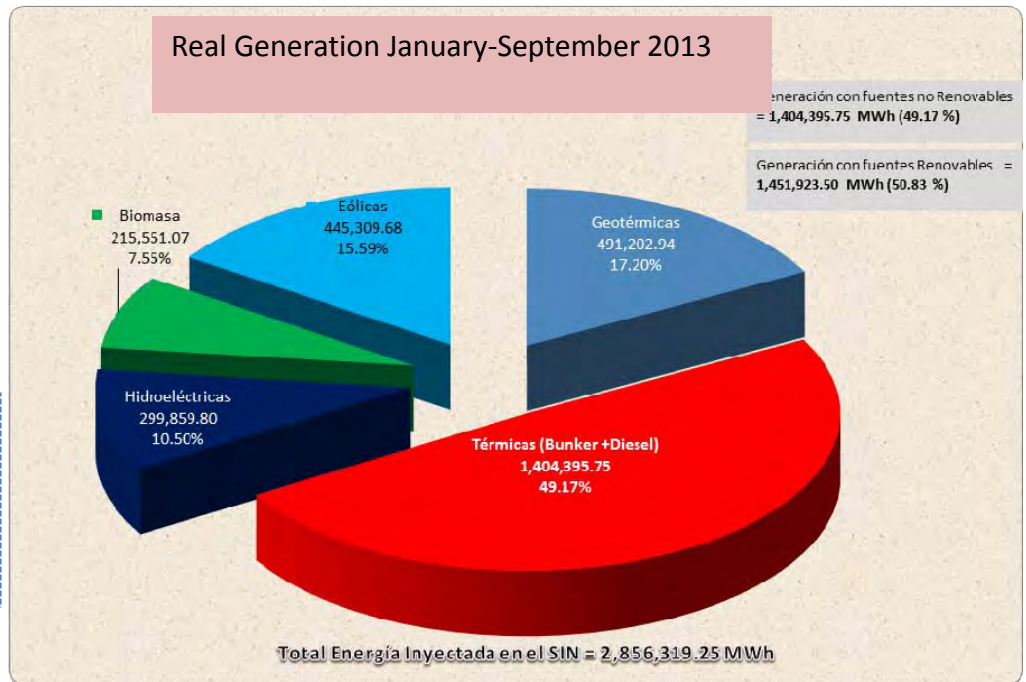
- Net generation : **3,682.31 GWh**
- Petroleum : 2.171.705 GWh
58.98%
- Eolic : 328.29 GWh
8.92%
- Co-Generation
from sugar cane : 248.633 GWh
6.75%
- Hydro: 413.443 GWh
11.23%
- Geothermal: **520.237 GWh**
14.13%



TRANSFORMATION MATRIX POWER GENERATION PERIOD: 2007-2013.



Percentage evolution of the contribution of renewable energy in electricity generation matrix: 2007-2013.



THE PARTICIPATION OF GEOTHERMAL ENERGY IN THE EVOLUTION OF THE MATRIX OF POWER GENERATION.

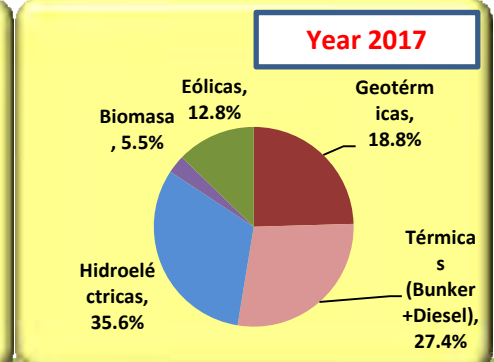
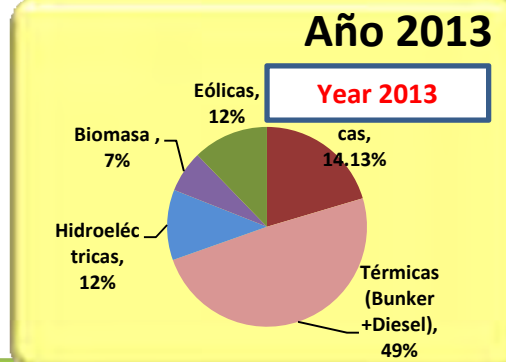
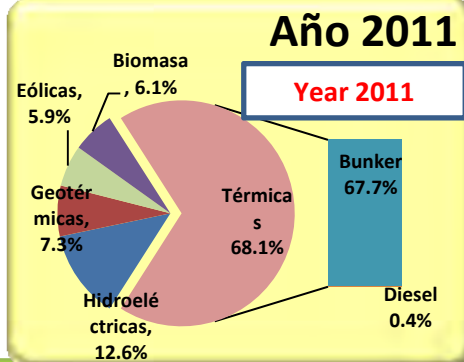
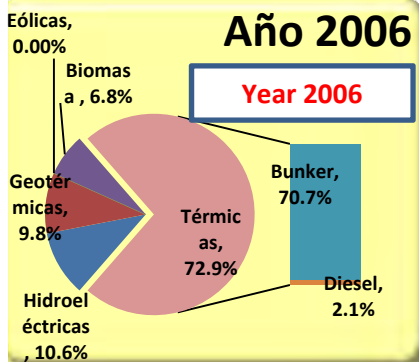
TOTAL PARTICIPATION OF ALL RENEWABLE ENERGY

27.1%

31.9%

50.78%

71.94%



9.8%

7.3%

14.13%

19%

PARTICIPATION OF GEOTHERMAL

Actual Geothermal Development



**154 MW installed geothermal generation supplies
12.06 % of country's electric energy consumption!**



Geothermal projects in operation:

- Momotombo Geothermal Field
- San Jacinto-Tizate Geothermal Field

Momotombo Geothermal Field:

- PHASE I: 35 MW FT Condensing Unit- 1983
- PHASE II: 35 MW FT Condensing Unit- 1989
- Binary Plant: 8 MW
- Total Installed capacity: 78 MW
- Five Wells to drill



San Jacinto Geothermal Field:

- PHASE I : 36 MW Fuji Condensing Unit-
January 2012
- PHASE II: 36 MW Fuji Condensing Unit-
December 2012
- Total Installed capacity: 72 MW
- 4 wells to be drilled to recover the generating
capacity



Other projects in development:



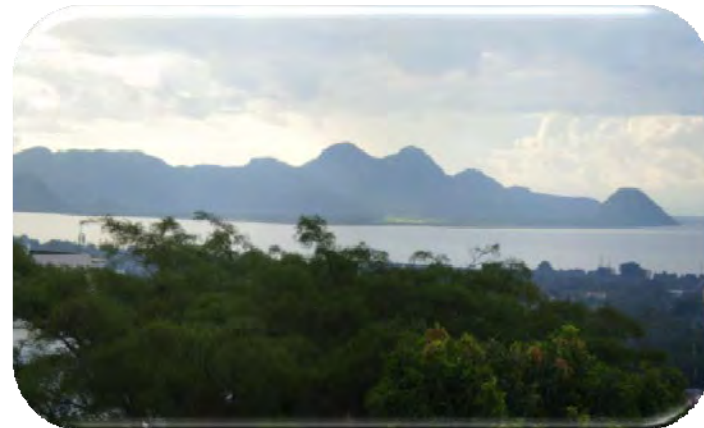
Casita-San Cristóbal Geothermal Project: Exploitation Concession

- PHASE I:
- 4 Wells to drill (In the second half of 2014)



Managua-Chiltepe Geothermal Field: Exploration Concession

- PHASE I :
- 3 Wells to drill (In the second half of 2014).

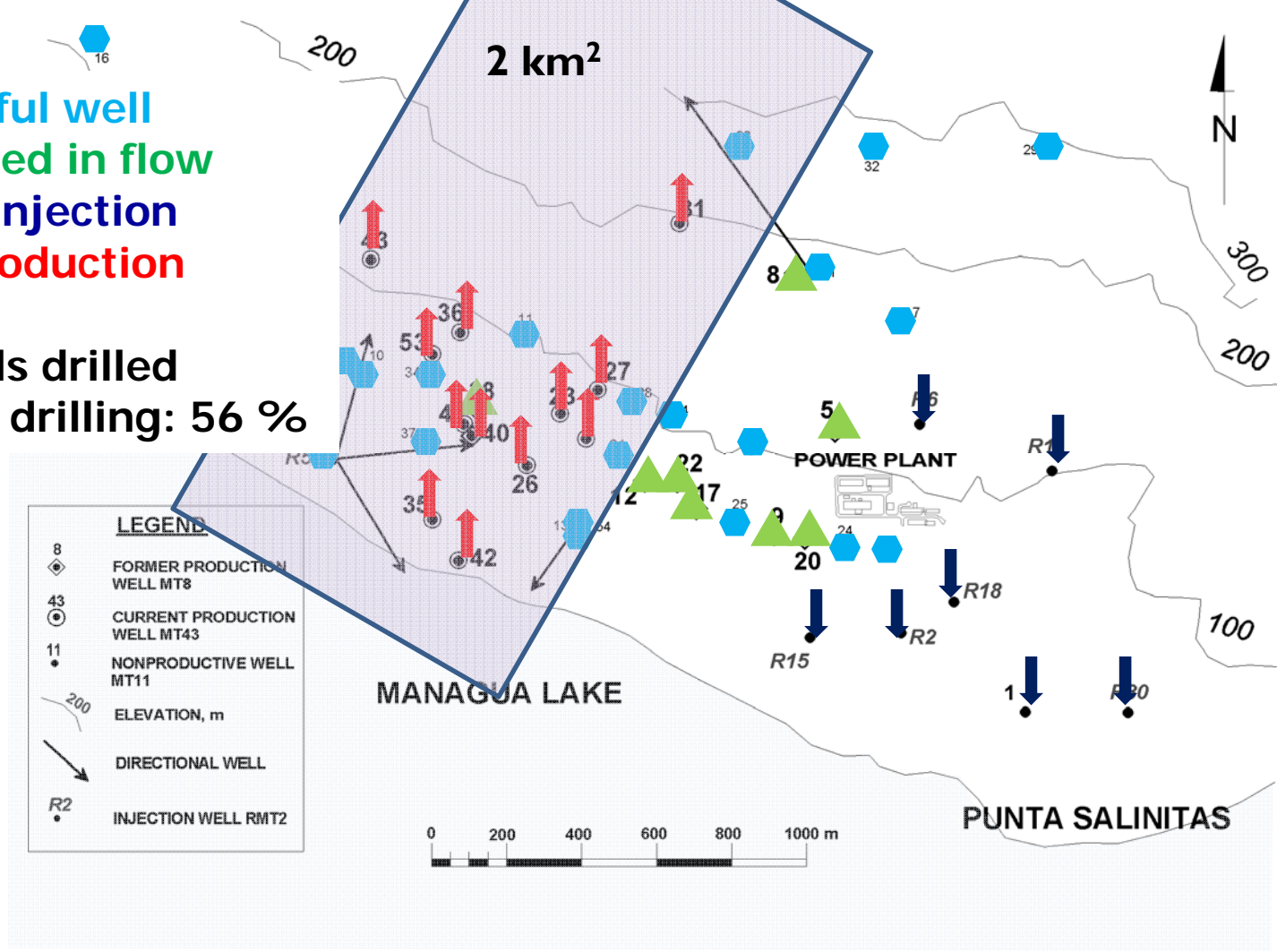


Exploratory Drilling Results (Projects under exploitation)

Momotombo-Geothermal Field

21 unsuccessful well
9 wells quenced in flow
7 wells for reinjection
11 wells in production

Total: 48 Wells drilled
% Successful drilling: 56 %

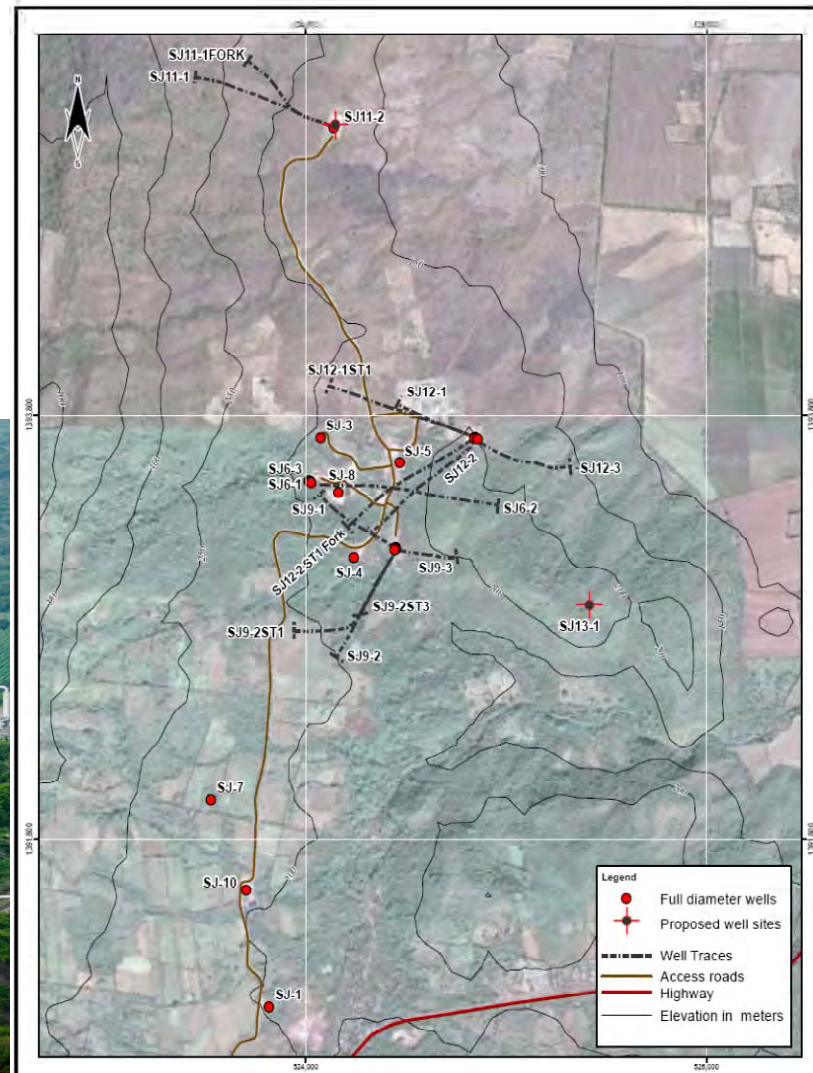


Exploratory Drilling Results ((Projects under exploitation)

San Jacinto Geothermal Field

7 unsuccessful well
3 wells for reinjection
12 wells in production

Total: 22 Wells drilled
Successful drilling: 68 %



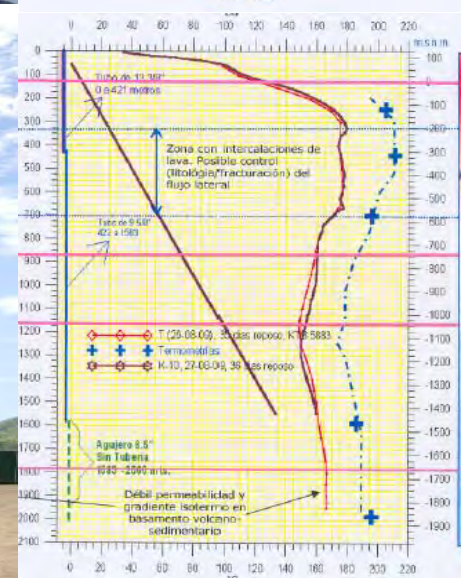
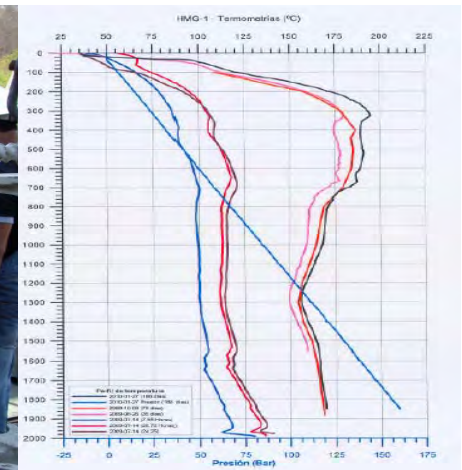
Exploratory Drilling Results (Projects under exploration)

El Hoyo-Monte Galán

2 unsuccessful well
(Commercial Diameter)

2 unsuccessful well (Slim
hole)

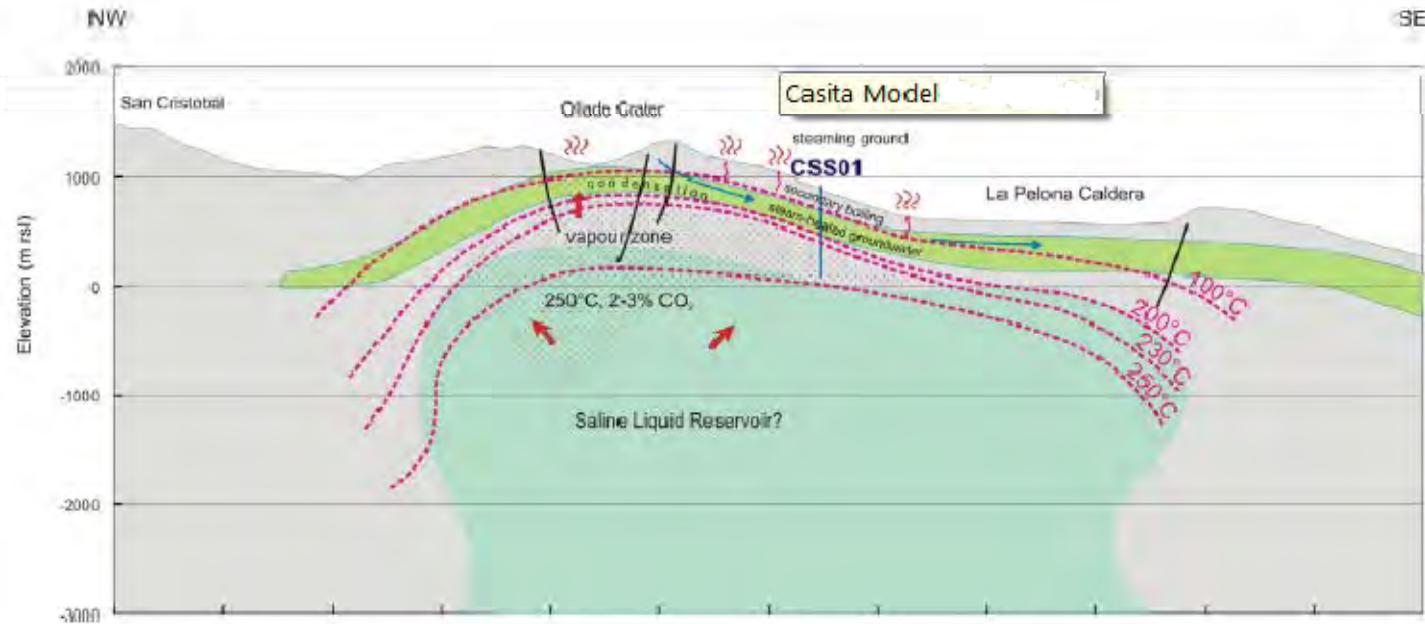
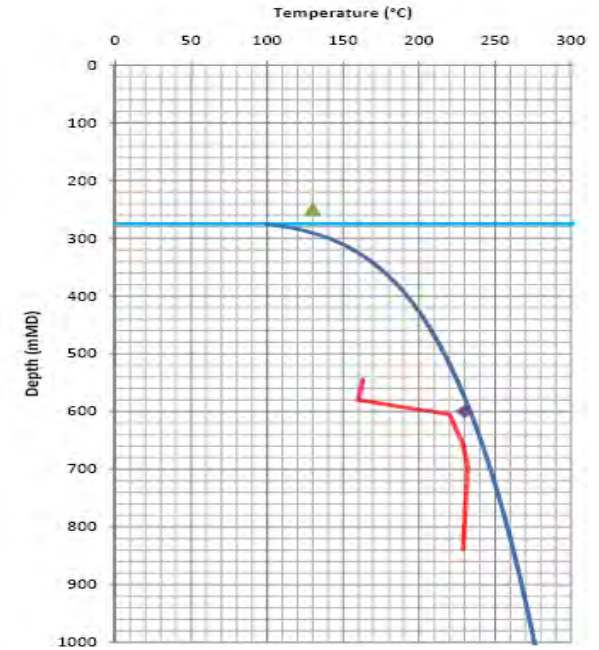
Success rate: 0%



Exploratory Drilling Results (Projects under exploration)

Casita-San Cristóbal Geothermal Project

The First Well drilled was successful (Slim hole)
This Well has good permeability and temperature



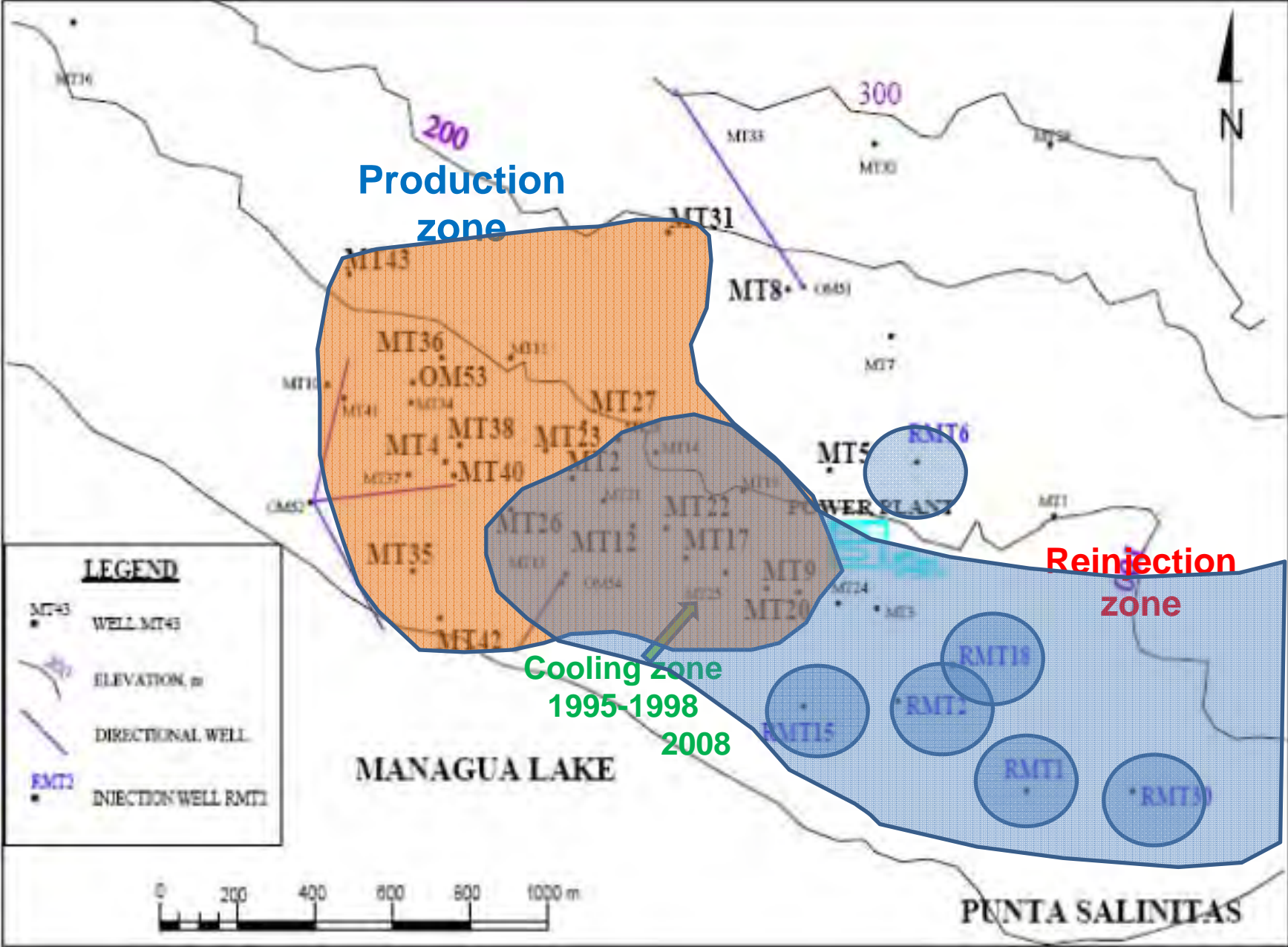
Aspects that did not work in the drilling of geothermal wells in Nicaragua

Momotombo Geothermal Field:

- The geothermal field was over-exploited during many years.
- Producing wells are very close to each other
- Separate waters were not totally reinjected for many years
- The shallow reservoir was depressurized allowing entry of naturally cold front located in the southeastern part of the field affecting a large number of producing wells



Distribution of wells in Momotombo



Aspects that did not work in the drilling of geothermal wells in Nicaragua

El Hoyo-Monte Galán Area:

The Investor should start drilling slim holes, then continue drilling with commercial diameter wells and avoid a higher risk investment.

Investment costs were US\$20 million

The ratio of costs of a Slim hole is 6 to 10% compared to a commercial diameter well

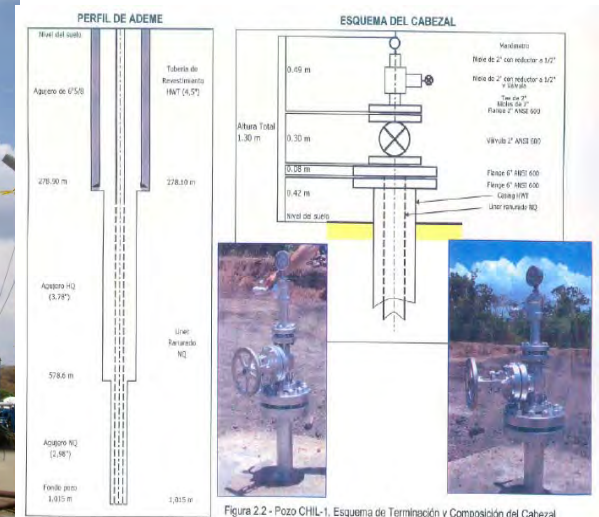


Figura 2.2 - Pozo CHIL-1, Esquema de Terminación y Composición del Cabezal

Aspects that worked best in geothermal drilling in Nicaragua

Casita- San Cristobal Geothermal Project

- The Investor began drilling slim holes , which was successful.
- By upgrading Geothermal Model Casita-San Cristóbal, they will continue drilling with commercial diameter wells.



GEOHERMAL POTENTIAL MAP, NICARAGUA MASTER PLAN 2001

MAPA POTENCIAL GEOTÉRMICO SEGÚN PLAN MAESTRO DE NICARAGUA, 2001.



Nicaragua has a great Geothermal potential (1519 Mw).

However, despite having eight areas available for private investment, the process should be faster and not take a long time

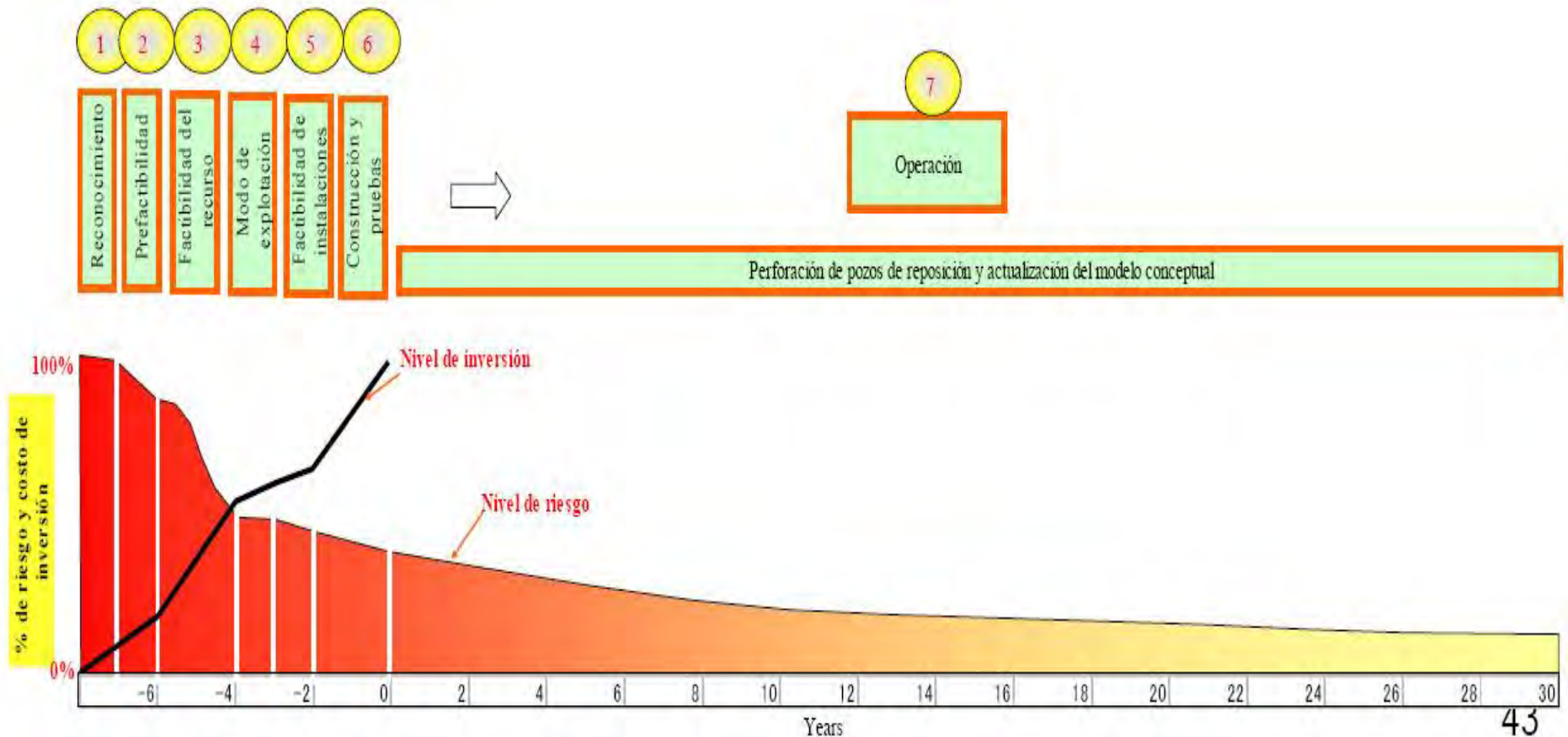
→ For what?

- High risk of development of the resource.**
- Financial obstacles by the high initial investment.**

ELEMENTS THAT HELP FURTHER GEOTHERMAL DEVELOPMENT TO THE FUTURE

Geothermal development is accompanied by the risk of finding the Geothermal Resource.

These risks decrease with the progress of the Project. However, even after the Central building is still some risk during the operation stage.



Conclusions

- The development of geothermal energy requires a long time for their completion, from initial survey to commissioning of the Plant.
- The high initial investment is necessary during this time.
- The Return on Investment begins only when the Central enters commercial operation.
- During the period of gestation the investor has to face high risks and payment of interest on money already invested.
- Low financial costs play an important role.
- It is important to find a mechanism that our government takes initial investment risks and thus be able to attract private investment.
- The Government of Nicaragua has taken the initiative with Cosiguina Volcano Geothermal Area to invest \$ 3.8 million to bring the current Recognition Stage to Pre-Feasibility stage (Area Studies and the drilling of three wells Slim holes)

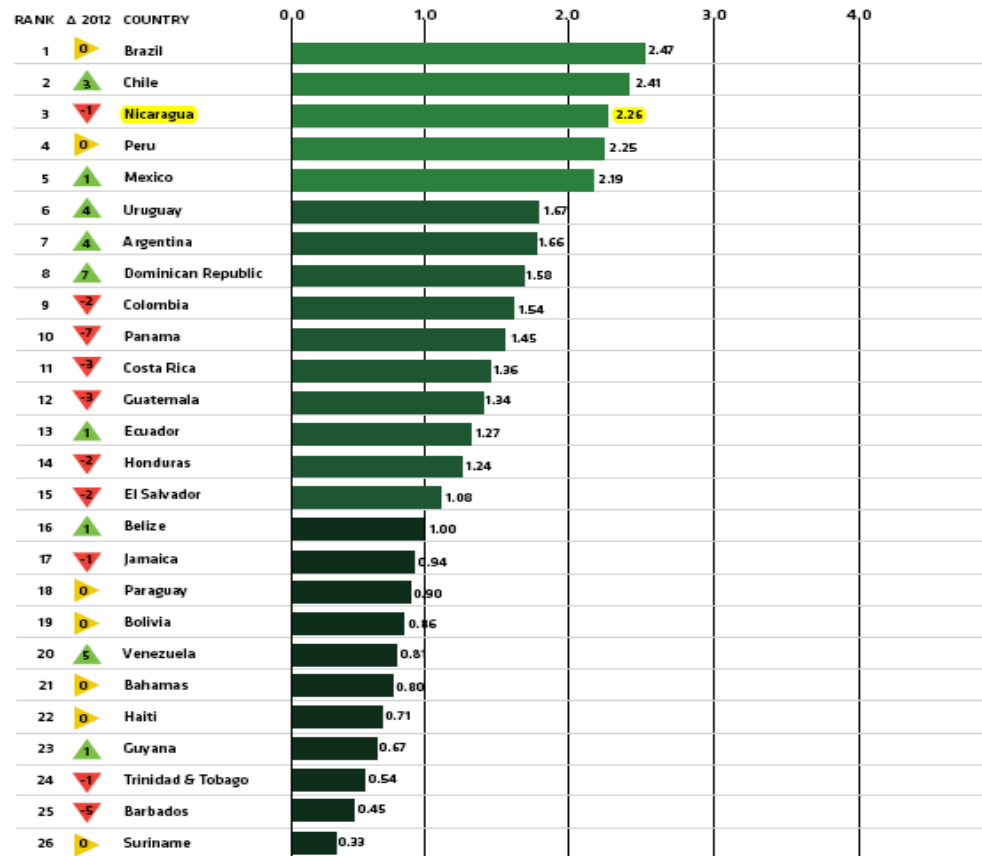


Cosiguina Volcano

POWER SECTOR: Nicaragua in 3rd place after Brazil and Chile, with market Clean Energy attractive, list of 26 countries of Latin America and the Caribbean.

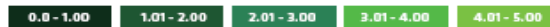
1st Place in "Enabling Environment" and "Investment and Financing for Clean Energy"

**Overall 2013 Climatescope score
Ranking and scores by country**

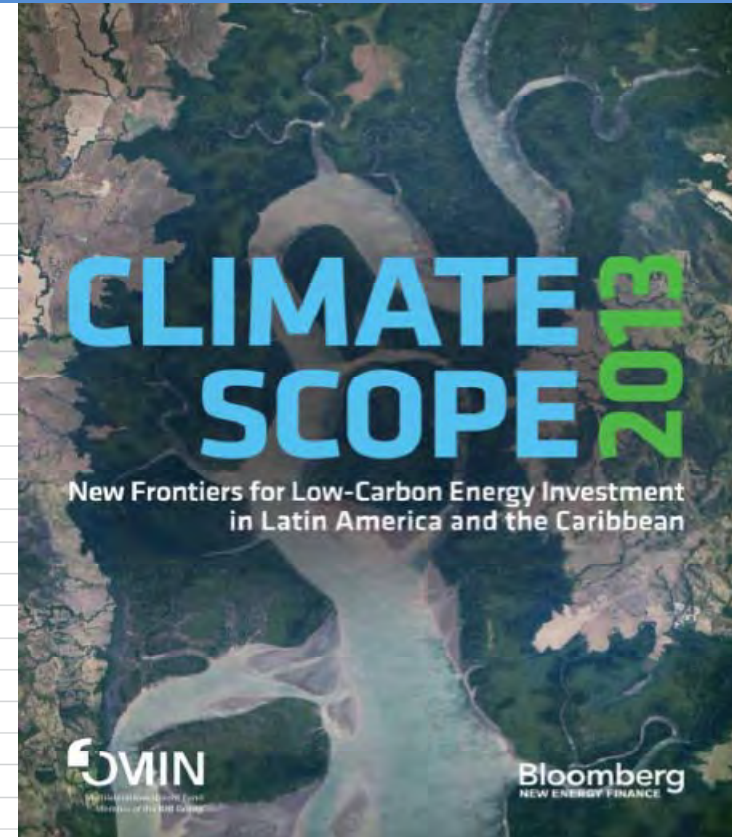


Green arrow refers to increase, red to decrease and yellow to no change

Colors show range for overall score



Multilateral Investment Fund: Climatescope 2013
Report by Bloomberg New Energy Finance



PARAMETER	RANKING	SCORE
I. Enabling Framework	1	2.49
II. Clean Energy Investment & Climate Financing	1	3.02
III. Low-Carbon Business & Clean Energy Value Chains	13	1.06
IV. Greenhouse Gas Management Activities	11	1.34

GEOTHERMAL PROJECT IMPACT (2013-2017)

PROJECTS YEAR 2013	PROJECTED ANNUAL ENERGY GENERATION (MWh)	REPLACEMENT FUEL (FUEL OIL)	
		THOUSAND BARRELS	MILLION (U.S. \$)
SAN JACINTO -TIZATE	586,570	891.40	97.80
MOMOTOMBO	231,264	351.43	38.74
TOTAL (1)	817,834	1242.83	136.54
PROJECTS YEAR 2017	PROJECTED ANNUAL ENERGY GENERATION (MWh)	REPLACEMENT FUEL (FUEL OIL)	
		THOUSAND BARRELS	MILLION (U.S. \$)
VOLCAN CASITA FASE I	260,600	396.00	43.60
TOTAL (2)	1,078,434	1638.83	180.14



THANK YOU FOR YOUR ATTENTION

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