Restructuring Chilean Electric and Gas Industries: From Monopolies to Competition

By Ricardo Raineri and Hugh Rudnick, Escuela de Ingeniería, Pontificia Universidad Católica de Chile

Abstract

The 1990's have witnessed large scale restructuring processes of the electric and gas industries in many countries around the world. Chile pioneered this reform early in 1982 by the publication of a new law that regulates the basis for the operation of electric utilities in a decentralized and investors-owned electric utilities environment. This new code was complemented in the second half of the 1980's with a large scale privatization process that affected most of the publicly owned electric utilities. These two events, plus the early 1990's internationalization processes run by the recently privatized utilities spurred a competitive war among electric utilities that has no precedence in the electric markets worldwide. Competition overpassed the boundaries of the electrical network, every single field of the industry was shock, demanding an improvement in efficiency to allow utilities to compete more effective at the industry level. This paper provides an overview of the restructuring process that shakes Chilean electric and gas industries, emphasizing regulatory issues and the microeconomic foundations that led to what was thought impossible two decades ago: cruel battles among firms that compete for attractive investments opportunities within the electric and gas industries. At the core of the deregulation process the ideas of open access and the granting of no exclusive concessions have been crucial for the enhancement of competition in the market. A key lesson that can be derived from a decade and a half experimenting with a decentralized and investors-owned utilities environment is the relevance of competition to discipline the behavior of established and potential investors who are attracted by the investments opportunities offered by the market.

1. Introduction

The Chilean economy is known today for the application of a free market model characterized mainly by the increasing participation of the private sector, the privatization of important state-owned firms, the liberalization of foreign trade (imports and exports), the promotion of foreign investment in Chile and Chilean investment abroad, the Social Security reform, and the structural change of important industrial sectors such as power and electricity, and telecommunications. The fundamental reality behind this transformation is the promotion of competition through the active participation of the private sector in the economy, retaining in the government a subsidiary role.\(^1\) This profound change of the relative participation of the private sector in the economy has required a thorough modernization of regulatory institutions. The electric industry was not absent from this process.

Chile has pioneered the modernization of the electric industry worldwide. Early, back in 1982, the law decree DFL1 from the Mining Ministry was promulgated, defining the basis for the operation of electric utilities in a decentralized and privately owned

\(^1\) Financial support from Fondecyt 1960397 is acknowledged.

\(^2\) The subsidiary principle stated that the government would undertake only those activities that private individuals were not willing to pursue.

\(^1\) See H. Rudnick, 1996.
industry. Notwithstanding, it was not only until the late 1980's, when electric utilities were privatized 3, that competition begun. Open access in the transmission network and the fact that anyone can own and operate a power generation plant promoted new investments in generation capacity. The requirement for generating companies to be centrally dispatched by an independent operator was seen as a guarantee for the efficient operation of the system.4 The transmission grid has performed a key role making power production competitive by providing open access to generating companies and allowing distribution companies and large users (who demand over 2 MW of capacity) to buy energy from generating companies, no matter their location in the grid.

The success of these policies has attracted the large investments required to supply for the fast growing energy demands of the country, the pension funds being the main investors. In December 1996 more than 43% of their investment in shares is concentrated in the power and electricity sector, amounting to almost $ 4 billion. As competition grew up, energy providers begun a search for alternative fuels with which they could compete more effectively with other utilities, mostly with hydroelectric generators. In the early 1990’s a new non-hydroelectric alternative to fuel power plants come into view: natural gas imported from neighboring countries, particularly Argentina and Bolivia. Thus, both for the central zone of the country and for the farther north, an economic alternative to satisfy the growing energy requirements was to import natural gas. At odds with Chile, Argentina and Bolivia have the advantage of owning large natural gas reserves that can be exported through gas pipelines across the Andes mountains to Chile. However to allow for the introduction of natural gas a new regulatory body was needed to complement the 1931 regulation that applied to the gas industry. Thus after a politically disturbed process, a new regulatory framework for natural gas was successfully promulgated in July 1995, dealing both with transportation and distribution. Also, an important event that contributed to the development of a competitive gas industry was the decision in 1995 by the Argentinean and Chilean governments to eliminate all restrictions on import and export of natural gas.

The major changes in the Chilean industry that led to the sharp changes in the electric and gas industries are:
- 1982, Law Decree DFL1 “General Electric Services Law” that defines a competitive regulatory regime for privately owned electric utilities’.
- Second part of the 1980’s decade, large privatization process where most public electric utilities were privatized.
- Since 1992, internationalization of the Chilean electric utilities.
- 1995, Bylaw N° 263 that define the rules for natural gas transportation and distribution.
- July 1997, arrival of natural gas to the central part of the country.

To open the power and electricity sector for competition and the participation of private firms in the industry, the DFL1 established three separate areas: power generation, transmission, and regional distribution of electricity. Allowing for: open competition in generation; open access to existent transmission lines; free entry to firms interested in the installation of new transmission lines; free prices for large energy consumers; and regulated prices for small consumers. Another key feature of the law is the use of marginal cost pricing, introduced as a practice since the mid 1970’s to promote efficiency in public utilities.

In July 1997 and following a world trend in the adoption of natural gas as a substitute for other fuels, the Chilean economy has began to import natural gas from Argentina, what has demanded the construction of a gas pipeline across the Andes mountains. To allow for the private participation and competition in this industry the regulatory regime was updated recognizing gas transportation and distribution as separate activities. The key features of the regulatory regime promulgated in 1995 are: open access to the gas pipeline; non-exclusive concessions for transportation and distribution; free prices for gas pipeline transportation and restricted free prices for gas distribution. In 1995 the government granted concessions to build the gas pipeline to two powerful consortiums of national and international firms. Electrical and oil companies are members of these two consortiums, showing that there are no constraints in horizontal or vertical integration in the energy sector. In 1997 only one gas pipeline is in operation. With the incorporation of natural gas in the central zone of the country, electricity prices are expected to decrease by 15%, while at the same time this cleaner fuel will help to reduce the high levels of air pollution in Santiago, the capital city of Chile.

This paper reviews the main policy decisions oriented at promoting competition, and briefly describes the differential characteristics of regulation in the most important areas of the electric and gas sectors. Also, a comment is made of important pending dilemmas which are being confronted by regulators today.

---

3 With the exception of Colbún, a large generating state own company. Only in 1996 the government sold 37.5% of Colbún to private investors.
4 The lack of information about the efficiency of the operation of the system by the independent operator is seen as a barrier that deter a deeper analysis in this issue.
2. Regulation

2.1. Electricity Regulation

Early, back in 1982, a new electricity regulation was promulgated in Chile. The law decree DFL1 from the Mining Ministry defines the basis for the operation of electric utilities in a decentralized and privately owned industry. The basic principles of the DFL1 are:

- Explicit separation of generation, transmission and distribution.
- Competition at the power generation level.
- Generating companies are centrally dispatched by a generators’ dependent operator.
- Licensed operation of transmission and distribution companies.
- Licensed construction of hydroelectric plants, and no licensing construction of thermoelectric plants.
- Open-access schemes, where transport concessionaires must allow open and nondiscriminatory use of their transmission systems.
- A pricing system for generation and transmission with operational and capacity expansion marginal prices.

2.1.1. Coordination: The CDEC\(^5\)

Interconnected generation and transmission units are required by the DFL1 for a coordinated operation by a generators’ dependent system operator. The operator, known as CDEC, is mandated to:\(^6\)

- Preserve the security of the electrical system.
- Guarantee the operation of the electrical system at a minimum cost.
- Guarantee the right of way on transmission units that are established with a public concession.

The above is to be done independent of plant ownership and commercial contracts of each generator.

In 1985 the DFL1 was supplemented with the Decree No. 6 from the Economic Ministry defining the bylaws that command the coordination of generation and transmission units that belong to an interconnected electrical system.

It should be acknowledged that the CDEC has a similar role to that played by the *Invisible Hand of Adam Smith* allocating resources in a decentralized manner in a free and competitive market. Where at odds with the *Invisible Hand*, the CDEC plays a similar role but in a centralized manner and subject to arbitrage restrictions. With this in mind, the authority at the time decided that the heart of the system should be in the hands of the firms who own generating units in the system\(^7\). Thus, and beyond the competition between the generating units to win a final consumption contract, the firms willingness to cooperate through the CDEC is a requirement for the proper performance of the industry.

As a complement to the above obligations, the CDEC define prices for energy and power transfers that take place among the generating units in the system. To price them the CDEC calculate marginal costs for energy with a model where all generating units are dispatched for a single bus system. Then, nodal or penalty factors are used for distributing the costs, causing that bus prices change throughout the grid and time, according to power balance and network availability. These penalty factors are presently calculated taking into account only marginal losses, but plans are to incorporate transmission restrictions. The marginal costs for power are based on the development costs of peak gas turbines units in one bus, with penalty factors that only consider marginal losses.

2.1.2. Generation

The DFL1 assumes that the development of generation capacity can be achieved in a competitive manner. Investment in generation is freely decided by interested firms, but there is an indicative development plan proposed by the National Energy Commission, that is not compulsory, but carries a lot of weight in private decisions and the authority provision of licensees for hydroelectric power plants and transmission lines.

---

\(^5\) CDEC or “Centro de Despacho Económico de Carga” stands for Load Dispatch Center.

\(^6\) See article 81 of the DFL1 from 1982.

\(^7\) Any generating firm with an installed capacity of approximately 60MW can have one director in the board of the CDEC.
Gencos (Generation Companies) can sell electricity in three different markets. First, as explained above, a producers market takes form at the CDEC where generators exchange energy to fulfill their contracts with third parties. Second, a free market is formed by large energy consumers who can freely bargain the price with Gencos or Discos (Distribution Companies). Third, a regulated market exists for small consumers with at most 2 MW of power demand who usually buy energy from a concessionaire Disco at energy and capacity prices set by the National Energy Commission (CNE) \(^8\).

2.1.3. Transmission

Electricity transmission cannot be classified as a perfectly competitive or contestable market. The elements that characterize the transmission sector are:
- large sunk and specific investments.
- lumpy investments.
- need for redundancies to meet security requirements.
- economies of scale in the construction cost in terms of the capacity of the transmission line.
- economies of scope given by the interconnection of electric systems.

Notwithstanding, the DFL1 provides a sort of competition for electricity transmission, where the essential economic characteristic recognized for the transportation service is one of capacity, linked to individual equipment maximum loading. The concept is that payments by all users should permit to cover investment costs as well as operation and maintenance. Installations to be considered are all those required to maintain an adequate quality and security of the service. To value investment costs a replacement price concept is considered, providing an expansion cost economic signal. The DFL1 defines that the electric company owning the transmission facilities to be used by a third party initially determines the replacement value. Then a negotiation takes place between interested parties and if no agreement is reached, disputes are submitted to an arbitration procedure in accordance with the law.

Transmission tariffs are based on a two part tariff approach. As a result of the application of full spatial short run marginal cost based pricing, in which generators are paid at marginal cost of generation buses and consumers are charged at marginal costs of load buses, a surplus is collected for the owners of the transmission system. The surplus or "marginal cost income" arises from differences between both energy and capacity locational spot prices. But, as electricity transmission presents increasing returns to scale, marginal cost pricing does not finance the system operation and development, as marginal costs will be lower than average costs. The marginal cost income only covers the cost of transmission losses and a small part of the investment and exploitation costs. Thus, for total transmission cost recovery (average cost) a transmission toll is added to the marginal cost income to fully finance the system. In the DFL1 these tolls, or wheeling rates, are charged only to the generators. This is justified by the belief that transmission services are required by the generators to reach consumers and compete. Also, it assumes that the combination of the generation and transmission business does not have economies of scale, thus marginal pricing providing enough revenues for the combined business. The toll allocation, based on the area of influence of each individual user, corresponds to the set of lines and substations directly influenced by the energy and peak power injected by the user. The area of influence pretends to represent the effective use of the transmission network made by each user, independent of the commercial contracts that each user may have. The allocation scheme further determines that only those contributing to positive flow pay for the equipment capacity. Further, a generator that wants to sell energy outside his area of influence should pay an additional toll for the use of outside transmission network.

2.1.4. Distribution

Electricity distribution cannot be classified as a perfectly competitive or contestable market. The elements that characterize the distribution sector are:
- large sunk and specific investments.
- need for redundancies to meet security requirements.
- economies of scope given by the network characteristic of the distribution system.

The DFL1 provides a non exclusive public concession for electricity distribution erasing any legal barrier to enhance competition in the industry. Energy and distribution prices for small customers who demand at most to 2 MW are regulated by the CNE.

---

\(^8\) "Comisión Nacional de Energía".
Discos with customers subject to regulated energy prices buy energy from generating companies at regulated nodal prices. The energy and power nodal prices for each electrical system is calculated each six months, in April and October, by the CNE. The energy nodal price is estimated as an equilibrium price for an expected demand increase that is satisfied by the generation - transmission expansion indicative plan determined by the CNE. The power nodal price results from the investment needed to satisfy the peak load in the load center of the system, corresponding to oil fueled gas power plants. Once basic energy and power prices are defined for the load center of the system, energy and power nodal prices for the rest of the system are obtained using penalty factors that account for geographic and transmission losses. The law assumes that the free energy prices that affect customers with demands that exceed 2 MW reflect market conditions. Thus, the nodal prices set for regulated clients cannot diverge more than 10% from average free prices. If they differ in more than 10%, nodal prices must be adjusted to the upper or lower limit of the band.

Finally, to the energy and power price paid by customers subject to price regulation, a “Distribution Value Added” or VAD is added, reflecting the efficient cost of distribution service. The VAD is calculated every four years as an average cost for a model company using a yard-stick competition approach and includes:

- Standard investment, maintenance and operation costs related to the distribution activity, per unit of power supplied.
- Fixed costs associated to management, billing and customers’ service, independent on the customers’ consumption
- Energy losses associated to the distribution activity

The VAD investment costs are calculated on standard replacement values to reflect the expansion cost of the system. Through formulas the VAD of the model company is applied to the different Discos requiring that the rate of return for all the Discos together be in a band of 10% ± 4%.

Thus, customers’ subject to regulated prices pay the VAD plus the energy and power nodal prices to reflect the customer use of the generation, transmission and distribution units.

2.2. **Gas Pipeline Regulation**

On July 1995 the authority published a new regulatory framework for natural gas, transportation and distribution. In brief, this new law, Decree No 263 of the Economic Ministry, establishes the following basic principles:

- Explicit separation of gas transportation and distribution.
- Licensed operation of transportation and distribution companies.
- Competition among firms that transport natural gas, allowing in the same zone more than one private concession for the provision of the service.
- Open-access schemes, where transport concessionaires must allow open and nondiscriminatory use of the gas pipeline to those who ask for transportation services. Open-access applies up to available transportation capacity. Open-access also means that each transportation contract should be signed after the gas pipeline owner runs an open tender among those who are interested in a transportation contract.
- A free pricing system for gas transportation where transportation charges are predetermined by the concessionaire firm. Free prices at the distribution level that apply as long as the rate of return obtained by distribution companies remains in a ± 5% band around the industry cost of capital.

Also important for the actual development of the gas industry in Chile are the Argentinean and Chilean governments’ suppression of all the restrictions that apply to natural gas import and export.

The following table summarizes the main characteristics present in the regulatory regimes that apply to the electric and gas industries.

---

9 “VAD” or “Valor Agregado de Distribución”
11 This new body of law complemented a 1931 regulatory regime that applied to the industry.
<table>
<thead>
<tr>
<th>Sector</th>
<th>Vertical Integration</th>
<th>Open Access</th>
<th>Price setting mechanism</th>
<th>Recognition of Scale Economies</th>
<th>Regulated Price defined over a stand alone model company that only accounts for regulated services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas Transportation and Distribution</td>
<td>Not excluded</td>
<td>Yes and free entry to build gas pipelines and distribution facilities</td>
<td>For gas pipeline transportation they are determined by the regulated firm. For gas distribution they are free, conditional on the rate of return</td>
<td>It is not clear</td>
<td>Yes</td>
</tr>
<tr>
<td>Electricity Generation</td>
<td>Allowed</td>
<td>Free entry to build power plants</td>
<td>Three markets for electricity: for exchanges among Gencos at spot marginal cost; for large customers at free bargained prices; and for small customers at regulated nodal prices.</td>
<td>DFL1 assumes no scale economies in electricity generation.</td>
<td>Yes</td>
</tr>
<tr>
<td>Transmission</td>
<td>Allowed</td>
<td>Yes and free entry to build transmission lines</td>
<td>Marginal Cost Income plus tolls according to NRV\textsuperscript{12} + O&amp;MC\textsuperscript{13}</td>
<td>Yes, by the toll charges.</td>
<td>It is not clear</td>
</tr>
<tr>
<td>Sub-transmission</td>
<td>Allowed</td>
<td>Yes and free entry to build sub-transmission lines</td>
<td>NRV + O&amp;MC</td>
<td>On the basis of charging average costs</td>
<td>It is not clear</td>
</tr>
<tr>
<td>Distribution</td>
<td>Allowed</td>
<td>Yes and free entry to build distribution facilities</td>
<td>NRV + O&amp;MC (or VAD)</td>
<td>DFL1 assumes no scale economies in electricity distribution. Marginal costs are considered equal to average costs.</td>
<td>It is not clear</td>
</tr>
</tbody>
</table>

3. Competition

For the 1986-1995 period, electricity consumption has grown at an annual average of 7.9\%, fueled mainly by the rapid economic growth experienced by the country with an annual average of 7.1\%, and the proper design of a competitive enhancement regulatory regime. Chile is a long and thin country served by four independent electrical systems: Sistema Eléctrico de Aysén; Sistemas Eléctricos de Puerto Porvenir, Puerto Natales y Punta Arenas; Sistema Interconectado del Norte Grande (SING); and Sistema Interconectado Central (SIC). From all of them, the SING and the SIC are the largest. The SING serves the northern part of the country, from Arica in the north to Antofagasta in the south. The SING is mostly thermoelectric and provides electricity to the fast growing mining activity of the region. The SIC is the electrical system that serves the central zone of the country, from Talca in the north to the Large Island of Chiloé in the south. By far this is the most important electrical system in the country, serving a region that counts for 95\% of GNP and 92\% of the population. Due to his relevance for the national economy, in the discussion that follows we will centralize the analysis on it.

The SIC is a long corridor with 220 kV and 500 kV lines, with 4162 and 623 kilometers respectively, that provide services to hydroelectric plants located in the south to transport their electricity to the central - north part of the country, where most consumption takes place. Electricity consumption by the commercial, public and residential sector is 35\% of total consumption, and the industrial sector consumption is 62\% of total consumption, the rest correspond to network energy losses.

Since 1989 generation capacity in the SIC grew at an annual average rate of 5.6\%, reaching 4077 MW in 1995 where 78\% of the generation capacity is hydraulic. The sector is highly concentrated. Endesa, the largest Genco, counts for 45\% of total capacity, and Transelec, an Endesa subsidiary, manages the main transmission lines and transformation capacity units in the country (100\% of the 500 kV and 73\% of the 220 kV lines; and 100\% of 500 kV, 37\% of 220 kV and 34\% of 154 kV transformation capacity in 1996). Transelec rents transmission lines and transformation capacity units from Endesa.

\textsuperscript{12} NRV stands for "New Replacement Value"
\textsuperscript{13} O&MC are Operation and Maintenance Costs.
Besides the concentration of power generation and transmission in a few hands, the industry has witnessed increasing degrees of competition among Gencos and Transcos, competition that has been enhanced by the recent introduction of natural gas in the industry. The leading Transco, Transelect, and also the leading Gencos have been affected by direct competition, potential competition, and competition by substitution.

For transmission, direct competition appears in situations where other companies build their own transmission lines, that has left unused some of Transelect transmission lines. Direct competition has been present in cases where companies that are different to the main Transco build a transmission line that runs parallel to an existing transmission line of Transelect. Examples are:

- 1997. Colbún’s strategic decision to build its own 220 kV transmission line to transport electricity from its generating plant to Santiago.
- 1995. Guacolda’s strategic decision to build a 220 kV line parallel to an existent transmission line between Maitencillo and Cardones.
- 1996. Pangue’s decision to sign a contract with AELSA, where the former built a transmission line to transport the electricity from the Pangue generating plant to the SIC.

For transmission, potential competition has appeared in the threat that intruder companies set on established companies. Examples of potential competition that affected the main Transco are:

- 1994. The threat that SAESA set on Transelect to left unused its subtransmission lines. As a response Transelect participated with SAESA in a new firm STS, whose objective is the development of a transmission systems in the SAESA area of operation.
- 1994. The threat that EMEC set on Transelect to left unused its subtransmission lines. As a response Transelect participated with EMEC in a new firm Empresa Eléctrica Transnet whose objective is the development of transmission systems.
- 1996. The threat that CGE set on Transelect to left unused its subtransmission lines. As a response Transelect sold to CGE transmission lines and transformation units in the area of operation of CGE.

Competition by substitution has resulted in the adoption of alternative technologies that affected the established companies. Examples of competition by substitution that affected the main Transco strategy and non on-site Gencos are:

- 1995-1996. The construction of Guacolda 1 and Guacolda 2, local generators in the northern part of the SIC, that left unused transmission lines of the main Transco.
- 1997 and on. The incoming natural gas fueled on-site generators that will compete with hydroelectric generators that make extensive use of the transmission system to transport their energy to the consumption points. For Transcos there is a substitution and for hydroelectric Gencos there is a direct competition by the use of alternative technologies.
- 1997 and on. The incoming natural gas that will substitute some residential and industrial electricity consumption's for natural gas consumption's.

For a selected group of electric utilities, the following graph illustrates the rates of return obtained. Two Gencos, Endesa and Chilgener, and two Discos, Chilquinta and Chillectra. For Gencos the rate of return has been in a range between 7% and 14.6%, and for Discos the rate of return has been in a range between 7.7% and 33.8%.

Rate of Return: Profits/Capital Stock
(Source: Firm's Finance Statements)

![Graph showing rate of return for different companies over the years 1992 to 1996]
The natural gas industry is of recent development, but not less interesting to analyze. So far, since the promulgation in 1995 of the Decree Nº 263 the country has witnessed four gas pipeline and electric wars where different consortiums compete on a pre-entry level for the success of their projects. The following table summarizes the four wars and the competing projects involved in each war.

<table>
<thead>
<tr>
<th>Recent Gas-Electric Wars in the Chilean Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Source: Rainer 1997)</td>
</tr>
<tr>
<td>1994-1996, Gas pipeline War 1:</td>
</tr>
<tr>
<td>• GasTransandino (1200 km gas pipeline between Argentina and Santiago-Chile.)</td>
</tr>
<tr>
<td>• GasAndes (465 km gas pipeline between Argentina and Santiago-Chile.)</td>
</tr>
<tr>
<td>1994-1997, Gas pipeline War 2:</td>
</tr>
<tr>
<td>• GasSur (400 km gas pipeline between Argentina and Concepción-Chile.)</td>
</tr>
<tr>
<td>• GasTransandino (400 km gas pipeline between Argentina and Concepción-Chile.)</td>
</tr>
<tr>
<td>1996-1997, Gas pipeline and Electric War 3:</td>
</tr>
<tr>
<td>• Gasoducto Atacama (900 km gas pipeline between Argentina and Mejillones-Chile.)</td>
</tr>
<tr>
<td>• ElectroAndes (500 km high voltage transmission line between Argentina and Antofagasta-Chile.)</td>
</tr>
<tr>
<td>• Norgas (880 km gas pipeline between Argentina and Tocopilla-Chile.)</td>
</tr>
<tr>
<td>1996-1997, Gas pipeline war 4:</td>
</tr>
<tr>
<td>• GasAndes (115 km gas pipeline between Santiago and Quillota, Chile.)</td>
</tr>
<tr>
<td>• ElectroGas (115 km gas pipeline between Santiago and Quillota, Chile.)</td>
</tr>
</tbody>
</table>

The ex-ante competition among the alternative projects has been cruel, each consortium making large investments in marketing and lobbying, trying to compromise long term contracts with their customers to assure the financial success of their investment. From the four mentioned battles, the most known one was that between GasTransandino and GasAndes They faced each other through an ex-ante war that has no precedence in the gas industry world wide. Both projects shared the objective to provide gas pipeline transportation services to the central part of the country by importing natural gas from Argentina. They differed in the route used to transport natural gas. GasTransandino considered a 1200 km gas pipeline that would cross the Andes mountains 300 km south of Santiago serving also the south of the country. On the other hand, GasAndes considered a route that would cross the Andes in front of Santiago, demanding only a 465 km gas pipeline. After months of disputes, the market decided based on the advantages of both projects, favoring the construction of the GasAndes pipeline that was built and begun operations on July 1997.

The other three gas and gas-electric wars compete for the market in the south (Gas pipeline war 2), the north (Gas pipeline and electric war 3), and large natural gas fueled Gencos close to Santiago (Gas pipeline war 3). There is a consensus that the winner projects will be chosen with the vote of the market on the project that first assures enough long terms contracts that guarantee its financial success.

Not withstanding the ex-ante competition observed among the different gas pipeline and electric projects, the ex-post competition for the supply of the gas pipeline install capacity is an open question that is an issue for future analysis.

The DFLI provides no exclusive concession for electricity distribution, however no overlapped distribution concessionaires have emerged. There are 36 private distribution companies with a public concession, serving almost 3.3 millions of clients, where 92% are residential customers that accounts for 30% of national energy consumption. The country shows a figure of 92% of electrification, with 98% in urban areas and 60% in rural areas. The VAD is calculated every four years using a model company that applies as a yardstick or benchmark for the whole industry. Every single Disco receives distribution tariffs that are obtained from the tariffs designed for the model company but adjusted for some of its specific characteristics. The approach applied in the Chilean industry has been successful in increasing efficiency at the Discos. As an example, Chiloelectra provides a better service that can be appreciated in a reduction of the average emergency attention time from 4.8 hours in 1988 to 1.5 hour in 1995. Also, there are important reductions in the energy losses since the utilities privatization in the second half of the 1980's. Technical and non-technical energy losses have decreased from more than 20% in 1986 to 8.6% in 1996. Finally, labor productivity increased dramatically in the 1987 - 1996 period, measured as number of customer's per employee increased 73%, and measured as GWh per employee increased 178%.

The improvement in efficiency that the model applied in Chile has had in all the links of the generation, transmission and distribution chain finally lead to lower electricity prices for final consumer’s. The following figure shows final electricity prices for

14 Cautions should be taken on these figures because they are not adjusted for the outsourcing of labor services.
residential and industrial customers subject to price regulation. As a test, is easy to verify with a second order linear autoregression with a time trend model that electricity prices are declining, what can be attributed in part to the greater efficiency achieved by electric utilities. The efficiency improvements have been partially transferred to consumers through lower VAD's values, which are adjusted every four years, and lower energy and capacity prices that result from the competition among Gencos and Transco. The extent of efficiency transfers is a matter of further analysis, given the high rate of return of distribution companies. Nevertheless, the latest VAD values published on June 1997 show a further reduction of 5.4% in the VAD.

Notwithstanding, the little doubt about the competitive nature among generators, there have been important disputes due to charges for transmission. The main controversy stems from the ownership of most transmission lines by Endesa, which is vertically integrated. This is an area that went over a long debate. The Fiscalía Nacional Económica (similar to the Federal Trade Commission in the US) alleged monopolistic behavior demanding independence in the ownership of the vertically integrated holding led by Enersis, and controlling Endesa, Transsec and Chillectrica. However on June 1997, after a 3 years lawsuit that began in 1994, the Antimonopolies Commission did not accept the charges and let the vertically integrated holding stay as it is.

In the 1990's the reduced size of the domestic Chilean market pushed electric utilities to look abroad to broaden the companies investment opportunities. The main effort was set on Latin America investment opportunities. This strategy was supported by the sharing of a common culture, the modernization of regulatory regimes that are similar to Chilean regulation, the chance to participate in privatization processes of badly maintained utilities whose efficiency could be largely improved, the expertise achieved by Chilean corporations in optimizing the operation of electric utilities, the scope economies that can be achieved by owning firms that share a common technology, and the per-capita electricity consumption growth opportunities shown by Latin America countries. Respect to the last, Latin America per-capita electricity consumption falls far beyond the consumption shown by higher per-capita income countries. Since GDP expected growth rates for Latin American rank behind Asia countries, offering important potential for further growth.

Today, Chilean corporations have become multinational corporations with investments in Argentina, Bolivia, Colombia, Brazil, and Perú. Some of them produce more electricity or have more customers abroad than what they actually have in Chile. The holdings Enersis and Chilgener stand out. Also, ownership of these corporations goes beyond Chilean boundaries. As example, in August 1996 17% of Enersis shares were traded in the New York stock market, where the aggressive internationalization program run by these corporations have sky rocket their market capitalization as shown by Enersis market capitalization that went from $ 517 millions in 1990 to $ 4,225 millions by September 1996.

4. **Summary**

Both the regulator and the private sector have been concerned with some limitations on the existing regulations and have for some years been assessing changes, particularly on the transmission open access ruling. Several have challenged any changes to the status quo as an indication of instability of the rules of the game that may deter further private investment.

Some of the changes that have been explored are: a regulated definition of the Gencos area of influence in the network, an improvement of the mechanism to set access charges for the distribution and the subtransmission networks, quality of service definitions for every stage of the electricity chain, a reduction in the 2000 kW limit for unregulated customers, and the incorporation of an arbitrage instance in the VAD calculations.

398
Another area of analysis has been that of the operation of the generators dependent system operator CDEC. Investigations on a recent blackout indicate that commercial interests may have influenced the CDEC decisions, not fully complying with its bylaw duties. The investigations have not been completed but sanctions have already been imposed on generators.

The natural gas industry is of very recent development in the country. The different gas wars witnessed appear as a guarantee of efficiency in the discrete choice problem of which gas pipeline should be built. Notwithstanding, the gas pipeline pre-entry competition in the supply of transportation capacity, the ex-post competition in the supply of the install capacity is a matter for future analysis.

Besides the disputes and pending dilemmas in the Chilean electric and gas industries, Chile has become a shining example of how free markets and privatization effort can provide for the increasing energy requirements that are demanded by a growing economy.

5. Bibliography