



**INSTITUTE OF THE AMERICAS PROGRAM
ON EFFECTIVE INSTITUTIONS FOR EFFICIENT MARKETS**

Improving Efficiency in the Chilean and Argentine Electricity Sectors

**Carlos Díaz V.
Universidad de los Andes, Chile.**

January 2001

TABLE OF CONTENTS

I. INTRODUCTION.....	3
II. CHARACTERISTICS OF THE ELECTRICITY SYSTEMS.....	3
III. AREAS THAT REQUIRE REFORM TO ACHIEVE GREATER EFFICIENCY.....	5
A. PROBLEMS IN THE GENERATING SEGMENT	5
1. <i>The Case of Chile</i>	5
a) Coordination of Dispatching.....	5
b) Spot Prices and Base Prices	6
c) Free Customer Contracts Market	7
d) Environmental Restrictions	7
2. <i>The Case of Argentina</i>	7
a) Rigidities in the Calculation of Spot Prices	7
b) Seasonal Energy Prices.....	8
c) Capacity Payments for Electrical Power.....	8
B. PROBLEMS IN THE TRANSMISSION SEGMENT	9
1. <i>The Case of Chile</i>	10
2. <i>The Case of Argentina</i>	11
C. PROBLEMS IN THE DISTRIBUTION SEGMENT.....	12
III. CONCLUSIONS	13
IV. REFERENCES.....	14

I. INTRODUCTION

Over the last twenty years, first Chile, then Argentina, have made profound changes to their electricity sectors, by substantially privatizing assets, establishing rules aimed at improving efficiency, and deregulating markets where competition was possible. In markets characterized by “essential facilities” or where competition would be difficult (either as a result of natural conditions or the market power of certain dominant players), authorities attempted to establish specific equality of access regulations to encourage companies to act as if they were in a competitive market and thus avoid monopolistic practices.

In terms of increased efficiency in allocating resources, improved quality of services and more extensive coverage, the effect of the reforms has been extremely positive both in Chile and in Argentina. In both cases, however, various problems have been identified that are hindering more efficient growth in the electricity sector and that must be resolved. The purpose of this study is to describe these problems and suggest feasible solutions for policy-makers and the private sector participants.

In the case of Chile, an ambiguous and incomplete institutional and regulatory structure for free access policies, methods for calculating spot and regulated prices, coordinating load dispatching, expansion of transmission and distribution networks, service quality and conflict resolution procedures, have adversely affected resource allocation, made it difficult to secure contracts and have encouraged opportunistic behavior among some agents in the market. This situation has been further aggravated by the technical and political inability of some regulatory agencies to ensure compliance with regulations and contracts, settle disputes between private parties and withstand pressure from various agents involved in this industry. In particular, the high level of vertical integration and concentration in this sector have given certain firms considerable economic and political power.

In the case of Argentina, although the situation is better in all segments, there are also areas that can be improved for increased efficiency. In particular, problems exist in the methodology for setting spot and regulated prices for energy, power capacity payment system, methods for expanding transmission and distribution lines, and distribution to the provinces.

II. CHARACTERISTICS OF THE ELECTRICITY SYSTEMS

CHILE

Geographically, Chile is a very long, narrow country with an area of 757,000 km² and a population of approximately 15 million inhabitants. The northern part of the country is rather desert-like, depends largely on thermal power, is very sparsely populated and requires electricity primarily to meet the demands of large mining companies. The situation is very different in the central and southern regions where most of the population resides and the demand for electricity is shared by a large number of companies and residential users, and where rainfall is abundant, therefore making hydroelectric power the main source of energy. For this reason, there are two independent electricity systems: the *Sistema Interconectando del Norte Grande* (Great Northern Interconnected System) (SING) and the *Sistema Interconectado Central* (Central Interconnected System) (SIC)¹. The SIC is subject to a high degree of water-related risk because a substantial part of the energy is generated in hydroelectric plants that, with the exception of the Lake Laja reservoir, do not have holdover storage and depend on annual volumes of water flow².

The structure of ownership of the industry is characterized by a high concentration in each subsector, and significant vertical integration, as well. There are three main generating companies - the Endesa group, Gener and Colbún -

¹ There are two other separate systems belonging to the state in the extreme southern part of the country which, because of their small size, will not be included in this study (23MW and 88MW).

² Considering that the annual consumption in the SIC in 1999 was approximately 27,000 GWh, it is estimated that 100% of the demand can be satisfied by hydroelectric power in a wet year. In a year of average rainfall, hydroelectric power satisfies 80% of the demand, while in a very dry year, such as 1998-99, less than 10,000 GWh or 40% of the demand is satisfied by hydroelectric power.

which together control 93% of the installed capacity³. The capacity to generate hydroelectric power is mostly concentrated in Colbún and in the companies of the Endesa group, while the Gener group plants, on the other hand, are mostly thermal. Transmission is 100% in the hands of Transelec, a subsidiary of Endesa. Finally, Endesa controls the country's main distribution company (Chilectra).

Prices have fallen over time to a level close to that of long-term incremental costs as a result of regulatory reforms; competition between the generating companies; increased investment; and increasing use of natural gas.

There are currently four institutions that regulate the activities of the electric industry in particular. The *Comisión Nacional de Energía* (National Energy Commission or CNE) researches and proposes regulations, calculates regulated prices (the base price and rates for electricity distribution) and advises the government on technical matters. It is important to note that this agency has no authority to enforce rules, settle disputes related to the operation of the system, or establish procedures in a crisis situation. The *Centro de Despacho Económico de Carga* (Economic Load Dispatching Center or CDEC), which includes all generating companies with more than 2% of installed capacity and transmission companies with more than 100 kms., is responsible for coordinating and planning the operation of the system and for ensuring adequate supply. The CDEC provides generating companies with information about supply and demand conditions coordinates the maintenance of plants and ensures compliance with operating guidelines. Finally, the CDEC must determine spot prices for transfers between generating companies. The Ministry of the Economy approves rates proposed by the CNE, is responsible for settling disputes within the CDEC, and must ensure and encourage that generation, transmission and distribution activities are carried out efficiently. Finally, the *Superintendencia de Energía y Combustibles* (Energy and Fuel Superintendency or SEC) is an independent agency that reports directly to the President and oversees compliance with the law, bylaws and technical policies, and is responsible for imposing sanctions and fines.

ARGENTINA

Argentina has an area of 2.8 million km² and a population of approximately 36.5 million inhabitants. The wholesale Electric Market (MEM), which has an installed capacity of 19,513MW as of the end of 1999, satisfies approximately 93% of demand, while the Patagonian system, which is independent of the MEM and is located in the southern region of Argentina, handles 6% of the demand, with the remaining 1% covered by separate electric systems. In the MEM, 46% of the installed capacity is hydroelectric, 49% is thermal and 5% is nuclear⁴. The MEM is related to the *Sistema Argentino de Interconexión* (Argentine Interconnection System or SADI), which includes 8,000 km of 500 kV lines.

As a result of the reforms begun in 1992, increased competition, large new investments, access to natural gas, and security of supply have improved considerably. Between 1992 and 1999 the average spot price for energy plus capacity fees have dropped by 46%. At the same time, demand has grown substantially, with 56% concentrated in Greater Buenos Aires and the Province of Buenos Aires. All firms or entities having a peak demand equal or greater than 30 kW can participate directly in the MEM.

The Department of Energy, which is part of the Ministry of Economy, is responsible for establishing regulations and industry-related policies, including, but not limited to, rules related to technical dispatching and the calculation of MEM prices, and to settle appeals filed against the regulatory agencies. The *Ente Nacional Regulador de la Electricidad* (National Electricity Regulatory Agency or ENRE) is responsible for ensuring compliance with the law and imposing appropriate sanctions, seeing that concession agreements are carried out, establishing necessary rules and regulations, preventing anti-competitive behavior⁵, monitoring service quality and establishing bases for calculating regulated rates and ensuring that they are applied. In order to manage the economic transactions in various sub-markets that make up the MEM, the *Compañía Administradora del Mercado Mayorista Eléctrico Sociedad Anónima* (Wholesale Electric Market Management Company or CAMMESA) was created, which is responsible for the centralized coordination of the technical operations of SADI, and carries out the technical and

³ Endesa Group 53%, Gener 23% and Colbún 17%.

⁴ A breakdown of the thermal capacity is: 23% steam turbines, 12% combined cycles and 14% open-cycle gas turbines. In 1998, the generating structure was 45% thermal, 44% hydroelectric and 11% nuclear.

⁵ Currently, the Competition Defense Court also acts in this regard.

economic dispatching of the interconnected generating capacity, while ensuring the safety and quality of the supply. CAMMESA is equally owned by the Department of Energy, the carriers, distributors, generators and major users. However, the Department of Energy has veto rights over CAMMESA decisions.

III. AREAS THAT REQUIRE REFORM TO ACHIEVE GREATER EFFICIENCY

A. PROBLEMS IN THE GENERATING SEGMENT

1. The Case of Chile

This analysis of the Chilean system will focus on the SIC, since it is the most important system and is where most of the problems have been detected.

a) Coordination of Dispatching

As alluded to earlier, the CDEC's operating structure and system for resolving disputes are not satisfactory. The CDEC began operating on the basis of a specific law that was enacted in 1985 that defined its governance structure in terms of how decisions are to be made, implemented and enforced, and how disputes are resolved. Regulation stipulated that only large generating companies could be represented on the Board of Directors. This resulted in Endesa having a controlling interest. According to the procedures defined, decisions were to be made unanimously and, in the case of disagreement, the Ministry of Economy was responsible for settling disputes within a period of 120 days.

This structure worked relatively well until 1995, at which time competition in the generating segment increased. Together with the advent of natural gas, this triggered a sharp decline in prices. In addition, two serious droughts occurred that adversely affected hydroelectric generation. Since 1995, the number of disputes has risen significantly, and on many occasions disagreements at the CDEC have been used strategically as a negotiating tool. These disputes resulted not only from the problems in the governance structure of the CDEC (the unanimity rule and the lack of adequate methods of settling disputes), but also from the flawed nature of certain laws and the technical weakness and lack of economic and political independence of several regulatory institutions.

The drought of 1998-99 led to a number of the conflicts within the CDEC⁶. During this period, opportunistic behavior led to overly rapid use of water reserves, fundamental discrepancies related to the spot price (which left the spot market without a price for several months), disagreements on power station dispatching models and safety strategies, and misuse of the methods and procedures for settling disputes. In this case, the Secretary of the Economy took four months to decide that, in view of the inability to satisfy the demand, the estimated price for transactions between generating companies should be the outage cost. The publication of this decision did not resolve the problem, however, since part of the solution was to refer the question back to the CDEC, where a new dispute subsequently arose. Since generators are obligated to meet dispatch requirements, this lack of definition resulted in the generating companies being compelled to do business for several months without knowing the price they would receive, and consequently led to a delay in adding new generating capacity.

In 1998, the authority amended the CDEC's framework in an effort to overcome these problems, including: the appointment of a government observer; the establishment of a 2/3 majority rule; larger fines were assessed; procedures were created to assign responsibilities more effectively; a committee of experts was set up to help settle disputes; and the number of participating members was increased by giving more access to smaller generating and transmission companies.

But, even with these changes in place, there are still a number of governance areas that need improvement. For example, the committee of experts is not functioning correctly because decisions are not binding on the parties, which results in CDEC remaining the agency of last resort for resolving disputes. An effort should be made to

⁶ For a detailed analysis of the power crisis of 1998-99, see Díaz, Galetovic and Soto 2000.

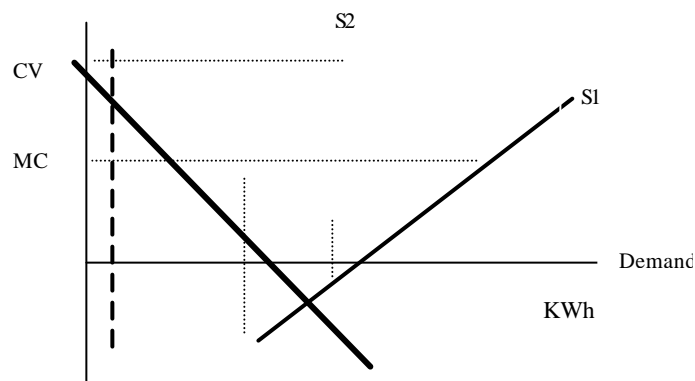
modify CDEC's bylaw in order to free the regulators of the obligation to solve conflicts between private parties, by laying out mutual obligations in sufficient detail in private contracts, supplemented with private arbitration procedures with no appeal. In addition, the possibility of adding major users and distributors to the CDEC's organizational structure should be examined as a way of guaranteeing the independence of technical decisions from the interference of any single market participant or class of market participants.⁷

b) Spot Prices and Base Prices

The electric industry consists of three markets on which the generating companies trade power and energy: a) the spot market, where power and energy are allocated based on spot prices; b) the regulated market, where distributors buy at a regulated price; and c) a free market, where consumers with energy requirements of more than 2MW can negotiate their supply contracts directly with the generators and distribution companies.

On the spot market, the order in which the CDEC dispatches the power stations is based strictly on operating costs. The dispatching is mandatory and independent of the business agreements made between the generating companies. Consequently, there are often transactions among the generating companies that are priced at the spot price, which should be set per hour, based on the marginal cost of providing an additional unit of energy (MC in Figure 1) if there is excess supply capacity (S1), or the marginal valuation (CV) to consumers if there is not (S2).

Figure 1



To determine the spot price, the CDEC uses a programming model that takes into account the degree to which the supply is dependent on rainfall conditions and the accumulation of snowfall, and which optimizes the use of water. The hydroelectric generating system consists of run-of-the-river plants, some reservoirs with limited regulating capacity, and several power stations associated with the Laja Lake. This lake has a large storage capacity that can be used to hold water for long periods, so it can substitute thermal generation across time. An increase in the use of water of the Laja Lake (*ceteris paribus*) diminishes the present marginal cost of energy since less thermal generation is required, but it increases the future expected marginal cost since more thermal energy would be then required. Consequently, the management of the Lake Laja reserves is the focal point of the spot price scheme, and under normal hydrological conditions the economic opportunity cost of the water is equal to the marginal operating cost of the last thermal plant dispatched. However, the greater the likelihood of present or future outage, the higher the economic cost of the water and, in extreme cases, the marginal cost is the same as the outage cost. The cost of outage is and administered “failure price” that provides an estimate of consumer valuation (CV in Figure 1), and hence efficient incentives. Its value varies according to the amount of energy not supplied.

As a result of incorrect information, technical problems with the model used, inadequate governance procedures for resolving conflicts within the CDEC, and the prevalence of economic and political pressures, several disputes have

⁷ A complete analysis on the governance and regulation of power pools outside the United States, and the lessons that can be learned from their experiences, can be found in Baker, Tenenbaum and Woolf 1997.

arisen regarding the management of the water reserves, the calculation of the economic cost of the water and the marginal cost of the system, as well as the order in which the power stations should be dispatched.

Another problem in this market arises from the fact that the outage cost is not a market price, but rather is infrequently determined on the basis of surveys. As a result, the price has proven to be too rigid to balance supply with demand in extreme situations such as the drought of 1998-99. For the future, it is important to devise a method that makes the outage cost a contingent price that accurately reflects the consumer's willingness to pay.

On the regulated market, sales of energy and power to distribution companies, which are subsequently transferred to the regulated users, must be made at base prices. The regulated price of energy is calculated by the CNE every six months based on a dynamic programming model that uses an estimate for the next ten years of the most important variables affecting the cost of energy over a 48-month period. Some of the variables considered in the projection are: the demand for electricity, the water reserves and the level of Lake Laja, expected rainfall, the cost of fuel, the cost of maintaining power stations, and the addition of new plants based on a construction schedule prepared by the CNE itself.

This method of price setting poses various problems. First, it is very difficult to foresee the variables used in the model, which in some cases has meant that the authority manipulates the price based on political criteria. Numerous agents in the industry feel that CNE analytical capacity is weak from both a technical and economic standpoint. Second, the calculation formula is rigid because it does not adequately allow for the inclusion of extreme short-term situations such as the drought of 1998-99, nor does it allow prices to be adjusted in response to untimely outages at very large thermal power stations.

Clearly, the pricing system must be made more flexible for an efficient energy system to operate.

c) Free Customer Contracts Market

The third market is that of free customers. On this market, only large users are allowed to negotiate directly supply conditions and quality, as well as the prices of energy and power. This market has grown slowly based on contracts that follow very closely the evolution of the base price. Its growth has been affected detrimentally by the transmission and distribution problems discussed below. In addition, and as evidenced by the positive experience of numerous countries, the 2MW limit that is required to be able to negotiate directly with distributors and generating companies is too high. This is a topic in need of urgent examination and revision.

d) Environmental Restrictions

The approval in 1997 of a series of laws and decrees aimed at protecting the environment has unfortunately led to more uncertainty in the generating sector. Since all generating projects are subject to this law, they must be approved by the Comisión Nacional del Medio Ambiente (National Environmental Commission or CONAMA). The main problem with this process is that the procedures and terms of reference of the required environmental impact studies are not well defined, and the regulators do not have enough autonomy to make sound technical decisions independently of political pressure exerted by interested parties. These problems have delayed the addition of large hydroelectric generation projects and made them more costly as a result of related lawsuits.

2. The Case of Argentina

This study will focus on the SADI system in Argentina, which correlates to the MEM in Chile. As in the case with Chile, there are three distinct markets on the MEM: spot, regulated and free.

a) Rigidities in the Calculation of Spot Prices

Both thermal and hydroelectric generating companies bid fixed amounts of power to the electricity system, but are required to do so in advance and for 6-month periods. Thermal generators declare the price of their fuel (subject to certain upper limits⁸) and, depending on the output of their equipment⁹, determine their variable cost of production adjusted by the nodal factor. Hydroelectric power plants declare the value of the total amount of water that can be stored in their reservoir, but may not quote amounts over 50% of the cost of the first stage of the outage cost. CAMMESA provides them with an indicative value for water, which they are free to accept or not.

This 6-month fixed supply system is very rigid and results in an inefficient allocation of resources, since it prevents prices from reflecting the true economic cost of the input factors that have changed during that time; particularly the economic cost of water in the event of a drought.

These bidding restrictions were first established to prevent monopolistic abuses and to provide greater price stability within the context of a delicate political situation, and the shortage of adequate information management technology. In the last few years, however, information systems have developed rapidly and, although formal studies on this matter are not available, the generating sector today is widely viewed as very competitive. Consequently, there is no reason to maintain these restrictions and administrative policies.

On the spot market, CAMMESA determines the marginal cost of the system per hour, also known as the hourly spot price, which, depending on the case, corresponds to the marginal cost of the last unit dispatched or the power outage cost when the system is unable to satisfy the demand. The outage cost poses the same problems as in the case of Chile, in the sense that it is established as a rigid figure based on the level of energy not supplied, except that the upper limits are much higher in Argentina.

b) Seasonal Energy Prices

Argentine regulation provides that all consumers that cannot access the free market should be charged a fixed price based on the hourly range. These fixed prices are calculated based on the amount of energy to be supplied by the generators over the succeeding six-month period, subject to hydrological projections. A seasonal price equals a weighted average of the spot market prices that would result under a range of hydrological conditions projected over a season. The differences between the seasonal prices and the spot prices are accumulated in a buffer fund that is used to stabilize the prices set in the next period.

Although the prices are reviewed quarterly and the price-setting method assumes an outlook of only 6 months and is based on the amounts of energy supplied by the generating companies, this method is not efficient in that it makes the prices relatively rigid during this period. Also, hydrological projections can be used for arbitrary adjustments. The existence of the buffer fund is also misleading since it simply means that the seasonal price for one quarter is based on incorrect forecasting during the previous quarter. As in the case of Chile, a more flexible pricing system is recommended.

c) Capacity Payments for Electrical Power

The payment scheme for the Dispatched and Scheduled Capacity for both thermal and hydroelectric power covers only business days¹⁰ and peak times known as off-valley hours (from 6 a.m. to 11 p.m.). The capacity payment scheme also includes another payment that is allocated to the Base Thermal Capacity, identify as those thermal-generating companies that are available in very dry years during off-valley hours. This payment is based on the amount of energy these generators could produce and is independent of whether or not they are generating in a normal year. For both types of capacity payments, the price for electrical power was established administratively by

⁸ In the case of gas, the limit comes from the price set by the regulating authority for gas. For liquid fuels, the limit is equal to the import parity plus 15%. Some adjustments are allowed during the 6-month period if the prices exceed certain percentages.

⁹ The output of the equipment is provided by the company and is also verified by outside companies.

¹⁰ Saturdays, Sundays and holidays are not included.

the Secretary at US\$10 per KWh, adjusted by nodal factors. These two payments are mutually exclusive for the same KWh, but are in addition to the outage cost that the generating companies can receive at any time.

Since these payments are related to KWh of energy generated, they produce incentives for generators to discount their bid prices for energy in order to ensure that they run during these hours. If the Dispatched and Scheduled Capacity were the only capacity payment, and there were no bidding restrictions, deducting these payments from the quoted prices for generating electricity should not be a problem, since generators would discount their bids so as to exactly offset the payments made for running. This, however, is not the case, since the restrictions on offer prices, the rigid cost of outage, and the method for computing eligibility for the Base Thermal Capacity payment result in a complex situation where costs are difficult to estimate. These facts, along with low fines for non-compliance, have also given rise to opportunism on the part of some generating companies that offer to provide more power in a dry year than what they are capable of effectively supplying. It is not known whether any studies have been conducted to measure empirically the effects of these distortions, but it can certainly be argued that they have skewed prices and had an impact on the allocation of resources. As a more long-term effect, some industry analysts feel that the make-up of the generator pool has been affected by artificially encouraging the installation of basic generating plants at the expense of less costly equipment to respond to peak time requirements.

Both in theory and in practice, there are various ways of paying for electricity power capacity in order to avoid untimely outages. Although in theory these methods are the same, in practice they produce very different results with regard to the system's capacity levels and safe supply.

In view of the advanced, competitive, institutional and technological development of its electricity market, Argentina should study the alternative of paying for capacity on the basis of the outage cost, which would be freely determined in the market.

Power outages due to fuel shortages or extreme drought conditions can be anticipated in such a way that in a competitive market users have the option of taking preventative measures. The system can also take measures to ensure that the restrictions on capacity affect users selectively, redirecting supplies based on contracts and the willingness of consumers to pay, as reflected by the outage cost.

B. PROBLEMS IN THE TRANSMISSION SEGMENT

In the electricity market, regulators must be able to facilitate competition in the sale and production of energy and power, while upholding the notion of natural monopoly conditions in services provided by transmission and distribution networks. In order to ensure competition, the authorities must guarantee that equal access to these networks really exists by establishing precise technical and economic standards. If not, the companies that control these essential assets will be able to create significant barriers to entry and competition.

In the case of the transmission of electricity, the main purpose of setting rates should be to establish a system of incentives that: a) allows current users of the system, whether generating companies or consumers, to efficiently use the existing transmission facilities and to make the right decisions regarding location and investments in generation; b) results in the efficient expansion of the transmission network; c) provides adequate incentives for the addition of new users to the transmission network; and d) encourages operation at the lowest possible cost by keeping intervention by the regulator to a minimum, given the agency and transaction costs associated with conflicts resulting from the lack of definitions in the regulations, which lead to disputes.

Efficient short-term rate setting for transmission should be equal to the differences in the spot-market prices across locations. These price differences of selling electricity at one location and buying electricity at another include the effect of marginal transmission losses, and faced with transmission constraints, it will also reflect the costs of system congestion arising from out-of-merit generation.

In the long term, the transmission rates must cover fixed costs without adversely affecting short-term operating decisions. Furthermore, the basic guiding principle regarding the financing of any expansion of the transmission network is that the beneficiaries should be those who participate in the financing in proportion to the benefits they obtain.

1. The Case of Chile.

In addition to the revenues obtained from charging the short-term marginal cost of transmission, a toll payment is required in order to finance the cost of replacing existing transmission lines and operating and maintenance costs. This toll is calculated based on generating company usage within its service area, defined as “all the lines, substations and other installations of the electric system that are directly and necessarily affected by the introduction of power and energy from a generating plant”.

There are two problems that must be resolved regarding the calculation of the short-term marginal costs of transmission. First, efficient short-term rate setting requires, as needed, the inclusion of a variable charge for congestion, which is currently not included as a variable charge in the Chilean pricing system. The cost resulting from congestion is being charged as part of what the regulation calls a “toll,” which is misleading since an amount that should be charged only at times of congestion is being charged as a fixed charge. Second, in order for transmission rates to be correct, there should only be a charge for marginal losses actually incurred based on the power transmitted and the capacity of the line. Finally, by using fixed penalty factors that represent an average marginal loss amount, an approximation is being made, the nature of which is difficult to evaluate.

As for the tolls, the law provided that the transmission company should calculate its amount by estimating the service areas, the new amount for replacing the facilities and the prorated amounts to charge each user within the service area. Any user who disagrees with these tolls can have recourse to an arbitration proceeding or the judicial system, but must deal with the high costs related to such proceedings.

One problem with the service area system is that the result is very unclear and limits the search for potential beneficiaries to those users who experience physical changes (in the flow of electricity) resulting from the existence of the transmission line. In this way, the mistake can be made of excluding potential beneficiaries of the line who should also participate in its financing, and including as beneficiaries other agents who are adversely affected by the line. Estimating the cost of replacing the facilities and the method of calculating the prorated amounts have also been points of disagreement.

The ambiguity of the definition of transmission tolls has led to numerous disputes. Up to now, neither the authorities nor decisions of the court have established an adequate calculation method. Private arbitrators have intervened on two occasions, but their findings have been inconsistent.

The vertical merger of Endesa and Transelec has aggravated the lack of a clear method of calculating the tolls. Even though a policy of equal access to the transmission lines exists, Transelec has significant advantages with regard to information that could benefit Endesa, and it has incentives to make access difficult for its competitors. The authorities and some competitors have argued on numerous occasions that Endesa’s dominant position in the generation, transmission and distribution segments prevents fair competition in the sector. During the 1990’s, two attempts were made by the *Fiscal Nacional Económico* (National Economic Prosecutor) to dissolve this vertical merger, but, in the end, the accusations were rejected on the grounds of insufficient concrete evidence. Partly because opposition to the vertical merger has persisted, a few months ago Endesa announced the sale of 100% of Transelec.

When the transmission capacity is limited or new transmission lines are needed, the law assumes that the interested companies and Transelec will come to an agreement so that these investments can be made. The law, however, did not consider the possible imbalance between the negotiating power of the parties and the procedural costs involved, especially when the increase in demand is not substantial. Furthermore, the network expansion method established by the Regulations is very complex and ambiguous.

This is less of a problem in the northern region of the country (SING), because the large mining companies have more negotiating power, and if they fail to reach an agreement they build a dedicated line. This is not the case, however, with the SIC, where there are many small customers. Perhaps the best example of inefficiency resulting

from access problems in the transmission segment is the decision by Colbún in the mid-1990's to build its own transmission line after numerous costly disputes with Transelec.

2. The Case of Argentina.

Any user may have free access to the transport capacity. Transmission is designed as a business that is independent of generation and distribution, and transport companies are prohibited from buying or selling electricity. Transener is responsible for the MEM's transmission system through a ninety-five year concession agreement, which authorizes it by management periods: 15 years for the first period and 10 for the remaining ones.

The transport system is subject to quality control programs and its income consists of the difference in node prices resulting from marginal losses and charges for transport capacity and connection and transformer services. There are no charges related to the cost of capital of the lines that existed at the time of privatization, since these were not charged for. For this same reason, any income resulting from congestion is not allocated to the transport company, but rather funneled into a special account known as SALEX, which is used to finance future expansions.

The expansion of transport capacity is realized through a Public Invitation to Tender or a Contract among Parties. In the first case, a group of users suggests an expansion project to ENRE, which makes its viability conditional upon an economic evaluation. If the project is profitable, a service area method is used to determine which users should start the annual payments needed to finance the cost of the line. The users identified through this method have the right to delay the project, provided they form a coalition that represents at least 30%. If they fail to exercise this right, the ENRE invites an open competition for awarding the contract. Once the contract for the line is awarded, the prorated amounts and the actual payments are calculated annually by using the same service area method. The investment for the expansion can come from the funds accrued in the SALEX account to finance the cost of the line.

Both the service area method used, which involves the same inefficiency that was discussed in the Chilean case, and the use of the funds accrued in the SALEX account create serious problems.

Leaving out some beneficiaries and requiring other agents to pay who will not reap any benefit at all and who will therefore conspire among themselves to oppose the expansion project has resulted in much needed investments being delayed for more than 4 years.

Furthermore, using the funds from the SALEX account and sharing the cost of the line with other agents who will not benefit from the expansion, makes it more difficult to find an appropriate location for the generators and results in the plants being located far away at the expense of locations which, if closer to net consumption areas, would be more convenient from a social point of view. For this reason, generating companies in remote locations will exert pressure to have the lines expanded as early as possible.

This could also encourage over-investment in transmission since, by not bearing the full cost of the expansion, the generator benefiting from it will compare the savings in losses resulting from an oversized transmission network to the higher cost implied by such a network. If this proves to be to their advantage, the generators benefiting from the expansion will not only exert pressure to speed up the expansion but also to have the new line be oversized.

Finally, once there are sufficient funds in the SALEX account to cover an expansion, or the date on which the funds can be transferred to the expansion of the transmission capacity in other regions is near, the ENRE will stand up to strong pressure to approve an expansion project even if, strictly speaking, it is not economically viable.

Corbo, Díaz and Sánchez (1996) argue that the main problem with the expansion of transmission capacity is the lack of property rights, which is why their proposal for Chile included a system whereby the beneficiaries are the ones requesting the expansion of a line and are treated as its shareholders. Under this scheme, the shareholders receive as a dividend the portion of income resulting from charging for transmission at the marginal cost. This shareholder scheme offers several advantages over an alternative scheme based on long-term contracts, the main advantage being that of easier design and application. For new users, economic efficiency requires that they incur charges that represent only the net increase in costs they provoke to existing users. This is accomplished by charging them the short-term marginal cost, the same as for current users of the transmission line minus an entrance subsidy. This

subsidy is derived from the fact that the marginal cost contains an income item that overestimates the cost of connecting a new user to the line. From the point of view of fairness, treating new users as described in the preceding paragraph poses problems in that new users would have an advantage over users who contributed financially to the cost of the expansion. To address this problem, the system of allocating shares for the expanded lines could be supplemented by a system of exclusive temporary rights of access to a line for a period of time once the expansion is completed, with the requirement that all users, both new and old, finance the cost of the line during this time. With this system, even though economic efficiency is sacrificed to some extent, a reasonable degree of fairness is provided among the new and existing users. In the study conducted by NERA in 1998 for the case of Argentina, a system similar in concept based on negotiable transmission rights is proposed.

C. PROBLEMS IN THE DISTRIBUTION SEGMENT.

To avoid discrimination related to access, Chilean law requires that the distribution company serve the users within its concession area under the same technical and economic conditions, whether they are free or regulated customers. However, there are two areas in which the laws and their procedures are incomplete: the setting of added distribution values (VAD) and access to free customers within a concession area.

Every 4 years, the VAD's are calculated based on the simulation of costs for a model company that is assumed to be efficient. Under a scenario of unequal information, the problem with this method is that the regulator does not have enough data to determine the cost structure of an efficient firm. Furthermore, rate studies are carried out by the distribution companies and by the CNE. The final rates are set as a weighted average between the study conducted by the companies (1/3) and the study made by the CNE (2/3). Normally, there is a significant difference between the studies and the process usually ends in the courts.

Two problems have been identified related to access to the distribution networks to service free customers. First, the price of transforming high-voltage electrical power to the standards required for customers is an unregulated service, making it possible for distributors to exercise some degree of monopolistic power. Second, tolls for transporting energy in these cases are negotiated rather than regulated. The law assumes equal negotiating power, which is not the case with small contracts and especially when a vertical merger exists between generators and distribution companies. The situation is even worsened by the fact that distributors can also compete for free customers within their concession area.

To resolve these problems, it is proposed that separating the functions of transportation and sales by the distributor be studied. To avoid possible monopolistic practices, it is recommended that rate-setting procedures be improved and that the method of calculating the VAD and the procedures for setting rates and settling disputes be reviewed. The idea of using an arbitrator procedure with no appeal is also worth considering.

Argentinean law has taken an important step in the distribution segment. The distribution concessions that have been granted are for a period of ninety-five years, divided into management periods, the first of which is for 15 years and the rest 10¹¹. Competition in this segment of the industry grew as a result of greater competition in the generating sector as well as a reduction of the limit that allows consumers to make contracts directly in the MEM. Currently, all users with more than 30kW of demand can participate in the MEM, and this figure is expected to continue to decrease in the medium term. Following a detailed study, NERA (1998) considers the quality control system to be fairly complete and to be working adequately.

The VAD is set every five years in dollars, but the first adjustment is made at the end of an initial 10-year period. For now, there is not enough cost information or practical experience to be able to express an opinion about the rate system. As stated in FIEL (1999), there are, however, many problems in the provinces that should be pointed out, including: a) the lack of progress with some privatizations; b) inconsistencies in the tax system and some tax incentives that encourage "by-passing" distributing companies; and c) disparities in the rate schemes. Finally, it would also be appropriate to consider separating the functions of transportation and sales by the distributor.

¹¹ The concession agreement includes a facility for assigning the rights and obligations of the concession through competitive bidding at the end of each management period.

III. CONCLUSIONS

The success of the reforms implemented in the electricity sectors of Chile and Argentina is irrefutable. However, there are still areas where problems persist. The main purpose of this study has been to identify the problems that still affect these markets and, as much as possible, propose changes aimed at increasing efficiency.

Chile, although a pioneer in implementing structural reforms in the electricity sector, later fell behind. Argentina, on the other hand, took advantage of the experience of other countries and instituted more sweeping reforms that have enabled it to have one of the most open and competitive markets today. Compared on a global level, it can be said that the regulations and institutions in Argentina are laid out better than those of Chile.

In particular, there is evidence of serious problems in the way Chilean institutions function, and there are many limitations and ambiguities in its regulations that are preventing the system from running more efficiently. It is clear from this which direction the reforms should take: a) from a technical point of view, the work of the regulatory agencies must be supported in order to separate them from the pressure groups; b) more flexible pricing mechanisms must be established aimed at allowing the market to function; c) regulators must be freed of the responsibility of settling disputes between private parties by establishing obligations in private contracts and resolving conflicts through arbitration; d) certain points in the regulations that are ambiguous and give rise to conflicts and opportunistic practices need to be clarified; e) more sweeping changes are needed at the CDEC, and the usefulness of adding more members to its administration should be studied; f) a detailed study is needed to find more efficient methods of setting rates for transmission and distribution network services; g) it seems appropriate to consider separating the functions of transportation and sales by the distributors; and h) progress must be made in reducing the required limit so that consumers can freely negotiate their own contracts.

In the case of Argentina, although the situation is better for all segments of the industry, there are also areas that could be improved in order to increase efficiency. Like Chile, the recommendation is to encourage more flexible prices so that they better reflect the behavior of the market (including the way power is paid for), review new methods of financing expansion of transport capacity and study the usefulness of separating the functions of transportation and sales by distributors. Furthermore, with regard to the regulation and operation of the electricity sector in certain provinces, there are many administrative and tax issues that need to be resolved, and it is recommended that privatization continue.

IV. REFERENCES

- Anderson, K., Hunt, S., Parmesano, H., Shuttleworth, G. and Powell, S. (1998). "Analysis of the Reform of the Argentine Power Sector: Final Report", National Economic Research Associates.
- Artana, D., Navajas, F., Urbiztondo, S. (1998). "Regulation and Contractual Adaptation in Public Utilities" The Case of Argentina. Technical Study Paper Draft IFM, Inter-American Development Bank.
- Basañes, F., Saavedra, E. and R. Soto (1999). "Post-privatization Renegotiation and Disputes in the Electricity Sector in Chile", Working Paper IFM-116, Inter-American Development Bank.
- Barker, J. Tenenbaum, B. and Woolf, F. (1997) "Regulation of Power Pools and System Operators: An International Comparison", Energy Law Journal Volume 18, N° 2.
- Bernstein, S. (1999). "Racionamiento eléctrico: causas y posibles soluciones" [Rationing of Electricity: Causes and Possible Solutions], Reference Point No. 2089, Center for Public Studies.
- CAMMESA. (1999). "Informe Anual del Mercado Eléctrico Mayorista de Argentina. [Annual Report on the Wholesale Electric Market in Argentina], *Compañía Administradora del Mercado Mayorista Eléctrico. S.A.* [Wholesale Electric Market Management Company]
- CNE (1986) "Estudio del costo de falla en el Sistema Interconectado Central" [Study of the Outage Cost in the Central Interconnected System], Santiago, CNE.
- CNE (1999). Biennial Report. Santiago, CNE.
- Corbo, V., Díaz, C., Sánchez, J.M. (1996). "Análisis Crítico al Proyecto de Reglamento de la Comisión Nacional de Energía Referente a la Ley General de Servicios Eléctricos" [Critical Analysis of the Draft Regulation of the National Energy Commission Relative to the General Law of Electrical Services] , *ibid.*, Institute of Economics, Catholic University of Chile.
- Díaz, C. A. Galetovic and R. Soto (1999). "Anatomía de una crisis eléctrica" [Anatomy of an Electrical Crisis]. Research Paper No. 121, Post-graduate Program in Economics, ILADES-Georgetown University and Working Paper No. 64, Center for Applied Economics, University of Chile.
- Díaz, C., R. Soto (1999) "Open-Access Issues in the Chilean Telecommunications and Electricity Sectors", Technical Study Paper Draft IFM, Inter-American Development Bank.
- Díaz, C., A. Galetovic and R. Soto (2000). La crisis eléctrica de 1998-1999: causas, consecuencias y lecciones. [The Electric Crisis of 1998-1999: Causes, Consequences and Lessons] *Revista Estudios Públicos* [Public Studies Review], Center for Public Studies.
- ENRE (1998). "El Informe Eléctrico: Cinco años de Regulación y Control 1993-abril-1998" [The Electric Report: Five Years of Regulation and Control 1993-April-1998]. ENRE.
- ENRE. (1998) "Annual Report 1998".ENRE.
- Fundación de Investigaciones Económicas Latinoamericanas* (FIEL) [Latin-American Economic Research Foundation]. (1999) Part III, Chapter 13 "La regulación del sector eléctrico" [Regulation of the Electricity Sector], *La Regulación de la Competencia y de los Servicios Públicos* [Regulating Competition and Public Services]. *Teoría y Experiencia Argentina Reciente* [Recent Theory and Experience of Argentina].
- Fierro, G. and P. Serra (1993). "Un modelo para estimar el costo de falla" [A Model for Estimating the Outage Cost], *Cuadernos de Economía* 30 [Economic Notebooks], 247-259.

Fierro, G. Y P. Serra (1997). "Outage Costs in Chilean Industry", *Energy Economics* 19, 417-434.

Fischer, R. and A. Galetovic (2000). "Regulatory Governance and Chile's 1998-1999 Electricity Shortage", *ibid.*, Center for Applied Economics (CEA), University of Chile.

Hunt, S., and G. Shuttleworth (1996). "Competition and Choice in Electricity". John Wiley & Sons Ltd.

Legisa, A. Juan (1999). "Problemas de Segunda Generación en la Reforma de los Servicios Públicos" [Second Generation Problems in Reforming Public Services] Technical Study Paper Draft IFM, Inter-American Development Bank.

Serra, P. (1997). "Energy Pricing Under Uncertain Supply", *Energy Economics* 19, 417-434.

Urbiztondo, S., Auguste S., Basañes F., (1999) "Access Arrangements in Argentina's Public Utilities: Electricity, Natural Gas and Telecommunications". Technical Study Paper Draft IFM, Inter-American Development Bank.