Nº 226

THE OLD AND THE NEW REFORM OF CHILE'S POWER INDUSTRY

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DOCUMENTOS DE TRABAJO

Serie Economía

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MINI BIO

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Abstract

Chile's regulatory framework introduced in 1981 remained unchanged for more than 20 years. The reform had a positive effect but several warning signals appeared by the end of the 90s indicating the need to introduce changes. The most important problems were the lack of competition in the generation segment and the reluctance to expand capacity. These problems were appropriately faced by two amendments to the law (2004 -2005). Knowing the experience of Chile is relevant because the lessons learnt can be applied to other countries which have adopted the same model. In addition it illustrates that the power industry can work reasonably well under a "regulated" competition framework, different from the de-regulation model currently being discussed in other countries.

Key Words: Chile, Electricity, Restructuring

JEL Codes: L94, L51

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The Old and the New Reform of Chile's Power Industry

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Introduction

Chile was the first country to reform and restructure its power industry. The power sector reform, implemented in the early 80s, was an element of a more general economic reform that introduced competition rules to different industries. Electricity companies were re-organized and then sold to the private sector. Privatization of power companies started in 1985; by 1990 almost the entire electric sector was in private hands while remaining state-owned companies were sold at the end of the 90s.

The regulatory authority chose to promote competition among generators and entry into the generation business was opened up to competitors. The reforms also created a so-called "spot market" but equilibrium prices were based on the marginal costs of generators in the system and the associated least cost dispatch; thereby, the spot market simulated a perfectly competitive market. Thus, generation prices were not "deregulated" in the usual sense of the term, except for the very largest industrial customers who chose to enter into contracts directly with generators. Generation price paid by small consumers was regulated. However, it was constrained indirectly by a requirement that they be no higher than 110% and no lower than 90% of the prices charged to large industrial customers. The transmission and distribution segments continued to be regulated because of their natural monopoly features.

The pillars of the regulatory framework introduced in the early 80s remained virtually unchanged for almost 20 years. It is fair to say that in general terms, the reforms had a positive effect: installed capacity increased, efficiency and quality of service improved, investors got reasonable rates of return and prices are low by international standards (see Pollitt (2004), Fischer and Serra (2006)). The relative stability of regulation came to an end in the year 1999. In fact, the severe drought that affected the country in 1998-1999 gave rise to changes in the law whose impact on the incentives to expand generating capacity remains to this day.[3] This crisis also led to discussion as to the convenience of amending the most structural aspects of the regulation in order to deal with the warning signals being sent by the system and which clearly indicated the need to introduce new changes.

Two of these signals merit our attention. The first is that, notwithstanding the increasing probability of future shortages and the evident weakness of certain transmission lines, transmission and generating companies were reluctant to expand their capacity. A second

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[3] In the 1998-99 period, and coincident with a period in which the first combined cycle electricity plants were coming into operation, the SIC experienced a severe drought which, combined with poor management of the situation, led the system into a crisis which resulted in both scheduled and unannounced power cuts. For further details regarding the crisis, see Díaz et al (2000), Fischer and Galetovic (2003) and Raineri (2006).

concern is that there is not enough competition in the segments of the industry that were seen by the regulator as competitive. The origin of these problems is certainly not unique, but a combination of different elements of the regulation. Indeed, while some of them have been there since the beginning of the new regulatory system –like the reduced flexibility of regulated prices to react to sudden scarcities and the absence of an explicit regulation for the distribution-toll to be charged to large consumers, others have been the unexpected downside of reforms introduced to improve the operation of the system –for instance the lack of incentives to expand transmission capacity that resulted from the separation of the transmission company from the largest generator.[4] In addition, the regulator has also contributed sometimes to these problems by applying the law with more discretion than is desirable, especially in the price-setting process.

The discussion about these aspects lasted longer than expected, creating a great deal of regulatory uncertainty which contributed towards further reducing investment incentives, thus creating new problems for the industry. Fortunately between 2004-2005, and possibly pressured by inauspicious perspectives for the near future, a proper level of consensus was reached in the industry which in turn led to the introduction of two amendments to the law. In this paper I discuss why these changes are likely to be successful in dealing with the most important challenges that the power industry was facing at that time. Indeed, although present regulations can still be further improved, clarity of the new rules of the game has enabled investments to slowly resume the dynamism of previous years. [5]

Getting to know the experience of Chile, its performance, the problems it has faced and the way these have been solved is especially relevant because the lessons can be applied to other countries in the region which have adopted the Chilean model, with minor changes, as is the case in Bolivia, the Dominican Republic, Nicaragua, Panama and Peru.[6] On the other hand, it is interesting to observe that under certain conditions the power industry can work reasonably well under a "regulated" competition framework, different from the complete de-regulation model currently being discussed in other countries.

This paper is organized as follows: the next section provides a brief description of the electricity industry in Chile. Section 3 analyzes the regulatory scheme in force until 2004 and discusses its impact on the industry's performance. Section 4 reviews the most important amendments made to the law in 2004 and 2005. The paper finishes with an analysis of the current situation and industry perspectives for the short and medium term.

[4] Pollitt (2004) discusses additional problems of Chile's regulatory scheme.

[5] The discussion is far from over: the convenience of allowing retailers to enter the market is currently being analyzed.

[6] El Salvador is currently analyzing the convenience of moving towards a marginal cost-based dispatch thus abandoning the unregulated wholesale market and the bid-based dispatch.

II. Chile's Electricity industry

Electricity supply in Chile is provided through four non-interconnected electric systems: Interconnected System of Norte Grande (SING) in the north, Central Interconnected System (SIC) in the center and Aysén and Magallanes in the south of the country. As Figure 1 shows, total installed capacity in 2004 amounted to 11567 MW. The SIC is the largest system in the country in terms of installed capacity (8000 MW) and concentrates more than 90% of the country's population. The size of Chile's electricity systems is small even when compared to other countries in the region such as Argentina (25,000 MW), Colombia (14,000 MW), Mexico (21,000 MW) and Brazil (91,000 MW). This difference is an important consideration, especially when it comes to evaluating the convenience of introducing reforms, because undoubtedly certain changes -such as the complete deregulation of competitive segments of the industry- require a minimum market size in order to be successful.

The most important source of energy in Chile is hydrological resources. Fuel resources are not abundant: natural gas and a large fraction of the oil and coal used are imported. In addition, Chilean coal is not of good quality. Due to differences in resource availability along the country, each system generates energy from different sources (see Figure 1). While the north relies almost completely in thermal sources, the rest of the country also generates energy from hydroelectric sources. The composition of the generation portfolio underwent an important change towards the end of the 90s due to the arrival of Argentine natural gas. Perhaps the most noticeable example of this change is that the SIC ceased to be a mostly hydraulic system: its share in total capacity went down from 80% in 1993 to 57% in 2005. In turn, between 1999 and 2001 the installed capacity in SING increased by 2000 MW, more than doubling the former capacity.

The incorporation of natural gas into the system reduced the country's dependency, especially that of the SIC, on the availability of water at dams. Notwithstanding, the above was not free because this produced greater and increasing dependency on natural gas. At first this change was not considered dangerous because this source of energy was perceived as "safe" (as opposed to the uncertainty of hydrology). The experience over the last few years, in which Chile has been the adjustment variable used by Argentina to deal with its own energy scarcity problems, has shown that the initial estimation about the certain supply of Argentine gas was mistaken.[7]

As it can be seen in Figures 2 and 3, the existing degree of adjustment between the installed capacity and system demand evidences different patterns throughout the entire period and between systems. For example, in the case of SIC, two sub-periods can be observed: between 1989 and 1999 installed capacity grew at an annual rate of 8.6%, above the growth of maximum system demand during the period (6.3%). However, an important change of trend is observed starting in the following year: on the one hand, and in keeping with the economic activity slump in the country, demand growth is moderated

[7] In March 2004 the Argentine government approved a resolution that established restrictions of natural gas exports to Chile. Export cuts began in May of the same year and have reached levels of approximately 50% of Chilean imports. See Raineri (2006) for additional details on this crisis.

(5.4% between 1999 and 2004). On the other hand, investment in generation capacity also dropped but at a higher rate. In fact, between 1999 and 2002 no power plants of relevant size were built. Between 2003 and 2005 three power plants became operational, one of which is a 640MW hydraulic plant for which construction began in the late 90s. Consequently, the balance between supply and demand was quite precarious. Indeed, estimations made by independent consultants regarding the expected probability of shortages were considerably higher compared to previous years.[8] This precarious nature was mainly due to the lack of investment over that period as the system's capacity increased by 75 MW per year, on average in the face of an average increase of 245 MW in maximum demand.[9] Problems experienced with the supply of Argentine gas contributed towards exacerbating the problem for two reasons: on the one hand, the risk of an energy crisis was higher. On the other hand, companies brought their pre-gas crisis investment plans to a standstill, exposing the system to a potential capacity crisis.

In the case of SING, installed capacity surpasses maximum demand by 2.3 times, a situation which stems from investments made in new combined cycle plants after the arrival of the natural gas to Chile. High dependency of the system on this source of energy and the steeply increasing demand of mining companies in the region (accounting for more than 50% of total demand) determine that the capacity slump observed in this system is merely apparent.

Present perspectives are more favorable as the result of changes made to the law in 2004 and 2005. These have contributed towards removing obstacles which hampered investment.

Throughout all of its segments, the electricity industry in Chile shows a high degree of concentration. As clearly indicated in Table 1, an important percentage of the installed generation capacity is directly or indirectly controlled by three economic groups: Endesa, Gener and Colbún. Although this concentration is quite high, the situation has improved over the last few years. The reduced importance of Endesa is an example of the above since its 1992 capacity amounted to 63% of the SIC. On the other hand, new groups have entered into the system such as Pacific Hydro, Innergy and Southern Cross. The participation of these groups is presently small but is expected to increase in the medium term.

The country's transmission lines are property of transmission companies, generation companies and some large-scale consumers (mainly mining companies). Transelec, SIC's most important transmission company, was owned by Endesa until 2000, when the company was sold to the Canadian group Hydro Québec. Endesa's decision to sell this company came after Chile's Antitrust Resolution Commission forced the company to make Transelec an open stock corporation and to make share ownership available to third parties.

[8] At the beginning of 2005, the expected probability of a shortage in 2007 was 26% and 34% in 2008. Usually this expected probability is less than 1%. For more details, see Agurto (2005).

[9] The system was fortunate because demand grew at a moderate rate compared to the behavior observed in the periods immediately before and after.

The distribution segment is organized in companies that hold concessions in specific areas of the country. The size of these companies obviously depends on the size and population density of their respective regions. As may be observed in Table 2, the distribution service in the SING is provided by three companies controlled by the EMEL group. In the case of the SIC, there are more than 30 distribution companies of which Chilectra is the largest. This company, which concentrates 47% of sales and 35% of all consumers is owned by the same group controlled by Endesa, which means that there is an important degree of vertical integration within the SIC. [10]

III. Operation and Regulation of the Chilean Electricity Industry until 2004.

The Chilean electricity industry reform began in the early 80s and included the restructuring of companies, their privatization and the implementation of a new regulatory framework.

The industry's restructuring gave birth to three generation companies of different sizes and several distribution companies. Ownership of the transmission company remained in the hands of the system's largest generator (Endesa). [11] Corporate privatization mainly took place in the late 80s and was completed by the end of the 90s.[12]

One distinctive aspect of the Chilean reform is that regulatory institutional development was implemented before the reform as such. This institutionality is made up by two entities: the National Energy Commission ("CNE") and the Electricity and Fuel Superintendency ("SEC"). The CNE, created in 1978, was in charge of advising sectorial policies and calculates regulated prices. The SEC, created in 1985, is in charge of enforcing service quality, handling consumer complaints and granting temporary concessions. Finally, the Ministry of Economy is in charge of signing tariff decrees and granting definitive concessions. If there is a shortage (for instace during periods of draughts), it is responsible for issuing the rationing decree.

The reform of the industry aimed to reach efficiency in the companies' operation and competition in every segment where it was possible. In line with the foregoing, the law of 1982 explicitly recognizes the generation, transmission, and distribution segments of the industry, but it does not prohibit vertical integration.[13] The regulator visualized the former activity as potentially competitive, reserving the category of natural monopoly only for the two latter activities. Interconnection among generators was mandatory, and non-discriminatory access to the transportation system was guaranteed. Finally, it was established that dispatch would be based on the audited marginal costs of the respective power plants and completely independent from the contracts signed previously by the

[10] The importance of this vertical integration is less than that observed some years ago when Chilectra owned the Río Maipo distribution company (which accounts for 8% of the system's customers). This company was sold to the CGE group in 2003.
[11] This continued up until the year 2000.
[12] For more information on Chile's privatization process, see Lüders and Hachette (1992).
[13] The most important law is "Ley General de Servicios Eléctricos" (DFL 1/82).

generators (merit order dispatch). An independent entity, the "Load and Economic Dispatch Center" (CDEC), is in charge of dispatch, operation of the system, estimation of short run marginal cost, and guaranteeing open access to transmission lines. [14]

System Operation

We will use Figure 4 to understand how the industry operates. Generating companies are allowed to sell to three different customers: large consumers, distribution companies and other generating companies. Large consumers – those whose installed capacity is greater or equal to 2 MW[15]- are entitled to enter into contracts directly with generators and to freely negotiate the price for electricity. These contracts are not subject to any kind of regulation; the negotiated price is known as the "free price". Distribution companies are required to enter into long-term contracts with the generators, at a regulated price, in order to purchase electricity for the supply of their regulated consumers. These contracts are paid in the form of a regulated price called the "nodal price", calculated by the CNE. Finally, transfers of energy between generators take place in a simulated "uniform price" spot market. These transfers stem from the differences produced between the generation of companies dispatched and the contracts these companies have signed. The "market" clearing price, called the "spot price" is given by the marginal cost of the last generator required to balance supply and demand, taking into account transmission constraints and losses.[16] It is calculated hourly by the CDEC according to marginal cost information reported by the generators themselves. Neither distribution companies nor large consumers have access to the simulated spot market.

The regulated price has two components, energy and capacity, and is set every 6 months by the CNE for each substation of the trunk system (14 in the SING and 22 in the SIC).[17] The nodal price of energy corresponds to the average expected marginal cost of producing energy in a certain period and is calculated based on simulations of the system's operation in the following 48 months (in the case of the SIC) considering the expected price of fuel, the economic value of water resources, demand estimates and hydrological conditions over the past 40 years. The nodal price of capacity corresponds to the marginal cost of increasing the system's installed power capacity.[18] A particular feature of the Chilean pricing system is that the nodal price is required to lie within a band of +/- 10% of the non-regulated price; this means that every time the regulated price is set, the regulator has to get information on the free price and make sure that constraint is satisfied.[19]

[14] Initially the CDEC was an informal coordination body. In 1998 regulation required that this entity had corporate existence.
[15] This limit was reduced to 500 KW in the year 2004 (Short Law I).
[16] If there is a shortage, the spot price is given by the failure cost which is calculated based on consumer willingness to accept compensation for a planned outage of a certain magnitude.
[17] The regulated price is calculated for one substation. Later, an energy penalization factor (that reflects system's marginal losses) is used to estimate the regulated price at each of the remaining substations.
[18] This is calculated based on the capital cost of a diesel turbine.
[19] In 2004 the width of the band was reduced to +/- 5%.

Distribution activity is organized on the basis of concession areas which are assigned to distribution companies according to a procedure established by law. The companies are obliged to provide service to all of the interested consumers who are located in "their" distribution area and to consumers that are connected to the company's lines by their own lines or third party. Distribution companies in Chile not only transport energy but also play the role of retailers.

As is the case with generation companies, distributors can make transactions with both free customers and regulated customers. In the first case, prices are freely determined by both parties. In contrast, small-scale consumers pay a regulated price which is calculated based on the nodal price and the value added in distribution ("VAD"). The nodal price is completely transferred to the price paid by the final consumer. The VAD is set by the CNE every 4 years considering investment, line maintenance and operation costs, fixed expenses (administration, invoicing, assessment, etc.) as well as energy and power losses. VAD is calculated in such a way that a "model" distribution company which operates efficiently is able to get a return of 10%. [20] As Pollitt (2004) points out, this regulation approach mirrors the suggestions made for RPI-X and yardstick competition. [21]

Although the regulator recognized transmission and distribution activities as natural monopolies, their tolls were not regulated. The law stated that charges for the use of transmission lines could be freely determined by the parties involved; a calculation methodology is provided only as guidance and its use is voluntary. [22] This basically consisted of setting transmission charges that would allow the transmission company to recover the new replacement value of the line plus its maintenance and operational costs. [23] Although the general criterion was clear, the calculation methodology proposed in the law was not. In turn, the law made no reference to distribution tolls. In practice these were freely determined by the distribution companies, a situation which exclusively affected large consumers.

Electricity companies are required to comply with certain minimum supply and service quality standards. Specifically, these companies are responsible for any failure, unless it cannot be attributed to the company and the SEC declares "force majeur" or an accident. In the event of deficit situations, and in the absence of a rationing decree, the SEC is authorized to apply fines to companies. If, in contrast, rationing is decreed, generating companies are required to compensate their regulated customers based on a formula

[20] Both the nodal price and the VAD are indexed to the prices of the main inputs used to provide the respective service.

[21] Even though these methods look alike, the Chilean "model company" regulatory approach differs from yardstick competition in a key aspect: while the former sets the price at the long run average cost, the latter sets the price at the observed average cost, which should converge over the time to the long run average cost.

[22] The payment system of the transmission system was incorporated into the law on a late basis. Originally, only open access to the network was established for all users. Subsequently, in 1985, together with the creation of the CDECs a payment system that provided the right to make withdrawals was established.

[23] The law enables transmission companies to finance their costs from two sources: the "tariff income" and tolls. The former comes about as the result of the difference between marginal costs at two nodes of the network. Together these incomes must be enough to finance the company's investment and operational expenses under a supposed 10% profitability scheme.

established by the law. This compensation is calculated based on the "failure cost" which corresponds to an estimate of the cost to users of not having energy.

Up until June 1999 the law established that energy produced in years drier than those taken into consideration for determining the nodal price could not be considered when estimating the extent of the deficit. In other words, neither generating nor distribution companies were required to compensate their customers in the event of drought, this being defined as a year drier than 1968.[24] The idea behind such regulations was that the minimum supply quality standards which companies were required to satisfy were the same used to calculate the nodal price. Thus there was reasonable consistency between what companies charged and the quality of service required. Radical changes were made in this regard in June 1999 and consequently to the incentives of generating companies. Specifically, it was agreed that a drought did not constitute "force majeur" and consequently companies would be required to compensate their customers even in hydrological conditions worse than those taken into consideration when calculating the nodal price.

Assessment

In general terms, there is a consensus that for more than 20 years the reforms were successful in many aspects (see Pollitt (2004), Fischer and Serra (2006)). Indeed, and as was shown in the previous section, during most of the period levels of investment in capacity closely followed movements in demand. This dynamism promoted the entry of natural gas from Argentina and reasonable quality of service.

Notwithstanding that, after 20 years of the restructuring of this industry, some issues that were not problematic at the beginning, started being critical. These issues fall under two categories: less than desirable intensity of competition in the generation segment and inadequate incentives for expanding generation and transmission capacity. Poor supply crisis management in the late 90s contributed in part to exacerbate the latter problem.

Regulation of the industry was designed so that competition between agents would occur over supply to free customers; the benefits of this competition would be transferred to regulated consumers through the band of +/- 10% that related the nodal price to the free price. In practice, however, the regulator was not very careful when laying the groundwork for such competition to truly take place. The first element to consider is that the number of large consumers was quite small, especially in the case of the SIC (see Table 3). Secondly, an important percentage of these customers were located within zones for which concessions had already been granted to a distribution company which, in addition to non-existent distribution toll regulation hampered generator access to this segment. Another factor that negatively affects competition in the large consumer segment is the existence of a complete pass-through of the nodal price to the final price paid by the regulated consumer as it makes no difference for distribution companies which generator they sign a contract with. In contrast, generators were definitely interested in contracting, especially during the long period when the nodal price was

[24] This was the driest year contemplated in the 40 hydrological conditions used to calculate the nodal price.

above the spot price (first half of the 90s), so they were willing to accept certain special conditions imposed by distributors such as the commitment not to sell to large consumers within the zone for which a concession was granted to this company Consequently, in many cases only distribution companies bid to supply to free customers. In practice, these consumers were not "free" but were monopolized by the distribution companies.

Enersis was the major stockholder of Endesa and Chilectra. Vertical integration between generation and distribution has a negative effect on the degree of competition in generation because the distributor, since it is indifferent about generators when it comes to signing contracts, prefers the related company, giving that company an advantage over other generators. On the other hand, vertical integration between Endesa and Transelec gave rise to complaints to the Antitrust Commission by other generation companies that argued that Transelec made use of monopoly power and discriminated against generators that were not related to Endesa.

The high degree of concentration in the generation segment, in both the SIC and the SING, might make one think that these companies could be exercising market power in the so-called "spot market." This, however, is not a market as such but rather a simulation of the operation of a market. In this context, the strategy available to companies to pressure prices above the competitive level in the spot market consists of overestimating production costs. The risk of this happening is limited due to certain aspects of the regulation. The first one is that the nodal price and the actual short-run marginal cost are not directly linked. The latter is the price that generators with short positions in the contract market have to pay in the spot market for the necessary energy to make up the difference between energy sold in contracts and energy actually produced (according to dispatch orders). Consequently, this generator has a strong incentive to make sure that whoever sells in the spot market declares its real costs. The alternating deficit and surplus positions of generators over time reinforces mutual surveillance, forcing declared costs to coincide with true marginal costs. This same characteristic limits the possibility of collusion among agents. Consequently, it is precisely the operating mechanism of the spot market that limits the possibility of exercising market power either individually or jointly.[25]

As mentioned in the previous section, parallel growth of demand and installed capacity in generation and transmission came to an end in the late 90s. In the case of generation, between 1999 and 2003, capacity grew at a rate of 75 MW on average per year; far below the 245 MW demand increase. As a result of the lag in investment and the restrictions on natural gas, marginal costs in early 2005 were at very high levels (US$ 159/ MWh average in April and US$ 109/MWh in May 05, far above the figures observed in the previous year: 37.7 and 54.7, respectively). The reasons for this situation are varied, but all have a common root: incentives provided by regulation.

[25] It should be borne in mind, however, that although it is true that in a market like the Chilean one it is hard to exercise market power through price strategies, generators can influence them indirectly through their investment decisions. This decision may affect marginal costs through the size and composition of their generator portfolio. Therefore, the spot market is still prone to becoming a more subtle victim of the exercise of market power. For more details see Arellano and Serra (2005).

The first incentive in the wrong direction resulted from amendments introduced to the regulations after the drought experienced in the years 1998-99. Among the changes introduced in June 1999 it was determined that the drought did not constitute "force majeur" and therefore companies would be required to compensate their customers even under hydrological conditions worse than those taken into consideration when calculating the nodal price. This law introduced a lack of consistency between what companies can charge and the quality of service required (equivalent to providing supply "in any event"). On the other hand, distribution of the costs of the deficit among all agents, whether they were in deficit or not, was also established. In response to these changes, both incentives to invest in hydroelectric plants and generator interest in contracting with distributors were reduced.

The years between 1999 and 2004 were intense in discussions aimed at modifying the law. At least five proposed laws were presented which, although they shared some elements, also contained radically different proposals. For example, whereas some maintained the need to perfect regulation, other argued about the advisability of leaving the "market" system with audited costs and implementing an energy market, following the, at the time, new California model. The idea of completely deregulating the market has been gradually abandoned.[26] Discussion also focused on the payment mechanism of the transmission system. Regulatory uncertainty helped stall investments as businessmen were not willing to risk capital on new projects until the regulatory framework was cleared up.

Finally, investment in greater generation capacity has also been affected because the pricing system has not played its role accurately in providing the right scarcity signal. Firstly, the regulator has a certain degree of discretionality in calculating the nodal price – by means of determining a works plan and fuel price assumptions, among others- which on occasions has meant avoiding price increases even though there was high probability of experiencing a period of high marginal costs. A look at Figure 5 is enough to illustrate this point. Observe that in the second half of the 90s the nodal price level fell consistently, a situation which continued on even under one of the worst droughts on record. It was only in the year 2000 that this situation began to turn around. A similar problem was experienced in the year 2004 and at the beginning of 2005; nodal price setting presupposed the entry of new natural gas combined cycle plants even though import restrictions for this fuel from Argentina were increasingly evident. In practice this

[26] In a previous paper I show that if an unregulated spot market were implemented in Chile's electricity industry, the largest generator (Endesa) would have the incentive and the ability to exercise market power unilaterally. Its most important strategy would be to distort the intertemporal allocation of its hydro resources in order to take advantage of differences in price elasticity of residual demand. In particular, it would allocate too little supply to high demand periods and too much to low demand periods (relative to the competitive equilibrium). As a result, prices are between 40 and 45% higher than competitive prices in the highest demand periods (assuming price elasticity of market demand = -1/3). Welfare is lower not only because total production is lower but also because the abandoning of marginal cost dispatch results in high operating cost plants being dispatched while some low operating cost plants are kept off the market. For more details, see Arellano (2005).

meant that the marginal costs expected by the authorities and thus the nodal price level were below those expected by the industry. The resulting low nodal price level was not enough to finance investment in other generation technologies such as coal.[27]

On the other hand, the rigidity of the nodal price –remaining constant for a period of six months- made it hard for both consumers and producers to receive the right signal for consumption and investment decisions.[28] This problem explains the lack of interest shown by generators in investing in technologies other than natural gas in recent years. These entrepreneurs argued that even if the nodal price were to reach the level that made coal plants feasible in the short run, the conditions would not be appropriate to guarantee that those investments will be profitable. The concern of those companies was that if the supply of natural gas should return to normal in a few years, the node price will fall again.

The law does not require transmission companies to expand the system. To the contrary, this expansion is decided upon through bilateral negotiations between the transmitter and the generators interested in connecting a new power plant. The law also allows generators to build their own lines in order to inject energy from their plants into the trunk system. Expansion of the transmission system worked relatively well until the mid-90s because the network structure was relatively simple and Endesa owned the largest transmission company in the system, Transelec, and at the same time was the largest consumer in the network and thus had appropriate incentives to extend it. However, the vertical integration between generation and transmission was not completely harmless as other gencos complained that Endesa/Transelec abused of its dominant position. In an emblematic case, this problem ended in Colbun building its own transmission line rather than using the existing line because of the high price initially charged by Transelec (US$ 21 million in tolls that was reduced to US$10.3 after Colbun threatened to build its own line (Politt, 2004). The situation changed when transmission assets were in the hands of a third agent, Hydro Québec. The lack of clarity in the law (for example, there was no clear methodology to define who was the user of the network and consequently who had to pay for it) and the definition of tolls through a bilateral negotiation, which usually ended up in an arbitration process whose result was uncertain, contributed to the fact that financing of the new lines was not guaranteed, severely limiting the network's expansion. The most emblematic case of this was the reluctance of the transmission company to expand the Charrúa – Temuco section, located in the South of the country, despite a general consensus about the urgent need to do so.

[27] See Pollitt (2004) for a discussion of additional concerns regarding the practice of regulation in Chile and the lessons learned.

[28] Fischer and Galetovic (2003) argue that the rigidity of the price system –unable to respond to large supply shocks- and the deficiencies in regulatory governance –that did not help to make the pricing system work- are to be blamed for the 1998-99 crises. Indeed, they show that it was feasible to manage the supply restrictions with no outages.

IV. The new regulatory framework post 2004-2005

Two laws that modified the regulation of the electricity industry were approved in 2004 and 2005, with a fairly broad consensus. The first one, called "Short Law I" introduced changes in the payment mechanism of transmission and distribution.[29] The second law, "Short Law II", progressed in the deregulation of the nodal price and introduced elements which enhanced demand management.

Short Law I:

Short Law I was approved in 2004 after a long period of discussion. Although most of the law refers to the transmission system, other changes were introduced to facilitate competition among generators, improve the dispute settlement mechanism, and perfect regulatory treatment of medium-sized electric systems, among others. The main changes that were made are discussed below.

The main change in the payment mechanism for the transportation system is that it established that tolls, for transmission and distribution, shall be regulated. An important part of the law describes the methodology that will be used to calculate transmission tolls, leaving the setting of distribution tolls to a regulation that would be issued later.[30] In regard to transmission, the law defines the extent of the trunk system, how its expansions are decided on, and the calculation methodology the CNE should follow in setting tolls, including the way charges should be assigned between generators and users. For the first time, in order to give the correct signals for the location of power plants and consumers, it was established that 20% of the tolls would be assumed directly by the parties that make withdrawals from the system.[31]

Expansion of the trunk system is defined according to a study carried out every four years by external consultants, who are entitled to recommend expansions and the construction of new lines. Expansion of the existing lines is compulsory for the owners of the respective lines. The law establishes that the awarding of new lines must be performed by means of an open and international bid to be organized by the corresponding CDEC.[32] Since it takes a long time to draw up this plan, the law included transitory articles aimed to guarantee the construction of those lines considered as essential for preserving supply

[29] This law is named the "Short Law," because it is an abbreviated version of a broader bill called the "Long Law."

[30] The implicit criterion of the law on this point is that the large customer pays for use of the distribution facilities the same as it would pay if it were a regulated customer. The setting of those tolls was carried out in September 2004.

[31] This applies for the portion of the trunk system called the "area of common influence." Outside of this area, the direction of the flow determines who shall pay. If the direction of the flow is towards the area of common influence, 100% corresponds to the generators, whereas if energy flows in the opposite direction, 100% corresponds to the consumers. The total charge is distributed in proportion to use among the generators or consumers that actually use the respective section.

[32] Given the fact that reality may differ from the assumptions used in the trunk system development plan, the law establishes that the CDEC must compare the industry performance with the recommended expansions on an annual basis. The CDEC is also entitled to propose projects for the next 12 months. In virtue of this proposal, once a year the CNE is entitled to present a transmission system expansion plan.

security. The aforementioned development plan must also include a valuation of transmission system assets and the estimation of system operational and maintenance costs. This information is used for determining the tolls.[33]

Short Law I also included a number of measures to increase competition at the generation level. For example, in order to increase the group of customers that generators can actually compete for, the limit on installed capacity was reduced from 2000 KW to 500 KW, a limit which becomes operational in 2006.[34] For those users, the category of free customer is "voluntary," because the law grants them the possibility of remaining as regulated customers; however, those customers shall remain in the rate regime they choose for a minimum of four years. This measure, in conjunction with the regulation of distribution tolls, should result in more intense competition to provide supply to this group of consumers. In addition, as a way of transferring the benefits of increased competition to regulated customers, the float range of the nodal price with respect to the free price was reduced from +/- 10% to +/- 5%.

The law also directly addressed the problem of vertical integration between the transmission segment and others in the industry. It established that transmission companies may not participate directly or indirectly in generation and distribution activities. On the other hand, any firm that participates in the power industry may own at most 8% of the value of the trunk system. The same limit, applied to joint participation (through conglomerates, for instance), amounts to 40%.

Lastly, this law created a specialized agency, the Panel of Experts, made up of independent professionals whose functions are to resolve the discrepancies which come up within the system between companies as well as between the regulator and companies. This new institutional system avoids having the regulator act as "judge and jury" in a significant part of the conflicts in the industry. On the other hand, the discrepancies must be resolved within the time periods established in the law, which are usually very short. The Panel's rulings shall be well founded and they may not be appealed.

Short Law II

The approval of Short Law I marked an important advance in the Chilean law, especially because it removed obstacles to expansion in transmission, and it put an end to a long period of regulatory uncertainty. The most important element that was pending in the discussion was the need to move forward in the deregulation of nodal prices. Despite the foregoing, it was considered there was not sufficient political support for a reform of that kind, especially considering that there were municipal elections in 2004 and a presidential election in 2005.

In the months following enactment of the Short Law I, the Chilean electric sector faced a crisis it was not prepared for. In fact, faced with problems of internal supply and despite

[33] In case of differences between the views of the external consultants and the companies, these must be resolved by the recently created "Panel of Experts".
[34] The 500 KW limit can be reduced even more if the Free Competition Court approves it.

the existence of a gas protocol approved by both countries, in March 2004 the Argentine government approved a resolution which permitted it to restrict exports of natural gas surplus to Chile. The restrictions started in May of that year and have lasted until the present time, at times affecting about 50% of supply. The industry has survived these restrictions with different measures being taken by the generators – like reconversion to diesel of natural gas-fueled plants – but this has resulted in higher marginal production costs.

The crisis resulted in a freeze on the few investments that had been previously announced, prolonging and accentuating the energy crisis. The generators considered the level of nodal prices were not enough to guarantee the financing of coal-fueled power plants; they also argued that even if prices reached necessary levels, there was no guarantee that prices would stay at that level for a long enough period of time to make the investments profitable.[35] On the other hand, the rise in production costs was not transferred immediately and completely to final prices, because contracts with non regulated consumers were indexed to the price of gas. In addition, the reduced width of the float range for the nodal price compared to the free price only made the situation more complicated, because a significant part of the free contracts had been signed when natural gas was normally available so prices were relatively low.

The crisis pointed up the problems caused by the rigidity of the pricing system, thereby providing the necessary foundations for approval of a law that would deregulate prices. This law was finally enacted in May 2005.

One of the most important changes introduced by the law was that the price at which distributors would buy energy for their regulated customers would be determined freely through open, public, transparent bidding. The price would remain fixed during the life of the contract, whose maximum limit was set at fifteen years. The bidding should be carried out three years in advance. In order to maintain the link between that price and the price of the free contracts, it was established that the former could not exceed 120% of the latter.[36] This means the end of the nodal price as it has been known for more than twenty years and the appearance of a "long-term node price" determined by the market. Calculation of the final price for regulated consumers includes the transfer of the weighted average price of all the prices the distributor has valid contracts for.[37] A

[35] Natural gas was a problem because of its current lack of availability and its eventual future availability. Because of restrictions on gas supply and the fact that no new natural gas export permits were to be granted in Argentina, new investments in natural gas-fueled power plants were halted. At the same time, generators were not willing to invest in coal-fueled power plants because of the risk implied in the eventual "arrival of natural gas" in the medium term.

[36] If the bid is declared void, the ceiling rises to 138% of the price of the free contracts. Note that this implicitly reverts the narrowing of the nodal price flotation bandwidth with respect to the free price introduced by Short Law I.

[37] During the transition between the current situation and the time when all the distribution companies' sales to regulated companies are associated to the long-term nodal price contracts, the CNE will continue to calculate the nodal price based on current methodology. This price shall be transferred to the final price with a weight equivalent to the proportion of the distributor's sales of energy that is not under the new system. Thus, the current version of the nodal price will gradually disappear.

solidary mechanism is also established that prevents prices contracted by a distributor from differing very much from the average.

Second, Short Law II permits generators to reward end consumers for reductions in consumption. A mechanism is established according to which generators, through distribution companies, can publicize offers to reduce energy consumption voluntarily in exchange for compensation, which will be paid by the generator making the offer. This measure aims to give the consumer an appropriate price signal when supply is restricted.[38]

Finally, the law established that the unavailability of natural gas could not be considered force majeure and, consequently, problems with supply would give rise to compensation for users in deficit. Gas drought was thereby equated with hydrological drought.

V. Final Comments

The amendments introduced in the years 2004 and 2005 are undoubtedly the most important changes made in the regulation of the power industry since the reform which took place in the early 80s. Surprisingly, some of those measures make it possible to fully implement the regulator's original view of the industry: prices of services with the characteristics of a natural monopoly were regulated while prices in the generation segment were left to the market, which has been recognized since the beginning of regulation as potentially competitive.

The modifications removed a significant part of the elements that negatively affected incentives to expand installed capacity in transmission and generation, with the (implicit or explicit) guarantee of financing the respective investments being the determining element. In the case of generation, the measures implemented made it possible to reduce the risk of a potential supply crisis, but their effect will be seen at different moments in time and therefore short term perspectives must be distinguished from medium-term perspectives. In fact, as a result of the introduction of the long-term nodal price the risk for new investments in generating capacity was reduced considerably, making investment more dynamic. In addition, the arrival of LNG is expected in 2009. This is the result of a government mandated project led by the state company ENAP in conjunction with Endesa and Metrogas (a gas distributor). In February of 2006 a contract was awarded by means of an international bid for construction of a port terminal, a regasification plant and exclusive supply of LNG to the company British Gas. AES Gener and Colbun, the other economic groups with generation investments, decided not to participate in the project. Since the effect of these investments will only be perceived in a minimum of three to four years, medium-term prospects look more favorable than they did at the beginning of the natural gas crisis. It is expected that medium-term system expansion will be based on coal and hydroelectric plants. High estimated prices of LNG suggest that this

[38] The normative considers rewards for users who reduce their consumption but does not punish overconsumption.

will only be used as a reserve by currently existing combined cycle plants; it is not very likely that new power plants will be built using the same as their primary fuel.

The mechanism that introduces flexibility in price management and, thereby, in demand, and given construction deadlines, the installation of new power plants with higher operating costs (diesel turbines) are the only tools available to the industry to deal with an eventual crisis in the short term. Notwithstanding, the use of the former is threatened by a lack of appropriate regulation of the way incentives to reduce consumption will operate and the uncertain cooperation on the part of the distributors, which lose the VAD for energy saved by the consumer. On the other hand, there is no full guarantee that there will be enough time to install the power plants required. The main stumbling block is not industry regulation but rather the long period than it takes to get the approval of environmental permits required for these power plants to operate.

It is evident that greater supply security is not free; on the contrary, it is expected that in the short and medium term the price level will increase to levels close to and even greater than those experienced before the arrival of natural gas. On the other hand, the new system does not recognize that preferences for a safe supply differ among consumers themselves.

Amendments to these regulations also meant a step ahead in terms of favoring competition, especially at the generation level. In fact, changes involving setting transmission and distribution tolls, increasing the size of free customers, and distributors' obligation to call to bid for supply contracts three years in advance should not only lead to increased intensity of competition between existing generators but also more favorable conditions for the entry of new firms. It is not yet possible to evaluate the effectiveness of the measures yet, because the setting of distribution tolls is recent and the reduction in the limit on installed power needed to qualify as a free customer will only start operating in 2006. However, there are at least two indicators that the prospects are favorable: first, in March 2006 four distribution companies called for a bid in order to satisfy supply requirements starting in the year 2009 for an annual total of 6820 GWh of base energy and 1320GWh/year in blocks of variable energy. These bids consider contracts with duration of between 7 and 12 years.[39] On the other hand, generators that are not installed have announced the construction of new power plants, some of which already started.

Notwithstanding the above, one must be aware of the fact that there are still factors in the regulations which hamper industry competition. Firstly, there is no absolute guarantee that bids will be competitive. The main concern is that it is not clear that distribution companies will seek low contracted prices, especially since this price is completely transferred to the final price. On the other hand, the system has not explicitly recognized that the retailing activity is potentially competitive and therefore should not be regulated. In effect, it should be pointed out that distribution companies do not just transport energy

[39] As pointed out by a referee, long term contracting between gencos and distribution companies in Chile contrasts with short term contracts in other free markets like the UK. This difference may be explained by distribution companies holding a continuing monopoly franchise and therefore long term contracts with their regulated final consumers.

but also carry out invoicing, sales, etc., all retailer-related activities. Introducing retailers allows offering differentiated products catered to consumer preferences for supply security. Distributors cannot presently offer different types of contracts to consumers who are willing to accept a lower quality level in exchange for a lower price; nor do they have any incentive to do so. A retailer would not only have the flexibility to offer different quality levels to consumers, but it might also profit from it.

Although the law does not recognize retailers, it implicitly allows generators to play that role by authorizing them to sign contracts directly with non-regulated customers. The reduction in the limit on capacity necessary to qualify as a free customer implies that the sphere of action of generators in their retailing role is potentially greater. Consequently, part of the problem may be resolved as the limit on installed capacity to qualify as a free customer continues to drop. This is a simple change, because it only requires the authorization of the Free Competition Court.

Consequently, the industry regulation is still perfectible. Notwithstanding the above, changes introduced in 2004 and 2005 meant a substantial advance for the industry, especially in terms of the incentives faced by industry agents to make their investments efficient and to compete as intensely as possible. The crises which have been regularly announced starting in the late 90s seem to have been overcome, although at no meager cost.

In all, the Chilean electricity industry's reasonable performance under a "regulated" competition system is a breath of fresh air for those countries whose market sizes or industry structure are not enough to guarantee the success of a reform which would completely liberalize the industry, such as those which have been implemented with varying degrees of success in several developed countries.

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Figure 1

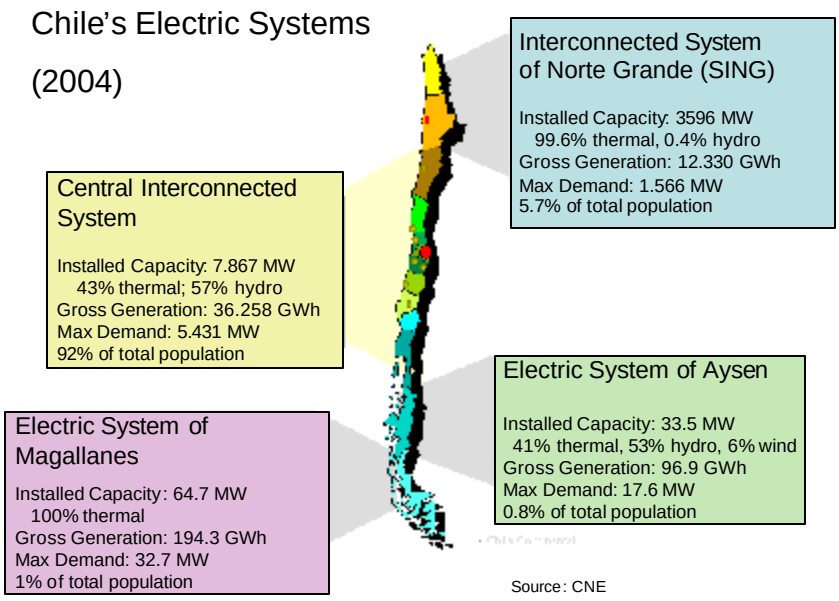
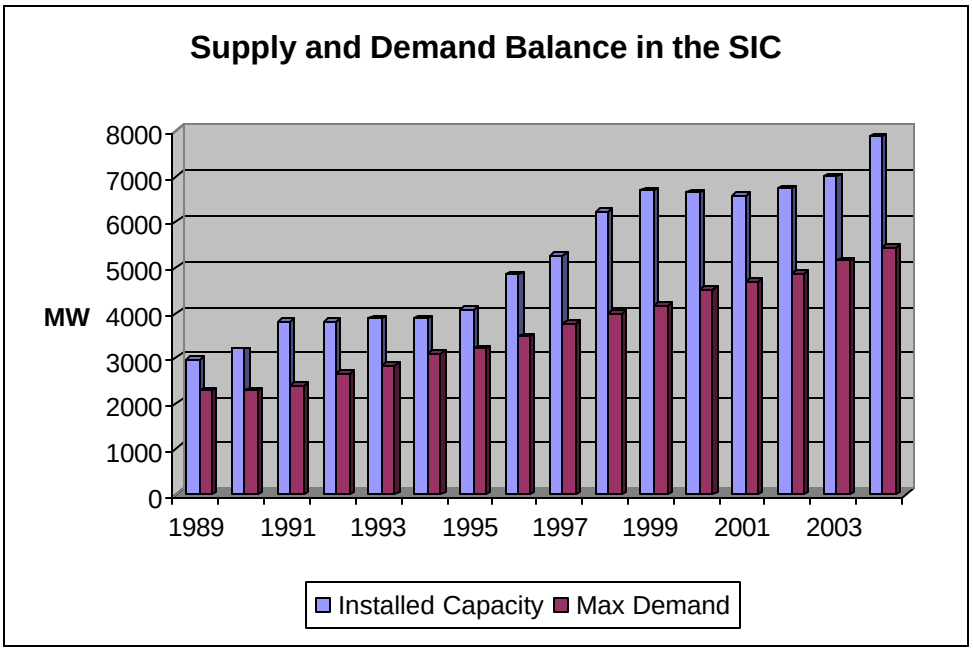
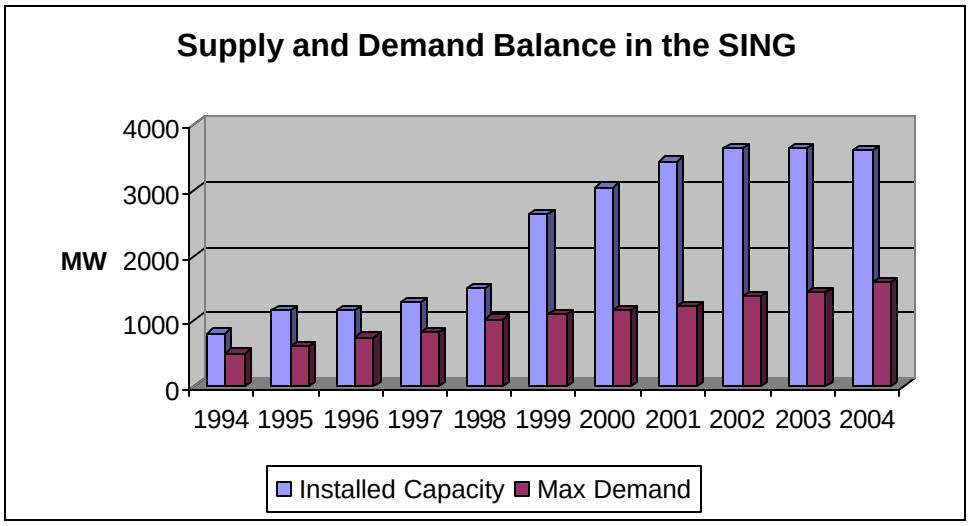


Figure 2



Source: CDEC-SIC

Figure 3



Source: CDEC-SING

Figure 4

Basic Architecture of Chile's Power Industry

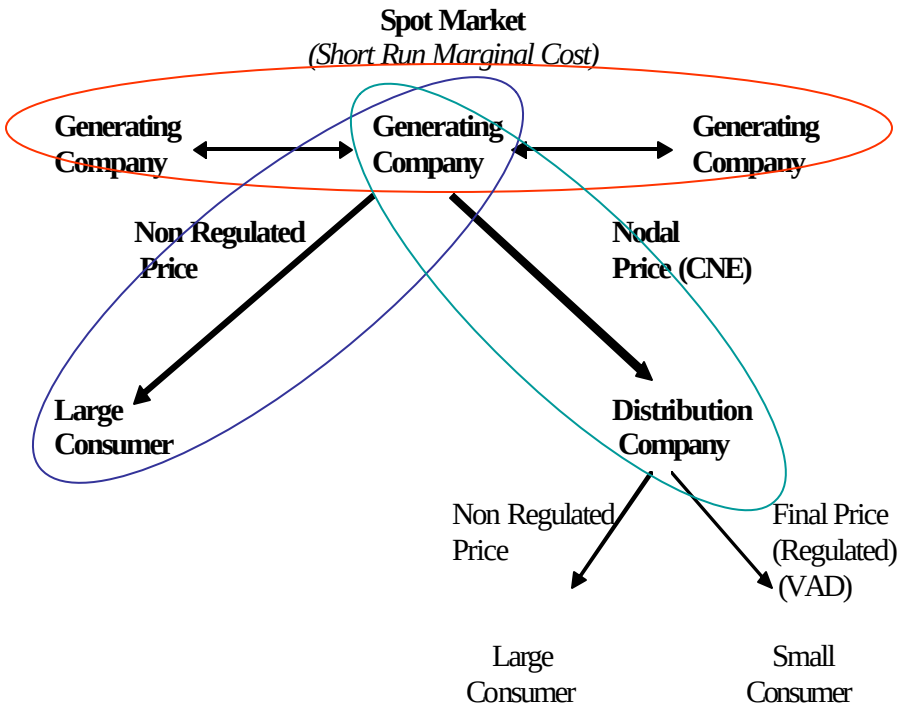
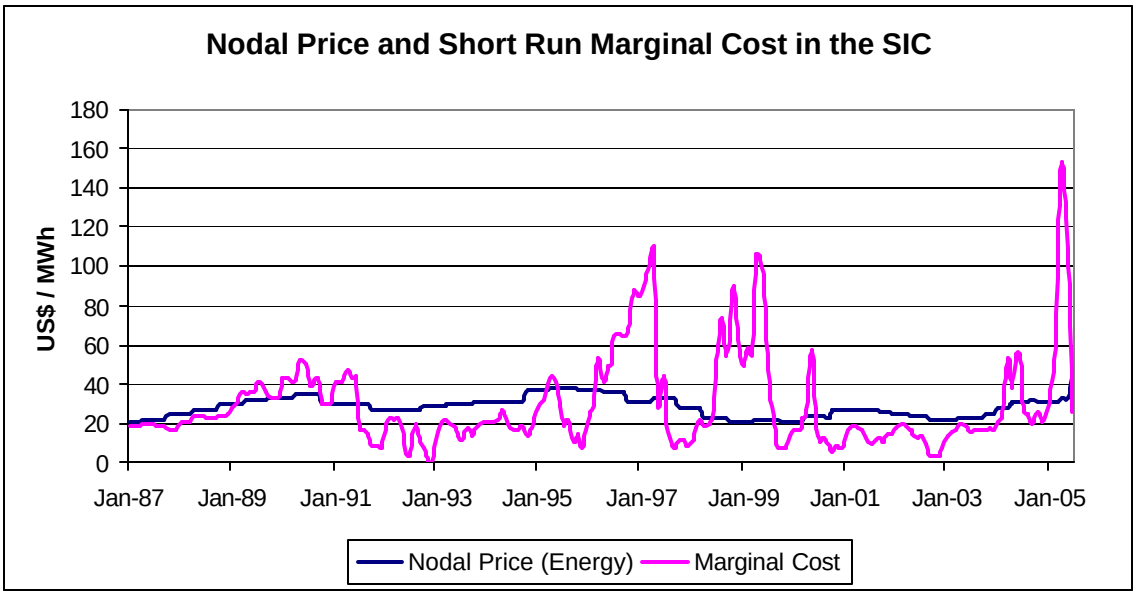


Figure 5



Source CNE, CDEC-SIC

Table 1
Property Structure of Installed Capacity (MW, July 2005)

Economic Group	SING		SIC	
Endesa	965	(27%)	4172	(51%)
Gener	920	(26%)	1482	(18%)
Colbun / (Suez Energy)	1711	(48%)	1925	(23%)
Others			647	(8%)
Total	3596		8225	

Source: CNE

Table 2
Main Distribution Companies (2004)

Economic Group	# Regulated Consumers	Total Sales (GWh)
SING		
Emel	252.615 (100%)	1.101,7
SIC	3.850.000	23.418,9
Chilectra	1.352.220 (35%)	10.991,1 (47%)
CGE	1.392.209 (36%)	6.573,9 (28%)
Chilquinta	509.110 (13%)	2.058,9 (9%)
Saesa	536.416 (14%)	1.894,1 (8%)
Emel	277.404 (7%)	1.295,1 (6%)

Source: CNE

Table 3
Importance of Regulated and Non Regulated Consumers (Dic 2004)

	Sales to (GWh)		Sales to (%)	
System	Regulated Consumers	Large Consumers	Regulated Consumers	Large Consumers
SING	1,076	10,164	10%	90%
SIC	23,515	11,088	68%	32%
AYSEN	82	-	100%	0%
MAGALLANES	147	33	82%	18%
Total	24,819	21,285	54%	46%

Source: CDEC-SIC

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