

COMPETITIVE MARKETS IN ELECTRICITY SUPPLY: ASSESSMENT OF THE SOUTH AMERICAN EXPERIENCE*

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ABSTRACT

The paper analyzes the South American experience in the creation of competitive markets in the electric industry, which has pioneered changes worldwide. The changes began in 1982, when Chile formalized an electric power reorganization. Argentina followed in 1992, and then Peru in 1993, Bolivia and Colombia in 1994. The Central American countries and Brazil joined the group in 1997. Venezuela and Ecuador have also started similar processes. The paper contributes with an assessment of the insights gained with the introduction of competition, as well as management challenges and opportunities. Problems in competitive markets operation are identified, along with the regulation of monopolistic activities, transmission access and distribution pricing. The consequent global interaction of the energy markets and related emerging issues are also analyzed.

Keywords: Electric Utilities, Electricity Markets, Utilities Policy, Deregulation, Industrial Organization, Industrial Policy

JEL Classification: L940

RESUMEN

Este artículo analiza la experiencia sudamericana con respecto a la creación de mercados competitivos en la industria eléctrica, la que ha sido pionera en el mundo. Los cambios comenzaron en 1982, cuando en Chile se formalizó una reorganización del sistema eléctrico. Argentina lo siguió en 1992, luego Perú en 1993, seguidos por Bolivia y Colombia en 1994. Los países centroamericanos y Brasil se unieron al grupo en 1997. Venezuela y Ecuador han comenzado procesos similares. Este artículo contribuye con un análisis de las lecciones aprendi-

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das como fruto de la introducción de competencia a estos mercados y también de los nuevos desafíos y oportunidades que se presentan para la dirección de empresas en este contexto. Se identifican problemas en la operación de mercados competitivos junto con la regulación de actividades monopólicas, el acceso a transmisión de energía y la determinación de precios de la distribución. Se analiza también la interacción global de los mercados de energía en competencia y sus problemas relacionados.

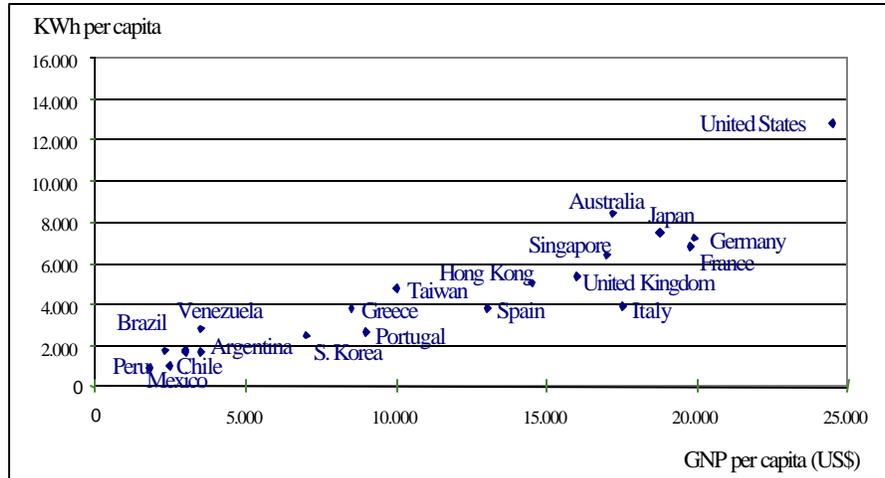
Latin America is going through political and economical transition, with a growing tendency to open economies and democratic governments. The debt crisis is coming to an end, irrespective of dramatic but transient slowdowns like that of Mexico. Significant economic reforms are giving shape to market economies with increasing growth. Geopolitic reasons are making North America and Europe look with increasing interest at investments in the region, some of these being drawn from the troubled South East Asia economies.

A further development of interest in the region is the contribution of new commercial international agreements to economic development, among them the new Mercosur pact, whereby an integrated market of 200 million people over an area of 12 million square kilometers was created, incorporating Argentina, Brazil, Paraguay, and Uruguay plus Bolivia and Chile.

The Latin American electric power industry has undergone profound transformation, with no parallel in the world. New electric sector regulations were set in Chile in 1982 [Philippi, 1992; Bernstein, 1988], jumpstarting a process that was to inspire several developments elsewhere. Argentina followed in 1992, Peru in 1993, Bolivia and Colombia in 1994, the Central American countries of Panama, El Salvador, Guatemala, Nicaragua, Costa Rica and Honduras in 1997. Brazil is also joining the group and Venezuela and Ecuador have initiated actions. This paper contributes with an assessment of these developments and the insights gained, particularly from the South American experience.

Country size and power demand diversity is striking, but all of them are following similar paths to reform (Brazil -on one end- is a 160 million people country with an installed capacity of 58000 MW, while Honduras -on the other- has 4.4 million people and 396 MW). The level of electricity consumption is still low, if compared to the industrialized world (Fig. 1).

FIGURE 1
PER CAPITA ELECTRICITY CONSUMPTION AND GROSS NATIONAL
PRODUCT (1996)



I. POWER SYSTEM DEVELOPMENT

Electric power was introduced in Latin America soon after electric light was inaugurated in New York City and London by the end of last century. At first the power sector development was based on private investment, under no special regulations. Nevertheless, during the Great Depression of the '30s, private investment dried up throughout the region, to the detriment of electricity supply to cities, industry, and mining. In most countries, governments seized the initiative and from the '40s through the late '70s put aggressive electrification programs into effect. Eletrobrás in Brazil, Endesa in Chile, Electroperú in Peru, ISA in Colombia, CFE in Mexico, Edelca in Venezuela and Ende in Bolivia were among the national electricity companies created. In general, power system development was concentrated in their hands, and they built hydroelectric plants and transmission lines tying previously isolated networks into interconnected systems. Private firms still existed, but mostly at the electricity distribution level in the main metropolitan areas.

In most countries, however, the state-owned, vertically integrated electricity monopolies failed in the end to adequately manage the electricity

business and diverse technical and financial problems became endemic.

Overinvestment in the Argentinean electricity system was accompanied by a severe deterioration of the electricity service under State hands. In Colombia, prolonged power rationing had to be decreed in 1992-1993 because of its limited thermal generation development confronted by climatic changes due to El Niño. In Brazil, a dire financial shortage halted public investment in the power system, in an economy with increasing energy needs. Meanwhile, in Bolivia and Peru, governments were failing to raise enough funds for the electricity sectors, yet at the same time were subsidizing rates for poor users. A similar situation is present in Venezuela and the Central American countries.

II. DEREGULATION, REREGULATION AND PRIVATIZATION

In the electricity industry, unlike the telecommunications one, there has been no great technical innovation or technological breakthrough to warrant the change of the industry's organization. The reasons for deregulation in Latin America varied from one country to the other, but most have been essentially economic or political, often driven by the endemic problems indicated above [Rudnick, 1996].

Free-market ideas gained currency, starting in Chile, and gave rise to the notion that government control over the economy should be reduced and the role of the private sector enhanced. The concept of the subsidiary role of the government was coined and soon extended to the energy and electricity business. The government should perform entrepreneurial activities only when such activities cannot or will not be carried out by the private sector, and its main job should be to regulate activities that are monopolistic in nature. Market forces are recognized as a basic mechanism in the correct allocation of resources in the electricity sector, with competition being welcome wherever it can take place. Deconcentrating, decentralizing, and ultimately privatizing electric companies' activities and property has been recognized as necessary for the efficiency and stability of the system.

To speed up the process, international lending banks, the World Bank included, started making loans conditional on the initiation of privatization or deregulation processes.

In the essence of changes, paradigms in the understanding of the

electricity business have varied, recognizing essentially different economic characteristics in the stages of generation, transmission, and distribution.

Generation is recognized as the one part of the chain where there are no significant economies or diseconomies of scale, since small power plants can produce energy at about the same costs as large ones. Generation is recognized as the stage where a competitive environment can be stimulated. The drive for deregulation has been emphasized in this sector. In spite of that, the South American countries chose to force the unrestricted generation markets into a competitive equilibrium by creating independent coordination pools that do both the physical operation and the clearing of the market.

To complicate the deregulation process, neither electricity transmission nor distribution can be classified as perfectly competitive or contestable markets. A re-regulation process has arisen, in an attempt to stimulate efficient behavior of companies in those monopolistic activities.

Transmission, because of both lumpy investments and the need for redundancies to meet security requirements, is recognized as the part of the chain where economies of scale operate. Power lines with higher nominal voltage and transmission capacity have a lower average cost per unit of power and per kilometer transmitted. The need to regulate an intrinsically monopolistic activity arises, particularly as the transmission system is the instrument for competition among geographically dispersed generators. Open-access schemes are defined, where transport concessionaires must permit open and non-discriminatory use of their transmission systems.

Finally, distribution has clear economies of scope or density, where one distribution network can provide a cheaper service than two or more networks serving a single area. Regulation is introduced; granting geographical concessions to distribution companies that must supply electricity to all consumers in the area, with regulated tariffs and quality.

With this knowledge in mind, several Latin American countries have developed new legal and regulatory frameworks for the electric energy sector. Explicit separation of the three businesses is defined (generation, transmission and distribution), making room for competition where possible and stimulating efficiency of monopolies through performance-based regulation. Some countries define a fourth competitive business, separating suppliers from the providers of electric wires. New pricing systems are introduced, where the generation and the transmission businesses have either

operational or capacity expansion marginal prices or both. The distribution service is priced on the basis of capacity expansion average costs, which are evaluated using model distribution companies or price cap schemes.

Reforms have followed similar, but not identical, paths in all the countries involved, each one benefiting from the experience of those that have made the changes earlier. To reduce market power, restrictions on cross ownership among different categories of companies (i.e. generation versus transmission versus distribution) were introduced in most countries, namely Argentina, Bolivia, and Peru, but they were not defined in Chile where market power has developed. Argentina and Bolivia further limited any one generating company from holding more than 10 or 30 percent of the market, respectively.

The system operator in charge of coordinating grid operation is run only by generators in Chile. In Peru the operator also includes transmitters, and in Argentina and Bolivia distributors, large consumers and the regulator. While in Chile, Peru, and Bolivia generation is dispatched based on audited costs, bid prices are used in Argentina and Colombia.

While most countries formulated two-part tariffs for transmission services based on multinodal marginal spot prices, coupled to tolls, Colombia used capital expansion marginal costs. While Peru, Colombia, and Bolivia left the transmission system under the control of a single company, Argentina and Chile have relied on market forces, favoring the development of several private transmitters.

Argentina, Chile, and Peru have chosen the concept of model distribution companies to set distribution rates; Bolivia has opted for the British price cap scheme, where rates are adjusted to inflation plus a yearly efficiency reduction.

Different privatization schemes have been used in each country. Private pension funds provided financing for the privatized electrical system in Chile, while in Argentina, Bolivia, Brazil, Colombia and Peru, major foreign investment joined the limited local capital market. Bolivia developed a new privatization program called "capitalization", whereby foreign investors commit to the company's expansion, controlling the company as shareholders that contribute a predefined amount to finance further investment. Stranded assets have been sunk in all deregulation processes and absorbed by the State.

III. IMPACT OF THE REFORMS ON THE ELECTRICITY SERVICE

The reforms have had radical results in all countries. In Chile, two power suppliers have given place to seven generating companies competing in the main grid. In neighboring Argentina, still more strikingly, over 30 private generator rivals have replaced two state-owned companies. In Buenos Aires and Lima, two distribution companies compete not only against each other but also against an ideal model.

The impact of the changes on service quality has been remarkable, with very strict electric quality standards having been set in Argentina, Bolivia and Peru, with penalties for not complying.

Argentina has been recognized as the country that implemented the most successful deregulation process [Sbertoli, 1998]. In spite of a high load growth that resulted in a 40 percent increase in the last five years, there have been increasing investments in new facilities, especially in new generation plants, a substantial increase in thermal plant availability and improved thermal plant efficiency. There have been declines of around 50 percent in both spot and contract market prices since the beginning of the process (price reductions in the wholesale market are shown in Figure 2). Finally, the service quality improvements have resulted in an extraordinary reduction of non-served energy (Figure 3), a decrease of system failure probability, and coupled to that, a reduction in total service losses. Competition is not only assured with the number of producers (none holding more than 10 percent of installed capacity) but also with the number of non regulated consumers contracting directly. A gradual reduction of the limit for direct contracting has taken place, from 5000 kW in high or medium voltage in 1992 to the current 50 kW in any voltage. Following the enlargement of the large user category, the number of agents and contracts in the market has increased accordingly, from under 100 in 1993 to over 1200 in 1997.

Nevertheless, prices have not necessarily decreased everywhere; in Peru they increased over two times when subsidies to end consumers were eliminated. Irrespective of this and coupled with distribution companies' obligation to serve any consumer, electricity's population coverage in Peru has been increasing continuously (Figure 4).

FIGURE 2
EVOLUTION OF ENERGY PRICES IN ARGENTINA

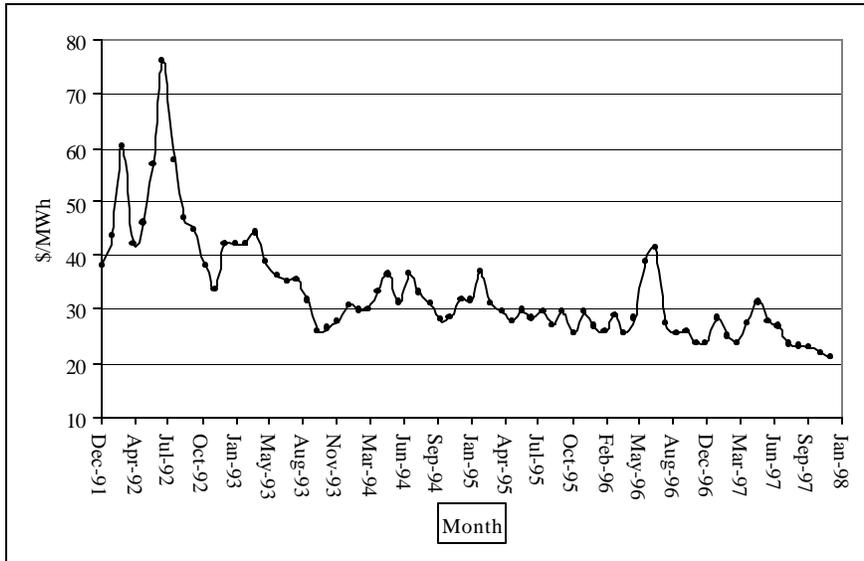


FIGURE 3
NON SERVED ENERGY IN ARGENTINA
JAN 88-DEC 95 (GWh)

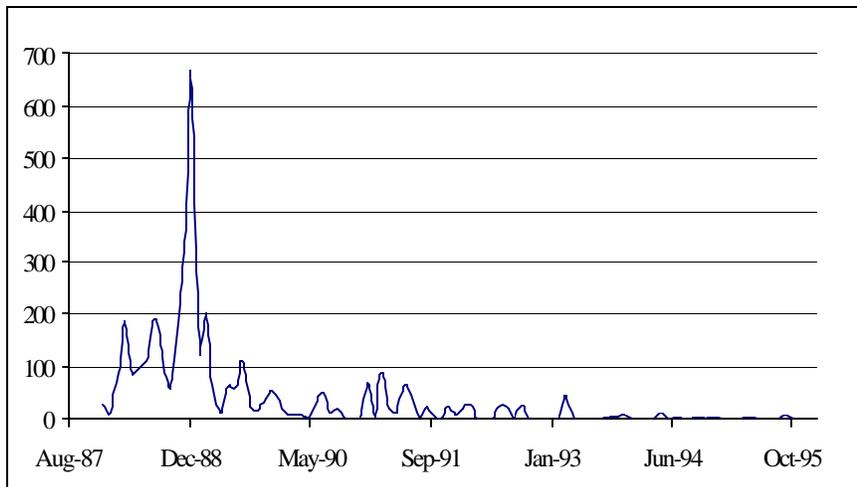
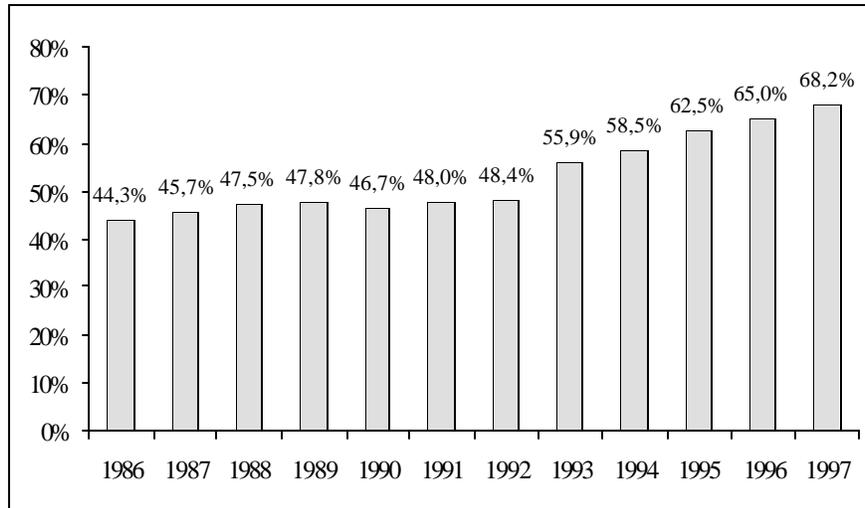


FIGURE 4
ELECTRICITY COVERAGE IN PERU



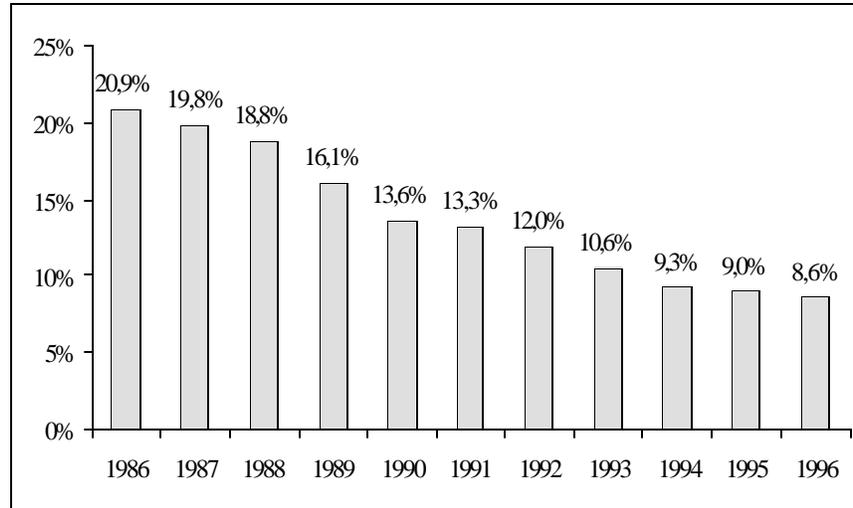
Distribution losses have shrunk in several countries where deregulation has taken place: losses in Chile, energy theft included, were halved in seven years (Figure 5) and in Argentina, in just three years.

The flow of capital to the region from other parts of the world has also been a welcome result. Countries that have restructured and privatized their electric power industries have attracted investments from numerous U.S., Canadian, French, Portuguese and Spanish companies, that face limited demand growth in their own countries.

IV. MANAGEMENT AND COMPETITION

The creation of competitive markets in a once fully monopolistic activity has created significant challenges in power companies' management. The evolution from "State protected companies that provide electricity at a given cost" to "private firms that compete to offer a commodity at the resultant prices" has been a crucial free-market process that has implied new management requirements. Private electric utilities bid publicly against

FIGURE 5
ENERGY LOSS REDUCTIONS IN CHILE (TECHNICAL AND NON-
TECHNICAL DISTRIBUTION LOSSES)



one another for the opportunity to supply large industrial and mining complexes with electricity. Generators also compete to supply price-regulated distributors. The utilities, while competing, must take action to increase their returns and respond to their stockowners.

Financial and commercial departments have been strengthened, within new organizational structures that focus on selected business activities. Companies wanting to maintain their market share face important financial requirements to respond to load growth rates of 5 to 14 percent a year. Without the traditional support from the State in securing loans, companies must demonstrate their financial strength to multilateral funding sources. Financial departments have had to adapt to these new requirements, to keep adequate financial indexes.

Commercial activities have also been reshaped, with regular market appraisements and contract strategies being developed, aimed at reducing business risks. Aggressive plans to reach potential clients have also been put in place. Sensitivity toward public image has also increased in the competitive framework, with distribution companies completely reorganizing their customer services and billing systems. Computerized distributed networked offices have spread, improving response to consumers

(both in the quality of service to current consumers as well as in reducing the connection times for new applicants).

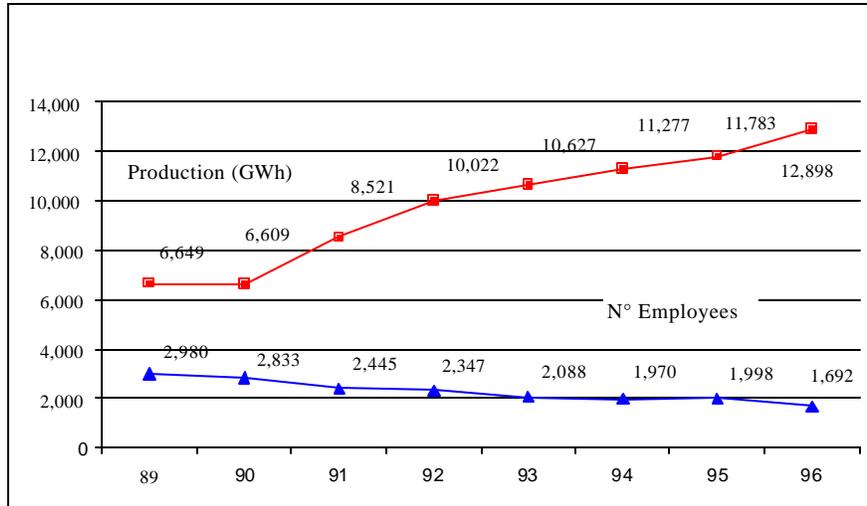
The restructuring process has advanced further, with both the creation of subsidiaries and the conception of new businesses related to the electricity market (as diverse as fuel, ports and shipping, engineering, computer services, road infrastructure, etc.), all within a decentralized framework. The objective has been to create independent companies that are then made to grow by serving new clients.

New management approaches to labor relations and to deal with worker unions had to be developed. State companies were often overstaffed. Downsizing and outsourcing made old jobs disappear and brought new jobs into being. Labor force productivity has increased in all the countries where restructuring and privatization have taken place. In Chile, for example, the number of customers per distribution worker more than doubled in 10 years, and dramatic growth in electricity production has accompanied increasing productivity (Figure 6).

Besides improving their management practices, utilities have had to incorporate technology in all those areas that noticeably affect income. More efficient maintenance, upgraded or replaced equipment, and more sophisticated control systems for a tighter use of installations—all have been used to increase reliability and postpone further capital investment. Development has been stimulated by the search for more efficient technologies in generation equipment as well as cheaper energy resources. Many investors have sought to build combined-cycle gas units, with related investments in transporting natural gas across international frontiers. Consequently, as indicated further on, South America will soon have an international network of natural-gas pipelines.

A chronic problem in Latin America has been the illegal use of electricity, which usually imposed severe burdens on the utilities. Losses over 20 percent were not uncommon, and even now, some utilities in Venezuela lose more than 50 percent of the energy bought. A political solution chosen by some countries had been to spread this burden among all paying consumers, assuming electricity theft as a social problem. However, in the new regulatory schemes, where distribution companies are asked to compete with a model or a price cap, control over these strictly non-technical losses is necessary if company revenues are to be increased. Creative solutions have been developed jointly by public

FIGURE 6
PRODUCTIVITY INCREASE - ENDESA EMPLOYEES AND ENERGY
PRODUCTION



authorities and private companies. Governments have provided financial facilities to cover unpaid electricity bills, while firms affected by the problem have taken managerial actions and have developed new distribution technology and hardware. Companies in Chile have designed and installed distribution lines that are protected through the use of low-voltage braided conductors, concentric conductors for hook-up points, and high-voltage power lines with small distribution transformers. Meter protection schemes as well as common feeders for shantytowns were also developed.

Another important managerial decision was to search for new markets where previous experience could be used. The advantage of knowing how to work in a deregulated environment proved useful for Chilean companies browsing for new businesses abroad. Chilean managers have made their companies grow into electricity multinationals involved in generation, transmission and distribution investments in Argentina, Bolivia, Peru, Brazil and Colombia—and waiting for better conditions in Venezuela and Mexico. Chilean companies Gener and Endesa own more installed generation capacity outside the country than inside. In addition to Santiago, three other capital cities, Bogota, Buenos Aires and Lima are now supplied by

Chilectra, which thus serves 39%, 15%, 17%, and 17% of the Chilean, Colombian, Argentinean, and Peruvian populations respectively.

V. LESSONS IN THE CREATION OF COMPETITIVE MARKETS AND REGULATION OF MONOPOLISTIC ACTIVITIES

The creation of competitive markets in South America has not developed without problems, particularly in the oversight of competition and in the regulation of the related monopolistic activities. Specific regulatory features of the Bolivian, Chilean and Colombian models are analyzed herein, as well as the difficulties faced in their implementation.

A. *The independent operator in Chile*

Chile has two interconnected systems, the largest one being 4858 MW, 22424 GWh (1996), with a 500 kV and 220 kV transmission longitudinal grid.

The market model assumes that a central dispatch is needed to clear the market [Rudnick, Varela and Hogan, 1997], thus playing the Adam Smith role. According to the law, companies engaged in the generation of electricity in Chile must coordinate their operations, through one autonomous entity integrated by the principal generating companies for each interconnected network, known as the Economic Load Dispatch Center (CDEC). The CDEC, as an independent operator, plans and coordinates the plants' operation to ensure secure and economic efficiency in the electricity system, irrespective of ownership. Demand is therefore met by dispatching the available plants according to their variable production costs, from lowest to highest, and is thus always done at the minimum attainable cost. The underlying assumption is that with perfect competition, prices would equal the optimal marginal costs. Another assumption was that pool governance was to be better achieved by agreement among all participants. Therefore, the law sets forth that agreements at each CDEC are to be achieved unanimously; otherwise, the Ministry of the Economy intervenes.

Generation companies meet their contractual sales requirements with dispatched electricity, whether produced by themselves or purchased from other generators in the spot market. Therefore, they sell to the following three markets:

a) Spot market: includes energy transactions between generating companies,

from those able to generate more than their contractual commitments according to the optimal operation of the system (surplus companies) to those with production levels below their commitments (deficit companies). Transfers are determined by the CDEC and are valued hourly at the system's marginal cost of operation.

b) Unregulated market: made up of consumers with a connected capacity of over 2 MW, normally industrial or mining companies. These customers are not subject to price regulation and may freely negotiate electricity supply prices with generating or distributing companies.

c) Regulated market: constituted by consumers whose demand is 2 MW or less, usually located within a distribution company's concession area (typically residential, commercial, small and medium industrial customers). Sales of generating companies in this market are made to the distribution companies, under regulated prices determined by the Ministry of the Economy. To ensure price stability, the National Energy Commission (NEC) sets them for six month-periods, based on projected marginal costs in the system. These projected prices are checked with those prevalent in the unregulated market, and adjusted if outside a 10 percent band. The regulated prices somehow provide a hedging mechanism for generators signing contracts with distribution companies.

The CDEC in the central system started operating with a specific bylaw enacted in 1985. It operated well for over ten years, with competition taking place on cost of supply (efficiencies were increased by generators, new technologies such as combined cycle gas units are being introduced) and on commercial actions (contract portfolios). However, as extreme drought conditions damaged hydro businesses, as competition increased and prices decreased with the arrival of natural gas, unanimous agreements became the exception. Disagreements arose on the determination of spot prices, on capacity payments, on the dispatch models, on transmission modeling and on operation security strategies, as each matter has an incidence on marginal prices and company income. Therefore, the regulator has been essentially directing the actions of the pool, with no interest to do so. Even reliability was endangered by the disagreements, and fines had to be applied to participants because of a recent blackout. The government has defined amendments to the bylaw, that will increase the number of participants (transmission and smaller generators, to respond to criticism by outside parties that the CDEC acted as an entry barrier to

new agents) and introduce an expert committee to act as an intermediate problem resolution level. Reliability obligations as well as fines are also being increased.

B. The open-access transmission scheme in Bolivia and Chile

Most countries in South America have chosen a nodal pricing scheme, with a two-part tariff for transmission services, adding supplement tolls to an income resulting from nodal prices, to cover replacement costs [Pérez-Arriaga, Rudnick and Stadlin, 1995].

All the countries, except Peru, have allocated the payment of tolls to those who make a “natural” use of the lines, where natural use is measured on the basis of incremental impact at optimal dispatch. The payments have no relation with commercial use and contracts among agents. The argument is that natural use determines the pressure over the transmission network imposed by generators and consumers, simply because they are connected to the grid, irrespective of their commercial supply agreements. The argument behind this tariff scheme is that those agents that cause transmission expansion have to take into account those costs in their investment decisions, as either generators or consumers. Argentina and Chile consider that generators, needing to reach the market, are fully responsible for transmission expansion and have to cover tolls. Bolivia distributes responsibility among generators and consumers.

Another central difference arises. While Argentina and Chile evaluate the natural use of transmission considering incremental impact at peaking conditions, Bolivia averages impact at different load levels. The first approach assigns responsibility to agents using maximum transmission capacity (assuming each line is used at its height at system peaking time). The second approach attempts to measure economic use in a full cycle of system utilization, corresponding to an energy flow approach rather than to a power flow one. It assumes that transmission line design and investment are conditioned by the flow of energy.

These incremental approaches have in practice proved to be very troublesome [Rudnick, Palma and Fernandez, 1995]. Disputes have arisen in Bolivia and Chile among agents on use determination, dispatch models utilized for that purpose and marginal bus location. In fact, the natural use is conditioned by the location of the marginal bus in the system’s economic dispatch. If the location varies over time, so does the allocation of

transmission tolls among generators and consumers, and within each of those two groups. Generators have complained in the Bolivian system that variability of the toll does not provide a stable coherent economic signal for system expansion; while in Chile, generators disagree on the dispatch model to use and its representation of transmission. Neither scheme has a clear definition on how network restrictions and the economic decoupling of system parts are to be handled in relation to transmission pricing.

Disputes in Chile have given rise to a sort of competition in transmission expansion, with generators developing their own transmission when no agreement has been reached with the main transmission owner [Rudnick and Raineri, 1997a]. Recently, a generator built a 220 kV double circuit to reach the Santiago market, instead of using the existing 500 kV lines. While this may, from the social point of view, imply uneconomic system expansion, it provides a way to contest the transmission monopoly.

C. System restrictions, market power and the regulatory agency in Colombia

Colombia has been the exception in South America in its working with the British model, which views all generation as being at a single point. The system size is 10600 MW, 77% hydro, 42412 GWh, 83% hydro (1996), with a 500 kV and 220-230 kV transmission grid. It works with a single bus generation market, where the 19 players bid into a pool, which corresponds to a multi-unit, last price, and sealed bid, day ahead auction.

The market design considers that the larger the market, the better the competition among generators; and that the closer the grid to an unconstrained network, the better [Benavides, 1997]. An unrestricted merit order ideal dispatch is made based on bids. Then, a real dispatch considering restrictions is performed, therefore reaching an ideal supply and demand equilibrium. Transmission grid weaknesses (transformation restrictions, line capacity limitations and compensation requirements), minimum water storage requirements and machine inflexibility modify the ideal dispatch and determine payments to constrained generators (which are unable to generate as in the ideal case). Out of merit generators, about 35-40 percent of generation, are paid based on bids. This condition severely undermines competition, with those out of merit generators achieving a powerful market power, by knowing in advance that they will be dispatched,

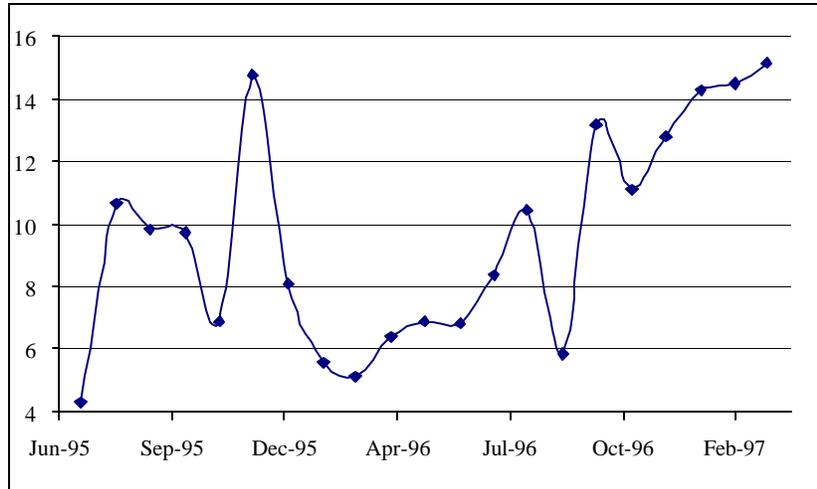
irrespective of their bids. Attempts by the regulator to restrict their offers to marginal costs have been unsuccessful. Figure 7 shows the evolution of the restriction costs (payments to dominant generators and opportunity costs to non dispatched generators) from 1995 to 1997. These costs are allocated as a postage stamp, 50 percent to generators and 50 percent to suppliers. Much discussion has taken place on alternative measures to reduce the climbing figures and transform the restrictions into economic signals that guide agents' individual decisions. The responsibility of the passive Transmission Company on system expansion, paid by ex-ante use of system fees, is another issue, particularly on the matter of investments to lift network restrictions.

One issue that often arises in the new energy market environments in South America is that of the independence and autonomy of the regulatory agencies controlling monopolistic activities as well as the appearance of dominant players in the competitive market. It has not been an easy process to set up these agencies in a region without a regulatory tradition. The new agencies have been questioned in Bolivia, Chile and Colombia. In the latter, the regulatory developments have been guided by the Commission for Energy and Gas Regulation (CREG), which has been successful in setting up the competitive wholesale market, but not as much in controlling market power [Ochoa, 1998]. The CREG was thought as an independent body that would define and sustain clear, transparent and non-discriminatory rules of the game, free from the interest of the different private agents and the short-term political interests of the government. In practice, the agency has encountered strong pressure from all parties and it has been criticized as being too dependent on government decisions. Even worse, some agents are using the Congress, a political body, to press for changes in CREG regulations and some new laws have been proposed with that objective.

D. The distribution pricing scheme in Chile

A fundamental reform in the Chilean case was the introduction of "pseudo" market principles in the electrical distribution activity for end customers, a stage of the electrical chain where competition is not considered feasible. As this activity was to be developed through geographic monopolies, it was considered necessary to introduce economic efficiency incentives to the provision of this end service. Different from the United States, or different from Chile itself before the reform, where the

FIGURE 7
COST OF RESTRICTIONS IN COLOMBIA (MILLION DOLLARS)



distributors are paid in function of their accounting costs, the new distribution tariffs try to make the private monopoly to “compete” with a reference efficient model firm, with a “yardstick competition” or “benchmark regulation” approach. It basically corresponds to a competition by comparison with a reference firm, where a specific profitability for each distributor is neither assured nor limited, depending on the results of its relative efficiency compared with the reference model upon which base the tariffs are calculated.

Therefore, an additional distribution component is added to the regulated generation and transmission prices. This value added component (VAD) recovers costs of operation, including allowed losses, and a return on investment of “efficient” distribution companies. It is based on the new replacement cost of assets employed in distribution with different efficiency standards applied to operation and system expansion. The tariff is not based on actual costs incurred by any given distribution company, but on investment, operation, maintenance and general administrative standards and overall efficiency of operations of a model company, which is used as a benchmark.

VAD values are determined every four years. Tariff studies are performed both by the NEC and by the distribution companies. Each party hires specialized consultants to perform a parallel tariff study. The tariffs are calculated as a weighted average of the results of the NEC-commissioned study and the companies' study, with the results of the NEC's study bearing twice the weight of that of the companies.

The VAD studies provided increasingly diverging results, as obtained by the NEC consultants and those of the distribution firms [Rudnick and Raineri, 1997b]. This became critical in 1992 and drove the parties to intense negotiations and some companies appealed before the Justice Courts, but with no success. This caused public turmoil and mutual recriminations throughout the national press and a severe impact on the Stock Exchange. The scope of the conflict went beyond tariff fixation due to the important presence of Pension Funds as owners of distribution firm's shares, which started to fall. With this information, in the 1996 tariff process all the involved parties made an important effort to revert this diverging historical trend. They agreed to reduce room for divergence and to focus their efforts on deep technical and economic analysis on the construction of the model reference firms. The differences in the studies in terms of the trend seen in former processes were substantially decreased. In spite of this initial positive exercise of convergence between the parties, the conflict still developed. Ultimately, the process ended at the Legal Courts. After a lengthy process that ended up in the Supreme Court, tariffs were set recognizing arguments filed by both the regulating and the regulated parties. Nevertheless, the Court decided mainly on procedural matters, leaving open the essential issues discussed. The handling of economies of scope and the characterization of the small endconsumers were among the diverging issues.

The Chilean government is assessing changes to the regulation. Different venues of future conflict solution have been stated. The need is there to continue the improvement of the VAD process methodology. In addition, the idea of using an arbitrating arbitrator has been considered, since it has been done in other cases in the electricity law.

No plans are considered to introduce retail competition. Efforts are concentrated on extending open access to distribution systems to increase competition on supply to larger-than- 2MW consumers. Retail consumers would benefit in the end, as regulated prices calculated by the NEC must

follow average competitive prices.

Other countries are exploring improvements to the Chilean scheme. Peru decided that only one study would be developed by the distribution companies, supervised by the regulator. Conflict equally arose on the resultant values. Bolivia chose a price-cap RPI-x approach, but the evaluation process is still in progress to draw any conclusions on results.

Ending a tariff process or any regulatory development in the Supreme Court is a matter of concern world-wide, as legal courts often do not have the technical or economic expertise to adequately handle such issues. Final arbitrator arbiters are seen as adequate alternatives in Chile and the creation of specialized legal courts dealing with economic matters is also being assessed.

VI. INTEGRATION OF THE ENERGY SECTORS

The structural changes that are taking place in Latin-American economies coupled to the privatization process have also accelerated energy industry globalization [Hammons *et al.* 1997]. Regional energy integration initiatives are developing that seek to reduce energy costs in front of stand-alone national systems. Electricity and gas are the most dynamic areas of the energy integration process and they develop hand to hand. While all power generation in Brazil and Paraguay is presently produced by hydroelectric plants, Chile, Colombia and Peru incorporate some coal thermal generation, still hydroelectricity covering most of the demand. Natural gas is abundant in Argentina, Peru and Bolivia and appears as an attractive alternative to respond to large demand growth in neighboring countries, particularly because natural gas is easy to use, has a low cost and significant environmental advantages. Natural gas network international interconnections are developing determined largely by the use of natural gas to fuel combined-cycle power plants.

Similar assessments are being made on the advantages of electricity interconnections. Argentina's power transmission network is already linked to those of Paraguay and Uruguay by interconnections associated with hydroelectric projects. Interconnections between Argentina and Brazil are being developed, while interconnecting Argentina and Chile is being considered.

The energy integration process and the growing energy exchanges raise different issues for the private parties and governments involved, where

new economic, political and regulatory matters need to be faced. Economic issues that need to be dealt with include import duties and how they impact producers and consumers, the need for consistency among the different economic signals (as they impact the use of and investment in competitive energy resources), and finally, the existence or not of cross subsidies in prices (providing protection for one energy producer against another producing a different energy product, like for example oil derivatives against coal, electricity against natural gas).

Among the political issues it is not easy to deal with a history of border conflicts between countries, that have even caused wars. The old concept of energy as a “national security” resource is present in many nations, mainly among the military hierarchy, with a deep fear of energy dependence. These fears are being overcome through the signing of bilateral and multilateral agreements, supported by a return of democracy and political stability to the region. The globalization of the markets in what has been termed “diplomacy of economics” is also supporting a change of the political atmosphere. International energy consortiums with complementary partners that support each other across political State boundaries are developing everywhere and furthering the cause of energy integration.

Among the regulatory issues that arise in the integration process, there is concern about how differently each country has structured its energy markets (mainly gas and electricity), allowing or not vertical integration. Although, as indicated, most countries have chosen similar paths for restructuring the energy industry, introducing competition where feasible, questions remain on the treatment of the monopolistic activities. Questions arise on the regulation of international transportation service (gas or electricity), with issues emerging on exclusive concessions, open access obligations, public service duties, regulation of prices and price differentiation, among other issues.

VII. CONCLUSIONS

State-owned electricity monopolies still exist in Brazil, both at the the Federal government and at the State level. However, privatization steps have been taken in the power distribution and generation areas, with specific contracts between the buyers and the government. Behind the privatization

process is the need for investment to support a growth of 1350 MW a year of new generating capacity over the next ten years, that is over two thousand million dollars a year. In parallel, the Federal government has initiated a global restructuring plan to demonopolize the industry and introduce incentives for competition. Changes included the creation of a new regulatory agency. The market design considers an Independent System Operator (ISO), responsible for operation and dispatch, using hydroelectric data as well as thermal fuel costs, and determining spot prices based on the resultant marginal costs evaluated with computer dispatch models. Bid schemes were considered incompatible with the predominantly hydro characteristic of the system. The ISO and the operation of the wholesale energy market are due to start in September 1998.

Government-owned monopolies still run the electricity sectors in Mexico, Paraguay and Uruguay and most of Ecuador and Venezuela. Incipient restructuring efforts have taken place, but the final structures are being discussed.

In the rest of Latin America, the electricity industry reforms have been dramatic, with all agents involved compelled to increase their efficiency, in either supply or demand. The challenges have posed difficult questions to all concerned, particularly as competition increases beyond geographical and political boundaries. Private generation investment has taken place without government intervention, increasing supply in countries where electricity growth is a basic requirement for economic development.

Market design has been based on a new understanding of the technical and economic characteristics of the market. Without any previous models or experiences to rely on, problems in achieving truly competitive markets have been encountered. The paper contributes with an assessment of these problems and identifies challenges to further introduce competition.

The creation of competitive markets has also implied significant demands in electric companies' management. The paper recognizes contributions in this area, but the subject clearly merits further analysis to be able to make proposals for the future.

Countries outside the region have examined with interest these reforms and have benefited from their design of competitive markets. Advisers to Mrs. Margaret Thatcher in the UK learned directly from the Chilean reformers before starting their world known privatization of the state-owned Central Electricity Generating Board. Even China is observing the South American experience and its initiatives to create wholesale markets.

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