Electric sector deregulation and restructuring in Latin America: lessons to be learnt and possible ways forward

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Abstract: The pioneering restructuring and deregulation process of the electricity industry, which started in Latin America as early as 1982, is assessed. Chile and Argentina, among others, have been at the forefront of innovation in the creation of electricity markets. The experience gained and the principal difficulties encountered in these 18 years are reviewed, highlighting the weaknesses and successes of the deregulation processes. A review is made of the challenges and prospects for development of the electrical sector in the region, where energy integration across countries flourishes and world energy players have started acquiring regional utilities. Regulations and market structures are being evaluated, and countries are introducing changes, the danger being that the remedies being considered may be worse than the disease.

1 Introduction

The electric energy industry in Latin America has undergone a profound transformation [1, 2], with no parallel worldwide. New electric sector regulations were set in Chile, in 1982, in Argentina in 1992, in Peru, in 1993, in Bolivia and Colombia, in 1994, and in the Central American countries of Panama, El Salvador, Guatemala, Nicaragua, Costa Rica and Honduras, in 1997. Brazil also joined the group and Venezuela, Mexico and Ecuador have initiated actions. Most of the countries of the region have followed the Chilean model (Peru, Bolivia and Argentina, in a first stage), whereas Colombia followed the English approach.

The diversity in the size of the countries and power demand is striking, but, as a whole, the Latin American market is comparable with the North American one if growth is used as the measure. The Canada and United States market has an annual growth of 7500 to 15000MW, whereas Latin America needs 10000MW a year. The level of electricity consumption is still low, if compared with the industrialised world, so that there is much room for further growth as these economies develop further.

The diversity of the countries’ electrical sectors complicates an integrated analysis. However, it is possible to indicate that, even though the reasons for the beginning of the processes were different between the countries (supply crisis, management inefficiencies, lack of resources for investment etc.), most of them have successfully achieved the objectives outlined at the beginning of the reforms.

With diverse problems arising in the liberalisation process, regulations and market structures are being evaluated, and countries are introducing changes in a process that has its parallel in Europe [3] and the United States.

2 Achievements of deregulation of electrical sector in Latin America

The reform processes followed by the different countries in the region have been very similar, based on a central change in paradigm for the electrical business. The paradigm has evolved from a vertically integrated business conception driven by the State, to one in which substantially different economic characteristics are recognised in the generation, dispatch, transmission, distribution and supply stages. Competition among private actors is established as the mechanism to assign resources in generation and supply, with the State regulating dispatch, transmission and distribution activities.

The original objectives that drove the reform process aimed at maximising the benefits to society and the establishment of efficient economic conditions in the industry, creating competitive markets in all possible segments and efficient regulations where this was not feasible. The purpose was to achieve the development of low-cost energy supply, with economic reliability levels and quality of service, increasing the efficient use of energy and reducing losses. On the other hand, governments have strongly encouraged private investment, evolving from the traditional entrepreneurial role of the State to a regulator role. National, state-owned, vertically integrated companies have given birth to many companies in generation and supply, that compete to provide electricity to the industrial consumers and end consumers.

Significant achievements have resulted from the reforms, although this varies from country to country. Inadequate investment in new generating, transmission and distribution capacity to balance fast-growing demand has given place to private investors competing to develop a new infrastructure. Costly shortages are the exception more than the rule. Capital has flooded in from North America and Europe, which see the Latin American sector as the best place for investment in energy.

Inefficient state management of electric utilities, with low labour productivity, has given way to efficient, competitive private companies that search for new opportunities to
reduce costs and increase revenue, while increasing energy production. Non-technical losses (originating in energy theft) have been reduced drastically, to the benefit of shareholders and consumers. In Chile, the losses at distribution level were reduced, by half in seven years and, in Argentina, this occurred in only three years. Labour productivity in distribution has more than doubled; energy generation per worker has more than tripled in some companies.

Companies previously constrained by country boundaries have grown to be energy multinationals. This was the case first with the main Chilean companies that are present, with investments in generation, transmission and distribution, in Argentina, Bolivia, Peru, Brazil, Colombia and Central America. Gener and Enersis own more installed generation capacity outside the country than within. In addition to Santiago, other important cities (Bogota, Buenos Aires, Lima, Rio de Janeiro and Fortaleza) are supplied by Enersis, through subsidiaries, supplying about 51%, 22%, 19%, 24% and 5% of the Chilean, Colombian, Argentine, Peruvian and Brazilian populations, respectively. These multinationals have later served as the platform for European investors to settle in the region.

but on a downward trend (Figs. 1 and 2) given regional energy networks (mainly gas) and new technologies (mainly combined cycle ones). This has been followed by opportunities for large consumers (qualification levels of large consumers reducing drastically with time) directly to negotiate prices face to face with producers. This has increased the number of contracts, permitting the participation of a greater number of agents in the electrical market.

Very strict electrical quality requirements were incorporated early in Argentina, Bolivia and Peru (only from 1999 in Chile), with penalties for not fulfilling the requirements. The impact of the changes in the quality of service has been notable. In Argentina, for example, the availability of thermal generation plants has increased significantly since the process started (Fig. 3).

The electrification coverage has grown significantly in the region. Additionally, and most relevant for the final consumer, prices have dropped. Political prices that, prior to deregulation, did not reflect operating costs, have given place to prices reflecting the reality of resources and the efficiency of their exploitation.

Fig. 1 Evolution of spot prices in two Chilean markets (northern SING and central SIC)
- Nodal prices of SIC
- Nodal prices of SING

Fig. 2 Evolution of spot prices in Argentinian market

Fig. 3 Evolution of thermal plant availability in Argentinian market

Fig. 4 Energy interconnections in South America

International energy interconnections have developed throughout the process. Electricity and natural-gas exchanges have grown, especially related to the utilisation of the natural hydro-electric potentials of Brazil, Paraguay,
the south of Chile and the gas resources of Bolivia, Peru and the south of Argentina. Gas resources have grown in appeal, given the technological developments of the natural-gas combined cycle plants, an attractive alternative because of their low investment and production costs and short installation time, in addition to their better environmental performance, compared with other thermo-electric alternatives. Thus, energy interconnections have developed between Argentina and Chile, Brazil and Paraguay, Argentina and Brazil, Paraguay and Uruguay and Colombia and Venezuela, and several others are to follow (Fig. 4). Only in Chile, over 1000 MW have been installed in the last two years in natural-gas combined cycle plants, feeding through three ducts from gas fields in Argentina.

3 Problems in development of different sectors of electricity industry

With these successes, the liberalisation process has not been exempt from difficulties that concern countries in the region. Incremental changes have allowed regulations, such as the Argentinean ones, to adapt to new needs and realities. 'Set in stone' regulations, such as the Chilean ones, have given birth to growing problems that are driving major changes to the law. Difficulties vary among the competitive and regulated sectors.

3.1 Generation

Ironically, the principal difficulty at this level, in many countries of the region, has arisen from a major design success. The implementation of generator pools, based on monopolistic co-ordination of their operation and seeking to emulate perfect competition conditions based on marginal costs, with centralised planning of their operation, has been successful in emulating competition and disposing of market power [4]. This role has been assigned to organisations such as the Chilean CDEC, followed by Peru, Bolivia and Argentina (and its successful CAMMESA) in the first stage. Contract financial markets have developed in parallel between generators and large consumers.

In the second stage, countries such as Colombia and Argentina have evolved towards a slightly different model (the English model), where bids replaced costs. A monopolistic pool still co-ordinates the technical operation of the electrical system, as well as the market management, while facilitating and organising the transactions and the price clearing in the balance between supply and demand.

Despite the advantages indicated above of the strong and centralised pools, criticism has centred on the lack of transparency and independence in their management. In particular, in Chile and Peru, they are said not to represent a real market scheme for electrical energy and not to reproduce adequately all the variables that intervene in the market, inhibiting the entry of new players and thus limiting competition. They were even blamed for provoking a supply crisis in Chile in 1999 [5]. Questions have also been formulated about the high level of conflict in these pools, about technical variables for spot price determination and disputes arising about marginal costs, owing fundamentally to the economic interest of agents involved, about ancillary services and about reserves, required for reliable and secure operation of the system. Large consumers have voiced the limited role of demand in the markets of the centralised pools.

Critics formulate the need for a second stage of reform, establishing highly flexible mechanisms of decentralised exchanges, to achieve real market mechanisms. The aim is to replace the centralised pool, forcing 'perfect' competition by the laissez-faire model of the power exchange, coupled with an independent system operator that supplies essentially based on long-term bilateral contracts plus short-term bids. They argue that commercial agreements should determine the supply through successive markets, with supply and demand independently considering all relevant variables in their decisions, including the business uncertainties. This should also allow the development of markets for all types of transactions involving the electrical product (ancillary services, reserves, load shedding etc.), including financial derivatives.

However, these critics may be seeking a remedy worse than the disease, assuming that unregulated bid-based spot exchange markets, which also drive system operation, are simpler than their counterpart. They also underestimate the dominant positions that may develop in highly horizontally and vertically integrated conditions. It is not easy to develop mechanisms to ensure free entry to the generation market, avoiding market power or cartel agreements, as experience elsewhere demonstrates; England and California are two classical examples [6, 7]. Besides, there is little knowledge worldwide of market power acting on predominantly hydro-electric systems [8], or of its impact on adequate reservoir usage and on price volatility.

3.2 Transmission

Another complex area has been that of providing open, non-discriminatory, access to the transmission and distribution networks to reach end consumers, along with developing efficient tariffs for transmission [9]. Creating adequate price signals to drive network operation and expansion has been particularly complex.

Solutions adopted by the countries of the region have been designed taking into account marginal pricing, coupled with complementary charges traditionally established by the regulator, intended to give a price signal based on the use of the network by the different agents. Disputes regularly arise among market players about allocation of transmission payments, with the regulator frequently having to intervene to arbitrate. There is not a generalised, worldwide consensus on which is the best approach to follow for transmission pricing. This is aggravated in Latin America by the different characteristics of unmeshed, geographically extended networks.

The expansion alternatives for transmission differ in the degree of intervention of the regulator. At one extreme is the example of Bolivia and Peru, where the regulator defines the 'economically adapted' transmission system, price-capping payments to the network owner. In the case of Colombia and Brazil, the transmission company proposes the expansion, and the regulator approves or rejects it. Argentina and Chile are countries with reduced participation by the regulator and a greater influence of price signals. Interaction develops among agents that individually or jointly define expansion based on market signals, with the Argentine process incorporating the regulator and the Chilean one being totally driven by the market. The impact of congestion on prices and company revenues has driven expansion.

The balance between efficient price signals and simple pricing schemes and the need to develop co-operative schemes where agents interact to expand needed networks are both the problems and the challenges in the region. The danger being faced in many countries is that simple 'postage stamp' pricing schemes are becoming attractive as a way to reduce conflict and intervention by the regulator. They are being introduced, throwing overboard the advan-
tages that locational and congestion pricing have over system operation and network expansion [9, 10].

3.3 Distribution and supply

A fundamental reform in Latin America was the introduction of what could be called 'pseudo' market principles in the electrical distribution activity for end customers, a stage of the electrical chain where competition is not considered feasible. The legislator considered that it was socially convenient for this activity to be developed through geographic monopolies, given important scale economies shown by the distribution technologies that make distribution unit costs fall as the density of population grows within an area.

The major tasks of distribution regulation are to ensure that tariff setting allows the company to recover its costs plus a reasonable return on its capital, taking into account the risks faced by the company, while promoting incentives to achieve greater efficiency. New regulatory schemes have been developed to stimulate efficiency within the companies, under what has been called 'benchmark regulation'.

The reform in the region has contributed to development, with a regulation that aims to make the private monopoly 'compete' with a reference efficient model company, with a 'yardstick competition' approach. It basically corresponds to a competition by comparison, where a specific rate of return for each distributor is not assured nor limited, but depends on the results of its relative efficiency compared with the reference model upon which base the tariffs are calculated.

This methodology has been complex to apply, with bitter disputes among the parties involved in Chile and Peru, where the tariff process often ends in the legal courts. This has not limited reduction in the prices of the distribution service over time, but critics still argue that the huge efficiency gains have not always reached the final consumers, most remaining with the monopoly. Countries continue to innovate in the procedures to determine the reference efficient model company [11].

Another field of improvement being introduced is that of separating the cable business from the supply business within the distribution activity. All the countries in the region, except Colombia, have kept both businesses integrated. The new agent, the supplier or commercialiser, is seen as a way to introduce competition at this stage, reducing the role of the regulator. It is also introduced as a tool to make available an unbundled transport service for the large consumers in the franchised area of the distribution company, previously captive to the franchiser.

4 New challenges in deregulation of electrical sector

The growing economic integration process among countries of the region, accompanied by the increase in the volumes of energy exchanges, present growing challenges to the governments, investors in the energy sector and the regulatory entities of the countries involved. The challenge is to allow the development of energy markets extending through international borders, while keeping or even increasing the benefits to societies and the efficient economic development of the industry. Important topics to define are the custom duties for energy and their impact on producers and consumers, and the need for price signal coherency among markets and its impact on the use of competitive energy resources.

Among the regulatory matters that emerge, products of this electricity market integration, the following stand out as significant:

- the existence of vertical integration in the structure of the energy market in each country and the degree to which this is to be allowed in the future integrated regional market
- the horizontal integration with other public services, such as water and gas
- the coherence of the regulatory treatment of network monopolies between the different countries
- the independence of the pools of common operation and system co-ordination and the creation of integrated pools
- the growing convergence of gas and electricity markets
- the adequate treatment of energy transportation (gas or electricity) across countries
- the reliance on market forces (the regional acceptance of the fact that the market must develop based on market price signals and not on decisions by the regulatory authority, in all those stages of the electrical market where this is possible).

The integration of markets changes the appearance of things. What may seem a monopolistic position within a country that inhibits competition, for example the control of a high percentage of the local generation, may not be so in integrated regional markets.

Another development of importance in the region, related to the integration process, is the merger of energy companies at the regional level and the arrival of world energy players (gas, electricity, oil) with important capital resources, interested in regional portfolios. Their arrival has radically changed the property structure of the companies, reducing the number of actors and agents in the markets. In the near future, there will probably be just five or six large actors in the region (Enel, AES, EcD, etc.), interested in all segments of the market and increasing vertical and horizontal integration. It is the era of globalisation and large company fusions that, at the local market level, are very transversal and may even confront local regulators.

The question arises of how to deal with these energy multinationals in the framework of an integrated market. The future, with fewer agents and growing regional integration, poses the challenge to develop an adequate regulatory coherence for the sector and for the interconnected markets. The challenge, whatever path is followed, is to define consistent regulations that stimulate investment in a region avid for foreign capital, coupled with controls on intra-segment and inter-segment conduct. Intra-segment conduct refers to that taking place horizontally, either at the generation or the distribution level, whereas inter-segment conduct refers to that taking place when monopolistic segments (transmission or distribution) link with competitive segments (generation or supply), when vertical integration takes place. In both cases, the concern is one of controlling and limiting, if not prohibiting, horizontal and/or vertical integration that could give opportunity to monopolistic activity. However, the emphasis is on regulating conduct rather than industry structure.

Adequate price signals should be established as the base for market development and for the linkage between segments. Competitive exchanges should be stimulated, forcing perfect competition wherever possible and aiming at a close relationship between the bids and the real costs. The participation of a large number of agents in the market will be achieved by reducing the qualifying level for unregulated consumers, with freedom to contract supply conditions.

Free access to the international networks (gas pipes, electric transmission and distribution wires) is one area condi-t
tioning regulatory coherence. It will be necessary to establish transparent and simple tariffs, with clearly established procedures and timeframes for application. Network expansion must flow through a natural process deriving from some sort of locational price signal.

At the distribution and supply level, it will be necessary to establish transparent bidding process as mechanisms of contract assignment at the multinational level. Distributors and/or suppliers should not have exclusion power over producers, either because of commercial affinity or property linkage with them.

The establishment of the supply stage as a competitive activity is essential. Multiple suppliers should compete to respond to requirements at the distribution level and to permit free election by final residential consumers. In this framework, in addition to the price component, the requirements for quality and continuity of service should surface, as well as price flexibility and demand control.

If some degree of integration between the sectors of the electrical market is allowed, vertically integrated companies should separate through independent shareholder societies and/or separate accounting processes.

These challenges involve the need to strengthen the quality and opportunity of the regulation process and of the entities responsible for the regulation and control of market operations. Regulator capture should be avoided, ensuring its independence and that of its members.

Availability and transparency of information on the operation of the electrical market to all market agents and the general public are also essential. Information asymmetries that could favour dominant market positions on the part of the agents should be avoided.

An important lesson in the design of deregulation processes relates to the flexibilities permitted to the regulator to perfect the process regularly, in agreement with representatives of the electrical sector and the agents of the market. The difference, in the future, is that this characteristic has to permeate over international borders.

5 Conclusions

Liberalisation, deregulation and privatisation of the power sector in Latin America have significantly improved the sector performance. These processes are being widely evaluated, and many countries are introducing changes to regulations and market structures. The challenge is to improve, and not undermine, accomplishments, particularly when a new framework of integrated energy markets with few players develops at the regional level.

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