Past, present and future of the electricity and gas integration between Chile and Argentina

Hugh Rudnick & Carlos Silva

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Summary

Analyze the love & hate relation between Argentina and Chile in relation to gas and electric interconnections, the history of developments and the opportunities for the future.

First, a discussion is made of the gas integration that took place in the late 1990s, with Argentina supplying abundant and economic gas to Chile, with an abrupt closing from 2004, with the lessons learned.

An analysis is made of the challenges of the reintegration that is taking place, where Chile transfers electricity as well as imported LNG to Argentina, the operational and economical dimensions, and perspectives for the future, also considering eventual electricity exchanges with Peru.
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• Gas integration between Chile and Argentina
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• Trying again to integrate
• Conclusions & final remarks
Energy demand in Latin America

MTOE

- **Oil**
- **Gas**
- **Bioenergy**
- **Hydropower**
- **Other**

CAGR

% of global demand

- 1990: 3.8%
- 2013: 4.6%
- 2020: 4.7%
- 2030: 5.1%
- 2040: 5.4%

IEA, WEO 2014
Gas production, consumption & reserves

Source: IEA
Gas imports and exports by country

Billion cubic meters per annum

Source: BP, 2014
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Chile facts

Population (2014) 17,762,964
GDP (PPP) per capita (2014) $14,980

Max power demand SIC (2015) 7,557 MW
Max power demand SING (2015) 2,290 MW
Annual energy demand SIC + SING (2015) 66,468 GWh

- Electricity sector reform in 1982
- All companies privately owned

Source: World Bank, CDEC, Systep
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Gas integration starts between Argentina & Chile

**SING**
- 5 combined cycles
- 2070 MW
- Norandino
- Atacama

**SIC**
- 5 combined cycles
- 1700 MW
- Gasandes
- Pacífico
- 4 gas distributors


Gas integration starts between Argentina & Chile

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**Investment based on Argentinean gas**

<table>
<thead>
<tr>
<th>Item</th>
<th>MMUS$</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 gaspipes</td>
<td>1.800</td>
</tr>
<tr>
<td>10 Combined Cycle plants</td>
<td>1.500</td>
</tr>
<tr>
<td>Distribution and industrial</td>
<td>2.200</td>
</tr>
<tr>
<td>Total</td>
<td>5.500</td>
</tr>
</tbody>
</table>

Ref.: GasAtacama
Argentina gas exports to Chile

[Chart showing daily gas exports from Argentina to Chile from dic-96 to dic-03, with various companies involved such as Metanex SIP, Metanex YPF, Metanex PA, Pacifico, Atacama, Norandino, and Gasandes.]
Significant impact on Chile’s electric Mg costs
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Macroeconomic crisis in Argentina

- 2004 crisis starts with gas cuts
Significant impact on Chile's electric Mg costs
Chile seemed reluctant to further exchanges

- International agreements proved useless in a critical economic condition
- Non discriminatory principle was violated
- Not political to cut essential services to the population
- Severe impact on Chilean economy
- Estimated cost of 20 billion US dollars (for more expensive generation)

- Never to become so dependent
Chile resorts to LNG

Regasification terminals built at Quintero & Mejillones

Quintero:
- British Gas (40%), Enap (20%), Endesa Chile (20%), Metrogas (20%)
- In operation from mid 2009
- Contracts that start at 6.5 MMm³/day
Supply chain for natural gas to Chile

Argentinean gas price was 1.5/MMBtu
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A little bit of history...

• In 1999, as part of Chile-Argentina gas integration, Chilgener & Termoandes (today AES Gener) decided to export electric energy from Argentina to Chile’s northern system, SING. This exchange operated until 2005.
A little bit of history…

- In 2013 AES Gener (owner of line) started studies to reactivate the line, but now to transfer electricity from the SING in Chile to the SADI in Argentina.
- Argentina had developed its transmission network, but not its generation matrix, so in the last few years its demand has caught up to its generation offer.
- In 2015, the government of Chile authorized the export under the principle of “indemnity.”
- “Indemnity” implies that operation with exports should not modify the prices at the sending end.
Operation

- To ensure the “indemnity” of the system, the operator in the Chilean side calculates the dispatch as always.

- Generators that were not selected by the dispatch can participate in the export, if they were previously accepted by the line owner (AES Gener).

- AES Gener submits sell offers to the SADI’s system operator, CAMMESA.

- The export is triggered if CAMMESA accepts the sell offers for its system, SADI.
Operation

- After a period of tests, export started in Feb 2016
- As of April, SING & SADI were 462 hrs. interconnected

46.6 GWh exported
Operation

- During the first period interconnected (February 12th until February 26th), the SING’s generated energy was 821 GWh and the flow to Argentina reached 37 GWh
Operation

• Up to this point, this may look like a good business for private companies, with no real “system” benefits
  – Idle generators in Chile get to sell their energy
  – AES Gener gets to charge for its transmission line
  – TermoAndes (AES Gener) gets to sell energy into Argentina
Operation

• However, the integration has very important “system” byproducts:
  – CAMMESA gets additional energy, that given current generation shortages, it is critical to avoid unserved energy
  – SING is also getting a better dynamic response to faults, avoiding unserved energy in the transients (SING has a poor dynamic response, mostly due to the slow response from its coal-fired plants).
Event 3962 (Nov. 5th 2015): Fault in Generator Angamos 1 with 263 MW
- Frequency reached 48.8 Hz → 3 levels of load shed
- Loss of 106.2 MW of load → Unserved load 48.6 MWh

Event 4052 (Feb. 22nd, 2016): Fault in Generator Angamos 2 with 253 MW
- Frequency reached 49.71 Hz → No load shed
Operation

• The integration has very important “system” byproducts:
  – SING is getting a smoother frequency while interconnected (SADI is ten times bigger than the SING)
Operation

• The integration has very important “system” byproducts:
  – BOTH systems know they can ask for assistance in case of a natural disaster or operational exception.
  – In July 2, 2014, the interconnection with Argentina was critical to minimize the consequences of a SING system wide blackout.
Chile started exporting gas to Argentina

- Chile agreed to export to Argentina some of the LNG gas it imports
- 5.5 million cubic meters daily (to feed Buenos Aires), implying payments of US$ 180 million per year
- Represents about 20% of LNG imports of Argentina
Electric Integration Chile-Peru

• Chile and Peru are part of SINEA (Andean Community plus Chile), where several interconnection studies have been conducted.

• Two interconnections are planned:
  – Short and thin, between Arica & Tacna (450 MW)
  – Long and strong, between Crucero & Montavo (1000 MW).

• Integration between Chile & Peru has shown to be more challenging due to geopolitical issues.
Shale gas resources in Argentina

Enormous resources anticipate future important energy exchanges

801.5 trillion cubit feet (tcf)

Chile has 48.5 tcf
US has 622.5 tcf
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Conclusions & final remarks

• Regional energy integration provides ample advantages, both economical and technical
• However, geopolitical conflicts are still an issue that limits integration (Chile-Bolivia, Chile-Peru, Peru-Ecuador)
• Although the Chile-Argentina energy integration seemed dead, integration advantages are stronger and are driving the market
• Merchant type investors are looking for opportunities
• New government initiatives are finding opportunities for exchanges, with private investors involved
Conclusions & final remarks

• Regulatory harmonization is an issue that needs consideration, particularly with existence of non market based schemes
• The principle of “indemnity” and/or subsidies work against market forces
• Probably energy integration will be volume bounded, not to create critical dependences
• The energy integration between countries goes beyond who sells to whom. There is always much more to win for all parties involved.
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