Geothermal Development Facility for Latin America

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Vice Presidency of Energy

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Content

- CAF Brief
- Geothermal Energy: Challenges & Opportunities
- Geothermal Development Facility
CAF – development bank of Latin America
CAF – development bank of Latin America

CAF is a development bank established in 1970. Its current shareholders are 18 countries of Latin America, the Caribbean and Europe, as well as 14 private banks from the Andean region.
Membership Evolution

1990
- Bolivia
- Colombia
- Ecuador
- Perú
- Venezuela

5 countries

2000
- Argentina
- Brasil
- Panamá
- Paraguay
- Uruguay
- Costa Rica
- Chile
- Jamaica
- México
- Rep. Dominicana
- Trinidad y Tobago

16 countries

2011
- Argentina
- Bolivia
- Brasil
- Colombia
- Ecuador
- Paraguay
- Perú
- Trinidad y Tobago
- Uruguay
- Venezuela
- Costa Rica
- Chile
- Jamaica
- México
- Rep. Dominicana
- España
- Portugal

18 countries
Support for Energy Projects

CAF’s Direct Portfolio

USD 5,255 MM
USD 13,607 MM

TOTAL CAF
USD 18,862 MM
(august 2014)


Energy
Others

2,000
CAF in numbers

CAF’s Portfolio by business sector

- Infrastructure: 36%
- Energy: 28%
- Productivity & Financial Services: 15%
- Social Development: 16%
- Country Programs: 5%

TOTAL CAF
USD 18,862 MM
(august 2014)

USD 5,255 MM
Geothermal Energy: Challenges & Opportunities
At a global scale...

Technical Potential for Geothermal electricity generation may be estimated at \(210\) GW.

Installed Capacity of Geothermal electricity generation is roughly \(11\) GW.

Source: WEC Resource Survey (2013)
Risk concentrates in early stages of the project

Source: geo-t.de
Geothermal projects compete with oil & gas projects for the same rigs

“Drilling rig rates and associated costs make-up the single largest cost of geothermal plants, upward of 55%”

WEC

Source: WEC Resource Survey (2013)
A risk mitigation facility could impulse geothermal energy development …especially if Multilateral funding comes in to play

Figure 1: Interest rate sensitivity to drilling success rate (%)  
Figure 2: Interest rate sensitivity to GDF cost of capital (%)

Source: Bloomberg New Energy Finance, Rinova International

Source: BNEF (2013)
Why do it?

“By 2050, geothermal electricity generation could reach 1400 TWh per year, avoiding almost 800 Mt of CO2 emissions per year”

IEA

Source: IEA (2011)
**Potential vs Installed Capacity in LAC**

<table>
<thead>
<tr>
<th>POTENCIAL</th>
<th></th>
<th>INSTALADO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>País</td>
<td>MW</td>
<td>País</td>
<td>MW</td>
</tr>
<tr>
<td>Argentina</td>
<td>2.010</td>
<td>Guatemala</td>
<td>3.320</td>
</tr>
<tr>
<td>Bolivia</td>
<td>2.490</td>
<td>Honduras</td>
<td>990</td>
</tr>
<tr>
<td>Brasil</td>
<td>115</td>
<td>Jamaica</td>
<td>100</td>
</tr>
<tr>
<td>Chile</td>
<td>2.350</td>
<td>México</td>
<td>6.510</td>
</tr>
<tr>
<td>Colombia</td>
<td>2.210</td>
<td>Nicaragua</td>
<td>3.340</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>2.900</td>
<td>Panamá</td>
<td>450</td>
</tr>
<tr>
<td>Ecuador</td>
<td>1.700</td>
<td>Perú</td>
<td>2.990</td>
</tr>
<tr>
<td>El Salvador</td>
<td>2.210</td>
<td>Venezuela</td>
<td>910</td>
</tr>
<tr>
<td>Grenada</td>
<td>1.110</td>
<td>AL Y C</td>
<td>35.705</td>
</tr>
</tbody>
</table>

Source: BNAmericas (2014); Data from OLADE

The gap can also be observed in LAC.
# Geothermal Project Pipeline in LAC

<table>
<thead>
<tr>
<th>Nombre</th>
<th>Etapa</th>
<th>País</th>
<th>Inversión</th>
<th>Capacidad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proyecto Geotérmico San Vicente</td>
<td>Estudio de Factibilidad</td>
<td>El Salvador</td>
<td>US$140mn</td>
<td>40MW</td>
</tr>
<tr>
<td>Ampliación Proyecto Geotérmico San Jacinto-Tizate</td>
<td>Operación Comercial</td>
<td>Nicaragua</td>
<td>US$400mn</td>
<td>72MW</td>
</tr>
<tr>
<td>Central Geotérmica Cerro Pabellón</td>
<td>Evaluación de Impacto Ambiental Aprobado</td>
<td>Chile</td>
<td>US$180mn</td>
<td>50MW</td>
</tr>
<tr>
<td>Central Geotérmica Copahue</td>
<td>Licencia de instalación aprobada</td>
<td>Argentina</td>
<td>US$100mn</td>
<td>30MW</td>
</tr>
<tr>
<td>Central Geotérmica Curacautín</td>
<td>Evaluación de Impacto Ambiental Aprobado</td>
<td>Chile</td>
<td>US$330mn</td>
<td>70MW</td>
</tr>
<tr>
<td>Geotérmico Domuyo</td>
<td>Estudio de Factibilidad</td>
<td>Argentina</td>
<td>S/I</td>
<td>30MW</td>
</tr>
<tr>
<td>Los Húmeros II</td>
<td>Operación</td>
<td>México</td>
<td>US$105mn</td>
<td>40MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Binacional Tuñio-Chiles-Cerro Negro</td>
<td>Estudio de Prefactibilidad</td>
<td>Ecuador</td>
<td>S/I</td>
<td>138MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Casita San Cristóbal</td>
<td>Inversión Aprobada</td>
<td>Nicaragua</td>
<td>US$185mn</td>
<td>140MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Chacana</td>
<td>Estudio de Factibilidad</td>
<td>Ecuador</td>
<td>US$183mn</td>
<td>318MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Chachimbro</td>
<td>Estudio de Factibilidad</td>
<td>Ecuador</td>
<td>US$175mn</td>
<td>113MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Chalpatán</td>
<td>Estudio de Prefactibilidad</td>
<td>Ecuador</td>
<td>US$175mn</td>
<td>51MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Chalupas</td>
<td>Estudio de Prefactibilidad</td>
<td>Ecuador</td>
<td>US$175mn</td>
<td>283MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Chinameca</td>
<td>Estudio de Factibilidad</td>
<td>El Salvador</td>
<td>US$186mn</td>
<td>50MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Los Azufres III</td>
<td>Licitación Aprobada</td>
<td>México</td>
<td>US$70mn</td>
<td>50MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Macizo Volcánico del Ruiz</td>
<td>Estudio de Prefactibilidad</td>
<td>Colombia</td>
<td>S/I</td>
<td>50MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Mariposa</td>
<td>Ingeniería de Detalle</td>
<td>Chile</td>
<td>US$50mn</td>
<td>320MW</td>
</tr>
<tr>
<td>Proyecto Geotérmico Pallas II</td>
<td>Estudio de Factibilidad Financiero</td>
<td>Costa Rica</td>
<td>US$300mn</td>
<td>55MW</td>
</tr>
</tbody>
</table>

**Total:** **1906 MW**

Source: BNAmericas (2014)
Geothermal Development Facility: A tailored approach to promote Geothermal Development
Complete program consists of tailored solutions for early development phases:

**Exploration & Pre-feasibility**
- 1. Grants for surface studies
- 2. Contingency grants for exploratory drilling

**Capacity Drilling**
- Bridge Financing Lines for capacity drilling

**Design & Construction**
- Financing Lines for power plant construction

Parallel Technical Assistance Fund
Geothermal Development Facility: A tailored approach to promote Geothermal Development

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Activities</td>
<td>• Geological desk study</td>
<td>• Exploration wells (max 3 production/reinjectio n wells to confirm reservoir for 20-30% planned plant capacity)</td>
<td>• Further confirmation wells (production and reinjection)</td>
<td>• Further production and injection wells (capacity drilling)</td>
</tr>
<tr>
<td></td>
<td>• Field reconnaissance</td>
<td>• Wells test program</td>
<td>• Reservoir tests</td>
<td>• Construction of power plant &amp; steam gathering system if combined use</td>
</tr>
<tr>
<td></td>
<td>• Geothermal exploration survey</td>
<td>• Feasibility study</td>
<td></td>
<td>• Connection to off-taking power utility</td>
</tr>
<tr>
<td></td>
<td>• Slim wells 300-1500 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Prefeasibility study</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product</td>
<td><strong>Grants</strong> for surface studies</td>
<td><strong>Contingency grants</strong> for exploratory drilling</td>
<td><strong>Bridge Financing</strong> Lines for capacity drilling</td>
<td><strong>Financing Lines</strong> for power plant construction</td>
</tr>
<tr>
<td>Costs per phase</td>
<td>US$ 100k – 2 MM</td>
<td>US$ 1 - 21 MM</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Geothermal Development Facility: A tailored approach to promote Geothermal Development

- **GDF Bridge Financing Lines** – Capacity Drillings
  - KfW / CAF
  - KfW / BCIE
  - IDB (CTF) in Chile

- **GDF Risk Mitigation Fund** – Contingency Grant
- **GDF Grants** - surface studies

- **GDF Investment Financing Lines** – Plant Infrastructure
  - KfW / CAF
  - KfW / BCIE
  - World Bank
  - IDB (CTF)
  - EIB
  - JICA

- **Private Financiers**

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Risk Mitigation Fund

- **Exploration Risk**

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**GDF Grants** - surface studies

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
Grant Repayments can be refinanced through Bridge Financing or Investment Financing Lines

GDF Bridge Financing Lines – Capacity Drillings
- KfW / CAF
- KfW / BCIE
- IDB (CTF) in Chile

GDF Investment Financing Lines –
- Plant Infrastructure
- KfW / CAF
- KfW / BCIE
- World Bank
- IDB (CTF)
- EIB
- JICA
- Private Financiers

GDF Grants - surface studies
GDF Risk Mitigation Fund – Contingency Grant

Risk Mitigation Fund – Contingency Grant

Grants - surface studies
### Geothermal Development Facility – Subsidy Intensity for Grants

<table>
<thead>
<tr>
<th>Partial Grants for Surface Studies (Phase 1)</th>
<th>Contingency Grants for (Phase 2)</th>
<th>Exploratory Drilling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Study</td>
<td>1st Well</td>
<td>2nd Well</td>
</tr>
<tr>
<td>Max. Total Project Costs</td>
<td>2 M$</td>
<td>7 M$</td>
</tr>
<tr>
<td>Max. Grant from GDF</td>
<td>800 T$</td>
<td>3.5 M€</td>
</tr>
<tr>
<td>Max. Equity VC from Project Developer</td>
<td>1.2 M$</td>
<td>3.5 M€</td>
</tr>
<tr>
<td>Max. Intensity</td>
<td>40 %</td>
<td>50 %</td>
</tr>
<tr>
<td>Max. Intensity per Instrument</td>
<td>40 %</td>
<td></td>
</tr>
<tr>
<td>Repayment of Grant</td>
<td>-</td>
<td>80%</td>
</tr>
</tbody>
</table>
Design and Governance Structure

Stakeholder Group

- Risk Mitigation Fund
  - Grants for Surface Studies / Contingency
  - Grants for Exploratory Drilling

- Technical Assistance Forum
  - Policy Dialogue; Coordination of existing Programs; Execution of TA funds

- Bridge / Investment Financing Lines

Board of Directors

- Financial Committee
- TA Committee

Fund Manager

- Advises
- Oversees
- Informs
- Manages
Geothermal Development Facility – Technical Assistance Fund

Tools for Assistance

- Conferences
- Seminars
- Webinars
- Workshops
- Studies
- Trainings

- 1 day **annual event** in changing locations
  - Public information conference
  - Non public workshop

- **Tailored events** provided in the form of conferences, seminars, webinars, workshops, studies and trainings

- The GDF will provide **information on the ongoing activities** of the TA Fund in all countries on an information window of the GDF website, as well as with regular reporting to the donors
Planned Launch at COP20 in Lima on December 8th 2014

GDF is presented as the 1st initiative to promote geothermal energy on a continental scale supported by the majority of donors and financiers active in the region.
Everything we do begins with you.