SOUTH AMERICAN EXPERIENCE IN DEREGULATION OF THE ELECTRICITY ENERGY INDUSTRY

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Abstract The broad transformation of the electric energy industry in Latin America has no parallel worldwide. The commoditiy began in 1982 when Chile formalised an electric power reorganisation. Argentina followed in 1982, then Peru in 1993, Bolivia and Colombia in 1994, the Central American countries and Brazil joining the group in 1997. Venezuela has also initiated a similar path. The paper reports on these developments, with emphasis on the experience of the South American countries.

Keywords South America, electricity industry, deregulation, regulation, privatisation, industry organisation, energy business.

1. INTRODUCTION

Latin America is a region in 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 slow downs like that of Mexico. Significant economic reforms are giving shape to market economies with increasing economic growth. Geopolitically reasons are making the USA and Europe look with increasing interest to investments in the region, some of these being transferred 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 Nato links between USA-Canada and Latin-American countries and the new Mercosur pact, that created an integrated market of 200 million people over a area of 12 million square kilometres, incorporating Argentina, Brazil, Paraguay, Uruguay plus Bolivia and Chile.

The electric energy industry in Latin America has faced a profound transformation, with no parallel worldwide. New electric sector regulations were set in Chile in 1982, Argentina in 1992, Peru in 1993, Bolivia and Colombia in 1994, the Central American countries of Panamá, El Salvador, Guatemala, Nicaragua, Costa Rica and Honduras in 1997. Brazil is also joining the group and Venezuela has initiated actions. The paper reports on these developments, particularly on the South American experience.

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

II POWER SYSTEM DEVELOPMENT

Electric power was introduced in Latin America soon after electric light was inaugurated in New York City and London at the end of the eighteen-century. Initially the power sector developed based on private investment, with no special regulation. 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, the governments seized the initiative and from the '40s to the end of the '70s put aggressive electrification programs into effect. Eletrobrás in Brazil, Endesa in Chile, Electroporá in Peru, ISA in Colombia, and Ende in Bolivia were among the national electricity companies that were 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.

Figure 1 Per capita electricity consumption (kWh, 1996)

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 Argentincan electricity system was accompanied by a severe deterioration of the electricity service under State hands. In Colombia, prolonged power
rationing had to be decreed because of its limited thermal generation development confronted by weather 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 Perú, governments were failing to raise enough funds for the electricity sectors, yet at the same time subsidising rates for poor users. A similar situation is present in Venezuela and the Central American countries.

III DEREGULATION, REREGULATION AND PRIVATIZATION

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

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. Market forces are recognised 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 finally privatising the activities and property of the electricity companies has been recognised as necessary for the efficiency and stability of the system. Speeding up the process, international lending banks started making loans conditional on the initiation of privatisation or deregulation processes.

In the essence of changes, there is change of paradigm in the understanding of the electricity business, recognising essentially different economic characteristics in the stages of generation, transmission, and distribution.

Generation is recognised 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 recognised as the stage where a competition environment can be stimulated. The drive for deregulation has been emphasised in this sector. Insipid of that, the Southamerican 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, pretending to stimulate efficient behaviour of companies in those monopolistic activities.

Transmission, because of both lumpy investments and the need for redundancies to meet security requirements, is recognised as the part of the chain where there are economies of scale. Power lines with higher nominal voltage and transmission capacity have a lower average cost per unit of power and per kilometre 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 economics 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, giving geographical concessions to distribution companies that must supply electricity to all consumers in the area, with regulated tariffs and quality.

With this knowledge, 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 yard stick regulation. New pricing systems are introduced, where both generation and transmission businesses have operational or capacity expansion marginal prices or both. Distribution service is priced based on 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 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 (Argentina, Bolivia, and Perú, but they were not defined in Chile where market power has developed). Argentina and Bolivia further limited any generating company from holding more than 10 percent 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, Perú, 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 Perú, Colombia, and Bolivia left the transmission system under the control of a single company, Argentina and Chile have relied on market forces, favouring the development of several private transmitters.

Argentina, Chile, and Perú 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 with inflation plus a yearly efficiency reduction.
Different privatisation schemes have been used in each country. Private pension funds provided financing for the privatised 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 privatisation program called "capitalisation". 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.

IV 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 neighbouring 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 countries that have restructured and privatised their electric power sectors have attracted investments from numerous U.S., Canadian, French, Portuguese and Spanish companies, with limited demand growth in their own countries. Chilean companies have grown into electricity multinationals present in generation, transmission and distribution investments in Argentina, Bolivia, Peru, Brazil, Colombia—and waiting for better conditions in Venezuela and Mexico. Chilean companies Chiligen and Endesa owe more installed generation capacity outside the country than inside. In addition to Santiago, three other capital cities, Bogotá, Buenos Aires and Lima are now supplied by Chilcatra, which thus serves 39%, 15%, 17%, and 17% of the Chilean, Colombian, Argentinean, and Peruvian populations respectively.

 Employment opportunities have undergone a metamorphosis. Downsizing and outsourcing have brought new jobs into being and made old ones disappear. Productivity of the labour force has increased in all the countries where restructuring and privatisation has 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 coupled to increasing productivity (Fig. 2).

The impact of the changes on the quality of service has been no less remarkable. In Argentina, availability of thermal generation plant has risen significantly. An extraordinary reduction in non-served energy has taken place (Fig. 3), coupled to energy price reductions in the contract market (Fig. 4). Nevertheless, prices not necessarily have decreased everywhere; in Peru they increased over two times when subsidies to final consumers were eliminated.

Distribution losses have shrunk in several countries where deregulation has taken place: losses in Chile, energy theft included, were halved in seven years (Fig. 5) and in Argentina, in just three years. During roughly the same period in Argentina, investment in the generation-transmission distribution chain dropped from $6000/kW of installed capacity to around $2000/kW, indicating a tripling of the productivity of money put into the system.

At the same time, very strict electric quality standards have been set in Argentina, Bolivia, and Peru, with penalties for not complying. More efficient maintenance, the upgrading or replacement of existing equipment, and more sophisticated
V CHILEAN STUDY CASES

Two regulatory features of the 1982 Chilean electricity law, common in concept to those of other countries, are described, as well as the difficulties faced in their implementation.

The independent operator

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 Economic Load Dispatch Centre (CDEC). The CDEC plans and coordinates the operation of the plants 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. Agreements in 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 them or purchased from other generators in the spot market. Therefore, they sell to the following three markets:

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.

Free market: made up of consumers with a connected capacity of over 2 MW, normally industrial or mining companies. These are customers who are not subject to price regulation and able to freely negotiate electricity supply prices with generating or distribution companies.

Regulated market: constituted by consumers whose demand is 2 MW or less, located within a distribution company's concession area and customers of that company (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, they are set for six month-periods by the National Energy Commission (NEC) based on projected marginal costs in the system.

The CDEC in the central system started operating with a specific bylaw enacted in 1985. It operated well over ten years, with competition taking place on cost of supply (efficiencies were increased by generators, new technologies 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 the dispatch models, on...
transmission modelling and on operation security strategies, as each matter has an incidence on company incomes. 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 given a recent blackout. The government is assessing changes to the bylaw, considering increasing the number of participants (transmission, smaller generators), a government observer incorporated, while at the same time introducing a two-thirds majority ruling. An expert committee is to act as an intermediate problem solution level. Reliability obligations as well as fines are also being increased.

The distribution pricing scheme

A fundamental reform in the Chilean case was the introduction of “pseudo” market principles in the electrical distribution activity for end customers, 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 United States, or different from Chile itself before the reform, where the 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 not 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, operating, 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 specialised 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. This became critical in 1992 and drove the parties to intense negotiations and some companies appealed before the Justice Courts, but those appeals were not accepted. This caused public turmoil and mutual recriminations through the national press and a severe impact in the Stock Exchange. The conflict had a scope that went beyond the tariff fixation due to the important presence of Pension Funds as owners of distribution firm's stock values, which started to fall. With this information, in the 1996 tariff process all the involved parties made an important effort to revert this increasingly diverging historical trend. It was agreed to reduce the divergence spaces and to centre the efforts in 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 eminently 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 in the Supreme Court, tariffs were set recognising arguments filed by both the regulator and the regulated. Nevertheless, the Court decided mainly on procedural matters, leaving open the essential issues discussed.

The government is also assessing changes to the regulation. Different avenues 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 arbitrator arbiter has been considered, as it has been done in other cases in the electricity law.

VI INTEGRATION OF THE ENERGY SECTORS

The structural changes that are taking place in Latin-American economies coupled to the privatisation process have also accelerated the globalisation of the energy industry. Regional energy integration initiatives are developing seeking 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 in hand. While all power generation in Brazil and Paraguay is presently produced by hydroelectric plants, Chile, Colombia and Perú incorporate some coal thermal generation, still hydroelectricity covering most of demand. Natural gas is abundant in Argentina, Perú and Bolivia and appears as an attractive alternative to respond to large demand growth in neighbouring countries, particularly given natural gas case of use, 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 those between Argentina and Chile are 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 the matter of import duties and how they impact producers and consumers, the need for coherency among the different economic signals (as they impact use and investment in competitive energy resources), and finally, the existence or not of cross subsidies in prices (providing protection of 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 has 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 globalisation of the markets in what some name the "diplomacy of economics" is also supporting a change of the political atmosphere. International energy consortiums with complementary parties 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, concern arises on 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.

Interesting developments are taking place in the energy exchanges between Argentina and Chile, illustrating the different issues involved as well as how competition can interlink both the gas and electricity businesses. Two examples make the point.

From 1994 to 1996, a "war" developed between two natural gas pipeline projects that were to transport natural gas from southern Argentina to central Chile. It was locally known as "the war of the gasducts". The main actors were two Chilean privately owned generating companies, Chilgener and Enadesa. Chilgener developed the GasAndes project with NovaCorp, the Chilean Gasco and others, for a 465 km pipeline crossing the Andes directly to Santiago, with 1000 million dollars to be spent in transport and distribution. Enadesa developed the Gasoducto Transandino project with Tenneo, British Gas, the Argentinean YPF and others, for an 810 km pipeline crossing the Andes directly from the gas fields in southern Argentina. The pipeline would then travel from southern Chile to Santiago, with 1700 million dollars to be spent in transport and distribution. Wide and bitter discussions developed. State intervention was requested, the House of Representatives resolved to favour the Enadesa alternative. It was always clear that both projects would provide overcapacity; therefore, both were not economically feasible. It did not help that there was no available regulation for gas exchanges between countries. Finally, agreements were signed between Argentina and Chile, lifting all limitations for exchanges, in practical terms governments stayed aside the competition, favouring market decisions. At the end, only the GasAndes project was built and it brought natural gas to Santiago on August 1997. It ensured contracts with several new combined cycle gas turbines generating plants, the first one starting operation on October 1997. The private sector is thus responding to electricity demand growths of 10 % a year in the southern system. A similar war soon started in the northern system, "the gaseducts-electric war". The matter at hand, northern Chile flourishing with mining developments that are thirsty of electric energy, demand growing at a pace of 12% to 15% a year. Three projects compete, one international electric transmission line transferring energy from combined cycle plants in northern Argentina and two gas pipelines feeding generation plants in northern Chile. Bidding stages are taking place, success of each project dependent on contracts with major generators and large consumers. Again, governments are challenged as there is no available regulation for electricity exchanges between Argentina and Chile. At the end, competition is being achieved with the final consumer becoming the long term beneficiary of price reductions and more reliable energy supply.

VII CONCLUSIONS

State-owned electricity monopolies are still in place in Brazil, both at the level of the Federal government and of the States. However, privatisation steps are been taken in the area of power distribution and generation, with specific contracts between the buyers and the government. In parallel, the Federal government is studying a global restructuring plan to demonomolize the industry and introduce incentives for competition. Changes announced include the creation of a new regulatory agency by the end of 1998. The new regulatory system is expected to set forth a mechanism for determining generation, transmission and distribution rates in a competitive context, taking into account the interconnected hydroelectric power system in Brazil, regional variations across the country, differences in the marginal costs of producing energy among the various generation facilities and public needs. Behind the privatisation process is the need for thirty thousand MW of new generating capacity over the next ten years, requiring investments of 20 thousand million dollars.

Government-owned monopolies still run the electricity sectors in Ecuador, México, Paraguay and Uruguay and most of 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, either in supply of 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.

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