Electricity reform in Latin America: Argentina, Chile and Peru

12 December 2013
Introduction
Economic growth and electricity supply

- All developing countries require high investments to meet growing electricity demand, which is directly related to economic growth.

**Introduction**

**Economic growth and electricity supply**

- Chile, Perú and Argentina have a high economic growth and electricity consumption for the period 1990-2010.

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</thead>
<tbody>
<tr>
<td><strong>Perú</strong></td>
<td></td>
<td>1.248</td>
<td>6.568</td>
<td>30.0</td>
<td>7.6%</td>
<td>3.6%</td>
</tr>
<tr>
<td><strong>Chile</strong></td>
<td></td>
<td>3.568</td>
<td>15.356</td>
<td>17.5</td>
<td>8.7%</td>
<td>5.0%</td>
</tr>
<tr>
<td><strong>Argentina</strong></td>
<td></td>
<td>2.967</td>
<td>11.452</td>
<td>41.1</td>
<td>3.8%</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

Introduction
Main interconnected electrical systems

- Chile, Perú and Argentina have a substantial dependency on hydropower generation.

Legend: Total generation (2012)

- SEIN (Perú)
  - SEIN margin: 69%
  - 40,934 GWh

- SING (Chile)
  - SING margin: 43%
  - 14,832 GWh

- SIC (Chile)
  - SIC margin: 51%
  - 46,282 GWh

- SADI (Argentina)
  - SADI margin: 71%
  - 121,192 GWh


Introduction

Role of the State before and today

- Initially (1900s to 20s) the power sector developed based on private investment, with no special regulation.

- Government seized the electric initiative in the 1930s and from the 1940s to 1970s put aggressive electrifications plans into effect.

- However, state-owned, vertically integrated electricity monopolies failed to adequately manage the electricity business. Technical and financial problems became endemic.

- With the electricity reforms, the government assumed a subsidiary role and performs entrepreneurial activities only when such activities cannot or will not be carried out by the private sector (for example, rural electrification programs).

- Thus, the government’s main job is to promote competition and regulate activities that are monopolistic.
Introduction

Regulatory objectives

- The State performs a subsidiary role in the new regulatory market scheme.

- Reduce costs
- Meet efficiency at all levels
- Reduce market power
- Sufficiency & efficiency in the long term
- System stability
- Increase electrification

Reform
Introduction
Market segmentation

- At the heart of regulatory changes, there is a paradigm shift in the understanding of the electricity market, essentially recognizing different economic characteristics in the areas of generation, transmission, distribution and marketing.
Generation segment  
Main regulatory changes

• During the decades of 1940s – 1970s generation was in the hands of the state:
  ▪ Endesa (Chile).
  ▪ Electroperú (Perú).
  ▪ SEGBA (Argentina).

• Through regulatory reform, electricity generation is recognized as an economic activity where there are not significant economies of scale and so competition can be stimulated.


• There is open access for the generation market and the investors decide the investments to be made (location, technology and size).
Generation segment
Main regulatory changes

- Generating companies can sell energy to the following markets:
  - Spot market
  - Regulated clients market
  - Unregulated clients market
ISO completely independent entity.

**Chilean market dispatch example.**

**Supply curve - Jan 10, 2013**

<table>
<thead>
<tr>
<th>Variable Cost (US$/MWh)</th>
<th>Available Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>3000</td>
</tr>
<tr>
<td>100</td>
<td>5000</td>
</tr>
<tr>
<td>150</td>
<td>7000</td>
</tr>
<tr>
<td>200</td>
<td>8000</td>
</tr>
<tr>
<td>250</td>
<td>Peak demand</td>
</tr>
<tr>
<td>300</td>
<td>Minimum demand</td>
</tr>
</tbody>
</table>

- **Run of the river - Wind and solar**
- **Low valued Dam Hydro**
- **Coal**
- **CC - LNG**
- **OC - LNG**
- **High valued Dam Hydro**
- **CC - OC Diesel**
- **Peak demand**
- **Minimum demand**

ISO: Generation segment Market operation by ISO
Consequences and impacts of reform in electricity generation:

- Increased efficiency in the electricity companies and reduced final prices.
- Increase in the supply offer of generation and better system security.
Generation segment
Positive effects in Chile – expansion

<table>
<thead>
<tr>
<th>MW</th>
<th>1982 reform</th>
<th>1997 Argentinean gas</th>
<th>2004 No gas</th>
</tr>
</thead>
</table>

www.systep.cl
Generation segment
Positive effects in Argentina – expansion - prices

Evolution of installed capacity

Source: D. Llarens, 2013

PRICES OF ENERGY

Source: D. Llarens, 2013
Generation segment
Positive effects in Peru - expansion

Source: C. Butrón, 2013
Generation segment
Positive effects in Peru - electrification

Millones de Clientes

Coeficiente de Electrificación (%)

Clients
CE
However, in the early 2000s difficulties emerged in Chile and Peru in relation to supply security due to energy crisis and shortage risks:

- Spot market was too volatile to correctly indicate and stimulate the commissioning of new plants.
- Uncertainties about coal or gas future developments.
- Favorable hydrological scenarios could greatly reduce spot prices, while drought conditions threatened the security of supply.
- In Chile, the Argentine natural gas supply, widely used in electricity generation until then, began to face increasing cuts from Argentina.

Discrepancies emerged on the determination of spot prices, capacity payments, the dispatch models used, transmission modeling and operation security strategies.
In Chile (2006), long-term public tenders were established for the provision of distributor’s regulated clients.

- Expected marginal costs were replaced as market expansion signal.
- Long-term price signals based on expected generation costs by suppliers are used.
- Long-term contracts with distributors allow to guarantee investments in capacity and manage risk.

Peru also started similar tenders.
In 2001, Argentina went through a severe macro economical crisis, which derived in the “Economical Emergency” Law in 2002:

- Argentinean and U.S. currency were pegged in a 1:1 ratio, leaving without effect indexation adjustment clauses.
- An increasing intervention of the State led to contra reform actions.
- A limit to the recognized variable costs of generators was defined, using the corresponding declared natural gas price (120 $/MWh, equivalent to 20 US$/MWh).
Generation segment
Away from the original concepts: Argentina

- As a result,
  - Most electricity companies presented large losses on their original (US dollar based) capital investments, leading to the collapse of new investment. No new generating plants since 2001 until 2006, while demand grew significantly.
  - Increase in bad debt among final electricity consumers.

- In particular, spot and seasonal prices for the regulated clients have been below the marginal costs of the system.
  - Different decrees and resolutions have determined the price generators can charge to final consumers.

- Government has introduced subsidies, backed by government funds.
- New state owned company Enarsa has been created.

A percentage of the energy commercialized must come from renewable energies.

Definition of renewable generation quotas instead of feed-in tariffs scheme.

Non discriminatory on any particular technology.

Increments from a 5% in 2010 basis up to 10% in 2024.

Applies to energy contracts subscribed posterior to 2007.
Increasing renewable energy generation in Chile - 20% in 2025 (1/2)

- **New NCRE Law 20/25 enacted in 2013.**
  - Renewable quota is increased.
  - Increments between 1% to 2% from a 5% basis in 2010 up to a 20% by 2025.
  - Applies to energy contracts subscribed posterior to July 2013.
  - Public tenders will be held 3 years in advance in order to fulfill obligations in case existing and planned NCRE projects are not sufficient to supply all NCRE energy requested.

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**Renewable energy quota required by Law**

- **Current Law (20/25-2013)**
- **Former Law (2007)**

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Diagram showing the increase in renewable energy quota from 2010 to 2025.
The new challenges
The power of social movements
The new challenges
The power of social movements

Social rejection

Brazil
Hydroelectric Belo Monte – 11,000 MW
The new challenges
The power of social movements

Social rejection
Perú
Hydroelectric Inambari – 2,000 MW
The new challenges
The power of social movements

Social rejection

Argentina - Brazil
Hydroelectric Garabí – 1,600 MW
The new challenges in Chile
Widespread rejection to power plants...

HidroAysén

Hydroelectric - 2,750 MW
Investment 3,200 MMUS$
May 2012

Barrancones

Coal-fired - 540 MW
Investment 1,100 MMUS$
April 2009
The new challenges in Chile
Widespread rejection to power plants...

Including renewable projects

- **Tatio**
  - Geothermal - 40 MW
  - Investment: 180 MMUS$
  - July 2010

- **Pichidegua**
  - Biomass - 35 MW
  - Investment: 95 MMUS$
  - October 2010

- **Chiloé**
  - Wind - 112 MW
  - Investment: 235 MMUS$
  - July 2011
The new challenges
What do we do now?

ARGUMENTS AGAINST:

NUCLEAR

OIL

COAL

IT'S IN MY BACKYARD!

BP
The new challenges
Peru still able to use its abundant resources

Hydroelectric potential
58 937 MW

Wind potential
22 500 MW

Geothermal potential
69 445 MW

Solar potential
Sierra: 5.5 – 6.5 kWh/m²
Costa: 5.0 – 6.0 kWh/m²
Selva: 4.5 – 5.0 kWh/m²

Gas potential 2012
Proven reserves 15.4 TCF
Possible reserves 5.1 TCF

Source: C. Butrón, 2013
The new challenges
The not so new context...(1/2)

- The context for new investments has changed forever in the region (not only for energy).
  - BAU is not feasible anymore.
  - New challenges of different nature.

- Educate public opinion as early as possible.
  - An uneducated public may cripple development.
  - Role for governments, but also of the private sector.

- Strong political leadership is a must.
  - Swift actions and guidance for the market and public opinion.
  - Need to develop common vision for the future.
  - Danger of partisan positions clouding main issues.
The new challenges
The not so new context…(2/2)

- Land use management plans according to national policies.
  - Overcome conflictive uses of land (population, tourism, industrial development, indigenous communities, etc.).

- Embrace civil society participation in licensing and approval process.
  - Civil society as a partner and not an enemy.

- Establish clear mechanisms for compensations to local communities for local impacts.
  - National interests complementary to serving local needs.
Electricity reform in Latin America: Argentina, Chile and Peru

12 December 2013
### Chilean electricity systems

- **Main characteristics (December, 2012)**

<table>
<thead>
<tr>
<th>Region</th>
<th>Gross Capacity</th>
<th>Electricity Generation</th>
<th>Maximum demand</th>
<th>Population</th>
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</thead>
<tbody>
<tr>
<td>SING</td>
<td></td>
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<tr>
<td>Arica y Parinacota</td>
<td>3,964 MW</td>
<td>14,830 GWh</td>
<td>2,016 MW</td>
<td>5.7%</td>
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<tr>
<td>Tarapacá</td>
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<tr>
<td>Antofagasta</td>
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<tr>
<td>SIC</td>
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<tr>
<td>Atacama</td>
<td>13,909 MW</td>
<td>48,868 GWh</td>
<td>6,185 MW</td>
<td>92.6%</td>
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<tr>
<td>Coquimbo</td>
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<tr>
<td>Valparaíso</td>
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<tr>
<td>Región Metropolitana</td>
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<tr>
<td>Bio-Bío</td>
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<tr>
<td>Araucanía</td>
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<td>Los Ríos</td>
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<td>Los Lagos</td>
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<td>SEA</td>
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<tr>
<td>Aysén</td>
<td>47 MW</td>
<td>98 GWh</td>
<td>20.4 MW</td>
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<td></td>
<td>0.3%</td>
<td>0.2%</td>
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<td>SAM</td>
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<tr>
<td>Magallanes</td>
<td>100 MW</td>
<td>260 GWh</td>
<td>50.2 MW</td>
<td>1.1%</td>
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<td></td>
<td>0.6%</td>
<td>0.4%</td>
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Source: CDEC, 2013