Chilean Energy Overview

Shift to renewable alternatives

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Chile Overview

- GDP 2005: MUS$115,300 (+6.3%)
- Capital City: Santiago
- Main cities: Santiago, Viña del Mar, Valparaíso, Concepción, Antofagasta, Punta Arenas
- Country risk**: 65 basis points over US Treasuries

Country Risk SA:
- Argentina = 390 bp
- Brazil = 220 bp
- Peru = 206 bp
- Chile = 65 bp
Chilean Energy Gross Consumption
(Primary Energy Balance-Teracalories per year-2004)

<table>
<thead>
<tr>
<th>Energy</th>
<th>Gross Production</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>2%</td>
<td>98%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>26%</td>
<td>74%</td>
</tr>
<tr>
<td>Coal</td>
<td>4%</td>
<td>96%</td>
</tr>
<tr>
<td>Hydroelectricity</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Wood &amp; Others</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Biogás</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>31%</strong></td>
<td><strong>69%</strong></td>
</tr>
</tbody>
</table>

We strongly depend on external energy sources...

Source: www.cne.cl
Energy Distribution in Chile
Renewable & Non-renewable
(Teracalories per year)

Non-renewable: 274.310; 100%
Renewable: 4.57; 0%

Non-renewable energy is not developed yet

Distribution of renewable kind of energies

Source: www.cne.cl
Since 2004: Interruption of NG flow from Argentina to Chile

Exports to Chile

Gas Curtailments to Chile

[Graphs showing the data for exports and gas curtailments to Chile from May 2004 to September 2005, with a legend indicating Power Plants [MMm3], Distribution [MMm3], and Industry [MMm3].]
Drivers of NG crisis in Argentina

- 2002 ➔ Argentinian authority decide to freeze gas&electricity prices
- Gas&electricity at very low prices
- Demand of gas&electricity increase over 20% in one year
- No new investments in capacity where undertaken
- 2004 ➔ Shock of internal demand ➔ Cut the exports to Chile
- 2007 ➔ Argentinian exportation license will be cancel
GDP and Energy Consumption
(Growing in relation to consumption of 1990)

- Chilean energy consumption is growing at the same rate of GDP

Source: www.cne.cl
GDP and Energy Consumption
(Growing in relation to consumption of 1990)

• Chilean Economy will grow over 6% in the coming years

• **Chile must develop alternatives source of energy in order to make its growing sustainable**
  - LNG – Landfills – Sewage - Biomass

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*Average 1990-2004 = 5.6*


*Source: Central Bank of Chile.*
Electricity generation forecast

MW

- Up to 2015 Chile needs to multiply by 2 its electricity power generation

There is an opportunity for alternatives energies
Geographic Areas consuming Natural Gas in Chile

Gas consumption in Chile - in MM m3/day

Total: 22MM m3/day  2004 figures

- Norte: 5
- Centro: 9.5
- Sur: 1.4
- Austral: 5.8

Total: 22MM m3/day
Natural Gas Consumption by sectors (%) - Chile 2004

- Transformation Centers: 66.0%
- Industry & Mining: 11.9%
- Commercial - Gov - Households: 4.9%
- Final Consumption: 17.0%
- Transport: 0.3%

Source: www.cne.cl
Natural Gas Distributors in Chile & NGV Market

- **Antofagasta – Calama**
  - Industrial-Electricity
  - NGV 40 veh x 1 filling station

- **Santiago & Metropolitan Area**
  - Industrial-Households-Commercial-Cooling-Cogeneration-NGV
  - 4500 veh x 6 filling station

- **Valparaíso**
  - Industrial-Households-NGV
  - NGV 250 veh x 1 filling station

- **Viña del Mar - Quillota**
  - Industrial-Households-NGV
  - NGV 250 veh x 1 filling station

- **Punta Arenas**
  - Industrial-Households-NGV
  - NGV 1500 veh x 5 filling station

- **Concepción**
  - Industrial-Households

**Total Vehicles = 6540 Veh**

**No. filling stations = 14**
NGV : Important Issues

• Transport Authority focused on NGV emissions and safety control ➔ very strong regulations

• NG distribution companies promote use of NGV by using marketing incentives

• NGV filling stations ➔ Mainly owned by oil companies (Shell – ESSO – Repsol – Copec )

• NGV users ➔ Taxis 86% & Fleets 14%

• 100% of vehicles have been converted to use NGV (bi-fuel) ➔ no OEM’s vehicles
NGV : Emission standard

- Chilena emissions standard
Fuel for transport: Equivalent comparison

<table>
<thead>
<tr>
<th>Fuel</th>
<th>US$/MMBTU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrol</td>
<td>10.9</td>
</tr>
<tr>
<td>Diesel</td>
<td>17</td>
</tr>
<tr>
<td>LPG</td>
<td>4.4</td>
</tr>
<tr>
<td>NGV</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Petrol price 0.9 EURO/L (VAT included); Diesel price 0.67 EURO/L (VAT included); NGV price 0.54 EURO/m3 (VAT included); LPG price 0.57 EURO/L (VAT included). Petrol performance 10.24 Km/L; Diesel performance 13.65 Km/L; NGV performance 11 Km/m3; LPG performance 8 Km/L. Fixed Tax rate for NGV and LPG = 196 EURO/year; Variable Tax for NGV use = 0.09 EURO/m3; Variable Tax for LPG use = 0.07 EURO/m3; 644 CLP/Euro
NGV : Very inexpensive fuel

- NGV is a very inexpensive fuel, but it is not the cheapest one...

Petrol price 0,9 EURO/L (VAT included); Diesel price 0,67 EURO/L (VAT included); NGV price 0,54 EURO/m3 (VAT included); LPG price 0,57 EURO/L (VAT included). Petrol performance 10,24 Km/L; Diesel performance 13,65 Km/L; NGV performance 11 Km/m3; LPG performance 8 Km/L. Fixed Tax rate for NGV and LPG = 196 EURO/year; Variable Tax for NGV use = 0,09 EURO/m3; Variable Tax for LPG use = 0,07 EURO/m3; 644 CLP/Euro
NGV development in Metropolitan Area

- NG distributors expect to continue pushing the NGV market in Chile
Alternative Solutions

- LNG
  - April 2005 ➔ 5 largest energy companies ➔ Pool Agreement
  - February 2005 ➔ British Gas was selected by the Pool to supply LNG and to build infrastructure required
  - By 2009 the project will be finished and available
  - Lately, as well as Oil, LNG price shows high volatility
### Alternative Solution

**• BIOGAS (around Santiago)**

- There is a number of potential projects nearby Santiago
- Around 90 Million m³ of Biogas per year

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Capacity</th>
<th>Unit</th>
<th>Dist. From Santiago</th>
<th>Biogás Production m³/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Trebal</td>
<td>Sewage Treatment Plant</td>
<td>4.4 m³/s</td>
<td>m³/s</td>
<td>15 Km</td>
<td>1800</td>
</tr>
<tr>
<td>La Farfana</td>
<td>Sewage Treatment Plant</td>
<td>8.8 m³/s</td>
<td>m³/s</td>
<td>10 Km</td>
<td>36000</td>
</tr>
<tr>
<td>Los Nogales</td>
<td>Sewage Treatment Plant</td>
<td>6.6 m³/s</td>
<td>m³/s</td>
<td>20 Km</td>
<td>24000</td>
</tr>
<tr>
<td>Santiago Poniente</td>
<td>Landfill</td>
<td>1000 Ton/d</td>
<td>Ton/d</td>
<td>25 Km</td>
<td>36000-50000</td>
</tr>
<tr>
<td>San Martín</td>
<td>Landfill</td>
<td>1000 Ton/d</td>
<td>Ton/d</td>
<td>30 Km</td>
<td>36000-50000</td>
</tr>
<tr>
<td>Los Colorados</td>
<td>Landfill</td>
<td>5000 Ton/d</td>
<td>Ton/d</td>
<td>80 Km</td>
<td>72000-100000</td>
</tr>
</tbody>
</table>

Source: Biogas Upgrading for NG Grid - S.Bernstein
Alternative Solution

**BIOGAS (potential uses)**
- Grid injection (Gas & electricity)
- Biogas for industries
- CHP (Co-generation)
- NGV

**BIOGAS IN CHILE**
- Along Chile there are 282 landfills (Catastro Rellenos sanitarios 2002)
- Over 300 Millions m³ Biogas in the whole country

<table>
<thead>
<tr>
<th>Región</th>
<th>Population Thousands</th>
<th>TON/Año</th>
<th>Millions m³ Biogás/Año</th>
<th>Millions m³ GN Eq</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>353</td>
<td>83.880</td>
<td>8,39</td>
<td>4,19</td>
</tr>
<tr>
<td>II</td>
<td>430</td>
<td>102.240</td>
<td>10,22</td>
<td>5,11</td>
</tr>
<tr>
<td>III</td>
<td>232</td>
<td>55.080</td>
<td>5,51</td>
<td>2,75</td>
</tr>
<tr>
<td>IV</td>
<td>394</td>
<td>93.600</td>
<td>9,36</td>
<td>4,68</td>
</tr>
<tr>
<td>V</td>
<td>1,355</td>
<td>341.280</td>
<td>34,13</td>
<td>17,06</td>
</tr>
<tr>
<td>Metropolitan</td>
<td>5,553</td>
<td>1,819.080</td>
<td>181,91</td>
<td>90,95</td>
</tr>
<tr>
<td>VI</td>
<td>494</td>
<td>106.560</td>
<td>10,66</td>
<td>5,33</td>
</tr>
<tr>
<td>VII</td>
<td>544</td>
<td>117.720</td>
<td>11,77</td>
<td>5,89</td>
</tr>
<tr>
<td>VIII</td>
<td>1,468</td>
<td>317.160</td>
<td>31,72</td>
<td>15,86</td>
</tr>
<tr>
<td>IX</td>
<td>536</td>
<td>115.920</td>
<td>11,59</td>
<td>5,80</td>
</tr>
<tr>
<td>X</td>
<td>649</td>
<td>140.040</td>
<td>14,00</td>
<td>7,00</td>
</tr>
<tr>
<td>XI</td>
<td>66</td>
<td>14.400</td>
<td>1,44</td>
<td>0,72</td>
</tr>
<tr>
<td>XII</td>
<td>140</td>
<td>30.240</td>
<td>3,02</td>
<td>1,51</td>
</tr>
<tr>
<td>TOTAL</td>
<td>12,214</td>
<td>3,337.200</td>
<td>333,72</td>
<td>166,86</td>
</tr>
</tbody>
</table>

Production of Home Solid Waste – Chile, 1996

Source: OPS/OMS 1998
Conclusions

1. Chile needs to diversify its energy sources
   - Chile depends strongly on external sources
   - Oil Price will remain high in the meantime
   - Our Natural Gas supplier is no longer reliable
   - GDP depends strongly on new energy projects
   - Renewable energies are not developed yet!

2. There is a national concern about Energy procurement
   - Government
     • CNE National Energy Authority
     • ENAP National Petroleum Company
     • Corfo supporting local and external projects (financing tools)
   - Private Sector
     • Electricity companies
     • Natural Gas Companies ➔ developing Biogas projects
Conclusions

3. Biogas projects: high interest to developed them
   - There are 282 landfills along Chile
   - Represents over 300 millions m³ of Biogas
   - Natural Gas distributors are already developing Biogas projects
   - Chile does not have comprehensive expertise in Biogas technology
     • Cleaning
     • Up-grade techniques
     • NGV

4. It could be feasible to apply Swedish expertise in Chile
Conclusions

5. Chile: the strongest economy in the region
   • Open market
   • Low risk
   • GDP growing forecast will be around 6%
   • Low inflation (3%)
   • Low corruption index

6. So far, Chile is the investment platform for multinational companies that wish to invest in Latin America
Thank you very much

Chilean landscapes

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## Landfills composition in Latin America (% Weight)

<table>
<thead>
<tr>
<th>Country</th>
<th>H2O</th>
<th>Paper</th>
<th>Metal</th>
<th>Glass</th>
<th>Textile</th>
<th>Plastic</th>
<th>Organics</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>México</td>
<td>45</td>
<td>20</td>
<td>3,2</td>
<td>8,2</td>
<td>4,2</td>
<td>6,1</td>
<td>43</td>
<td>27</td>
</tr>
<tr>
<td>Peru</td>
<td>50</td>
<td>10</td>
<td>2,1</td>
<td>1,3</td>
<td>1,4</td>
<td>3,2</td>
<td>50</td>
<td>32</td>
</tr>
<tr>
<td>Chile</td>
<td>50</td>
<td>18,8</td>
<td>2,3</td>
<td>1,6</td>
<td>4,3</td>
<td>10,3</td>
<td>49,3</td>
<td>13,4</td>
</tr>
<tr>
<td>Colombia</td>
<td>0</td>
<td>18,3</td>
<td>1,6</td>
<td>4,6</td>
<td>3,8</td>
<td>14,2</td>
<td>52,3</td>
<td>5,2</td>
</tr>
<tr>
<td>Ecuador</td>
<td>0</td>
<td>10,5</td>
<td>1,6</td>
<td>2,2</td>
<td>0</td>
<td>4,5</td>
<td>71,4</td>
<td>9,6</td>
</tr>
<tr>
<td>Argentina</td>
<td>50</td>
<td>20,3</td>
<td>3,9</td>
<td>8,1</td>
<td>5,5</td>
<td>8,2</td>
<td>53,2</td>
<td>0,8</td>
</tr>
</tbody>
</table>

Source: Diagnóstico de situación del manejo de residuos sólidos municipales en América Latina y el Caribe; BID – Organización Panamericana para la Salud 1998
Natural Gas Consumption Forecast
2003-2011
(For Households & as raw material)
## ENTRADA EN VIGENCIA

<table>
<thead>
<tr>
<th>Tipo de Vehículo</th>
<th>Norma que se aplicará</th>
<th>Regiones (excluida RM)</th>
<th>Solicitud de primera inscripción en el Registro Nacional de Vehículos Motorizados del Servicio de Registro Civil e Identificación</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIVIANOS</td>
<td>EPA 91</td>
<td>I a XII</td>
<td>A contar de 9 meses de publicada la norma en el Diario Oficial</td>
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<tr>
<td></td>
<td>EPA 94 FEDERAL o EURO III</td>
<td>I a XII</td>
<td>sept. 2006</td>
</tr>
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<td>MEDIANOS</td>
<td>EPA 91</td>
<td>I a XII</td>
<td>A contar de 9 meses de publicada la norma en el Diario Oficial</td>
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<tr>
<td></td>
<td>EPA 94 FEDERAL o EURO III</td>
<td>I a XII</td>
<td>sept. 2006</td>
</tr>
<tr>
<td>PESADOS</td>
<td>EPA 94 o EURO II (Diesel)</td>
<td>I a III y XI a XII</td>
<td>A contar de 9 meses de publicada la norma en el Diario Oficial</td>
</tr>
<tr>
<td></td>
<td>EPA 98 o EURO III (Diesel)</td>
<td>IV a X</td>
<td>3 meses después de la entrada en vigencia a nivel nacional de la norma que establezca un contenido azufre diesel &lt; 350 ppm.</td>
</tr>
<tr>
<td></td>
<td>EPA 98 o EURO III (Gas)</td>
<td>I a XII</td>
<td>A contar de 9 meses de publicada la norma en el Diario Oficial</td>
</tr>
</tbody>
</table>