

Contract auctions to assure supply adequacy in an uncertain energy environment

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Abstract—The paper reviews solutions being explored to face the supply problems faced in the Chilean electricity market over recent years, given unexpected restrictions in natural gas transfers from Argentina. Investment in generation came to a stall, given uncertainties in natural gas supply and the risk to contract with distributors at regulated prices. A change of law was introduced, incorporating market oriented schemes that aim at transferring market expected long term prices to final consumers, replacing the action of the regulator. An auction scheme was introduced and distributors will make a first call for bids at mid 2006.

Index Terms—Power sector deregulation, electric market, risk allocation, natural gas, energy dependence, auctions.

I. INTRODUCTION

If there is one thing that is characteristic of electricity markets worldwide, it is a rising awareness of risk. While electricity markets worldwide are becoming increasingly competitive, risks associated with rising fuel prices, fuel availability, economic and political changes, among others, are confronting those markets. Utilities and their customers are recognizing the need to develop risk management skills to compete in the marketplace [1].

The Latin America energy marketplace led the world with its power sector reform process, but is confronting new risks that are challenging its market structures and imposing new competitive arrangements, with transactions being based more and more on prices set by market forces rather than regulation [2, 3].

Fuel availability and energy dependence, and risks associated, are a growing concern worldwide. The concern is not only with the traditional western world dependence on Middle East oil, which has even caused wars among countries, but also with dependence on natural gas. The Russian gas imports to central Europe were at risk on January 2006, causing concern on the energy future of the continent. Similar situations are being faced in South America, The energy thirsty Brazil and the fast economic growing Chile depend on natural gas imports which are uncertain [4]. This paper analyzes the Chilean case.

The Chilean power sector, that started a power sector

reform process back in 1982, has experimented several crises over its development that have tested the strengths, or weaknesses, of its market model. The most recent crisis began when the Argentinean government started facing problems with its gas supply and in April 2004 decided to reduce gas exports to Chile. Emergency changes had to be made to the electricity laws to face the crisis.

II. CHILEAN ENERGY DEPENDENCE

Chile is a country with limited energy resources other than its hydro reserves in the Andes mountains. Its own oil only provides less than 10% of the country's needs, while its coal is of poor quality, so that imported coal has to be used for electric generation. Hydroelectric generation has developed using most of the low cost resources in the central part of the country, with remaining significant reserves thousands of kilometers south of the main load. Argentinean gas arose as an attractive abundant cheap alternative and an energy integration protocol was signed in 1995 with the neighboring country. Under that protocol, both governments agree to establish the necessary regulations to allow freedom of trade, export, import and transportation of natural gas. Private investors were strongly behind the process, and invested heavily in several pipelines that crossed the Andes and defined an energy path that would rely heavily on the efficient combined cycle generation plant technologies. The protocol worked very well and Chile fully relied on Argentina to provide the necessary energy required to sustain its important economic growth. Gas exports grew steadily through several pipelines. The petrochemical industry and the thermoelectric generation became the main users of natural gas. The arrival of this cheap fuel and the efficient generation technologies meant a significant reduction in the electricity prices in the main central interconnected system. Figure 1 shows the evolution of natural gas consumption in Chile.

However, since March 2004, Argentinean natural gas supply has been facing a deep crisis, driven by a number of factors. These factors include the economic crisis in Argentina and the consequent devaluation of that country's currency, the freezing of wellhead prices and the increase in Argentina's internal demand in recent years. In practice, this supply crisis meant that not only interruptible, but also firm contracted natural gas supply was curtailed in Chile, negatively affecting the power generation and industrial sectors in the country. The situation worsened in 2005 by decisions of the Argentinean authorities to prioritize their domestic market supply under

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any event, discriminating against Chilean consumers.

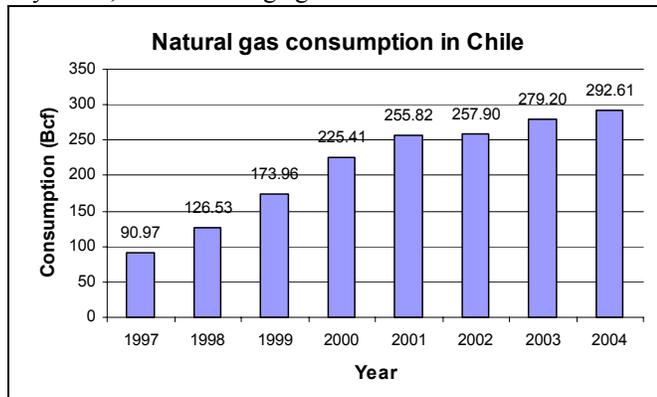


Figure 1. - Evolution of natural gas consumption in Chile

The alternatives being explored by Chilean investors include going back to thermal generation with imported coal, importing liquefied natural gas (LNG) to feed existing combined cycle plants, and developing far away hydro resources. In effect, there are plenty of hydro resources in the southern part of Chile, over 1,500 km south of the mail load. Endesa (the main generator, Spanish owned) is planning to develop several hydro projects in the Pascua and Baker rivers, with more than 2,500 MW of installed capacity. A DC transmission line is being considered to bring energy to Santiago. Uncertainty on the environmental approval of those plants is a worry for Endesa.

Uncertainty also is present on the implementation of the LNG regasification plant, given the difficulty of estimating natural gas demand in Chile and Argentina, determining the expected behavior of natural gas producers in Argentina, and projecting the political decisions of Argentinean authorities.

III. THE CHANGE OF LAW

With those risks in view, investment in generation halted, as the existing laws and the energy pricing scheme did not offer stable returns in an uncertain gas environment. If an investor kept on and built a fluidized bed coal plant, it could eventually run out of business if Argentinean natural gas came back. Given existing tariff laws, risks to investors were enormous.

Thus, concern grew in the country on a future secure energy supply, when the country is going through a high economic growth process, accompanied by high electricity growth rates (Figure 2).

Thus, deep reforms were implemented in the power sector rules and particularly in relation to the price paid by distributors to generators (Law 20.018). The old model, based on a price calculated every six months by the government, evolved towards a new mechanism which incorporates a real market signal through an auction process [5]. As a result of the reforms, distributors will have to bid their supplying contracts in an auction scheme. These auctions are not discriminatory, and existing generators as well as new agents or investors can participate.

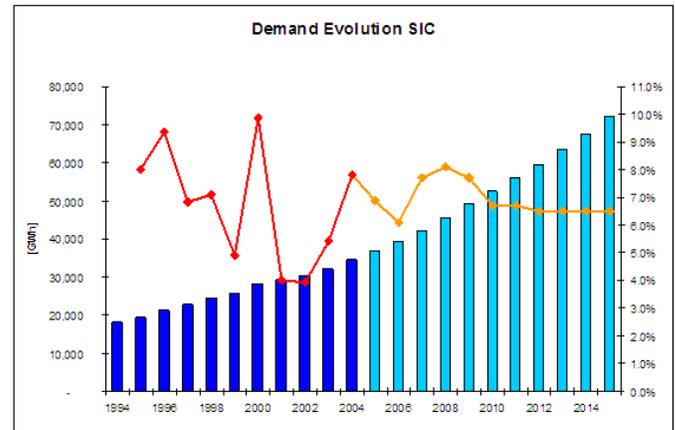


Figure 2. – Demand evolution and growth rate in main system

This new regulatory model incorporates a real market signal in the price to the consumer. Therefore, it will reflect generators and investors expectations about costs, which allow the existence of an attractive market with high yields. In addition, the new law allows the accomplishment of a large auction, in which generators and new agents can make bids for the added demand of several distributors. Others characteristics of the Chilean electric auctions are:

- Distributors must be 100% contracted all the time, at least for the next 3 years.
- Distributors must contract their energy through auctions
- Auctions must be public, open, transparent and without discrimination.
- Several distributors can bid an auction for their aggregated demand.
- Each distributor must design and manage its own auction.
- Distributors can offers contracts for 15 years at a fixed price (indexed to changes in main variables).
- The government has the power to set a price cap.
- Fixed capacity payments are offered.
- Auction winners will be the agents who bid the cheapest alternative.

Finally, the new model will offer contracts which will enter in operation, at least, in 3 years' time. It allows investors to obtain project finance and have enough time to build new plants. Hence, the new mechanism represents a business opportunity for new investors in the generation business.

IV. THE AUCTION PROCESS

On October 2005 the regulator issued Decree 704 that defined the process that distributors must follow to develop the auction process. By February 2006, each distributor must propose its auction scheme for approval by the regulator. As indicated, distributors are free to do auctions on their own or to join others and do them collectively. They are also free to define the time schedule of their auctions. Thus, detailed auction rules and tender documents are to be ready by early 2006.

Generators participating in the auctions compete by

offering energy prices, which will be indexed during the contract period. Capacity prices will be defined by the regulated price at the time of each auction, and fixed during the contract. Offers will be of two types, as illustrated in figure 3: Offers for Base Supply and Offers for Variable Supply (the later associated to changes in demand of the distributors during the time of the contract).

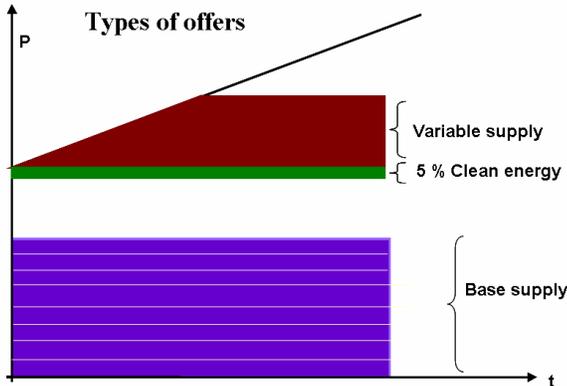


Figure 3. – Auction offers

Thus, the auction process is significantly different to that of Brazil, different rules and different timing process.

At a Seminar held on November 15, 2005 [5], announcements were made that provide some idea of how the first auctions will develop. For a start, it seems improbable, but not impossible, that distributors will join their auctions. Figure 4 shows regulated demand by distributors in 2003, with a total of 18,000 GWh. While Chilectra, the largest distributor, indicated its interest to join others in the first auction process, CGE, the second largest, announced it will go independently. The reason given by most not to join others is the short time available to start the process.

As far as size of contracts to be auctioned, the regulator provided its estimates of future uncontracted energies, as per figures 5 and 6.

Large distributors as Chilectra and Chilquinta announced their intention to hold auctions, even though their contracts do not end in the near future. Chilquinta's contracts start ending by 2009. Chilectra is trying to integrate Chilquinta or Saesa to their auction, and call for 3,000 to 5,000 GWh offers. These are attractive numbers for new investors.

Given the energy resource restrictions in Chile, distributors indicate the long term expected prices are between 50 to 70 US\$/MWh, much conditioned by coal technologies. LNG is foreseen to reach Chile at a much higher price.

V. THE CHALLENGES

The ownership of generation assets is highly concentrated in Chile so that there is the need for a careful design of the auction process in the new regulatory environment, so that full competition is achieved and the lowest possible prices are accomplished. Also, it should be a first priority for the government to stimulate distributors calling for a contract auction to aggressively search for new entrants. A recent

research demonstrates that market equilibriums are very similar between different auctions mechanism which have ideal and equal conditions [7]. However, under a real market scheme, prices of market equilibriums could result very different, because diverse auction mechanisms affect the participation level of the agents.

The authors are concerned that forcing a fast process, to commit new investments in the short term, will conflict with the need to give equal opportunities for new entrants already interested in investing in a fast growing market.

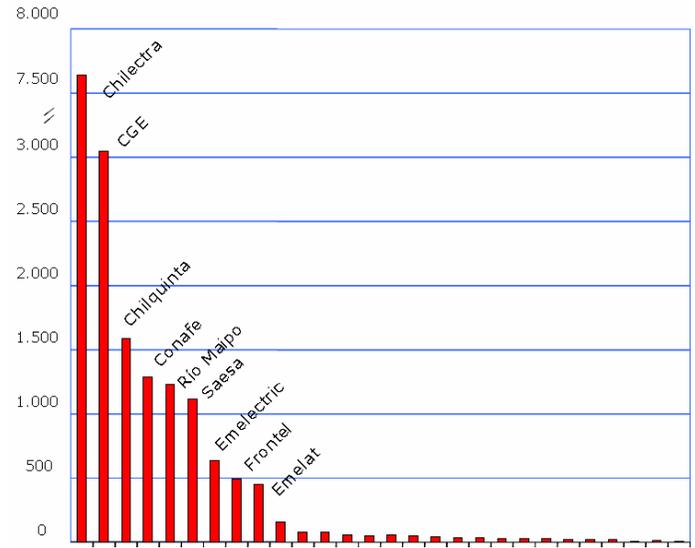


Figure 4. – 2003 demand by distribution companies

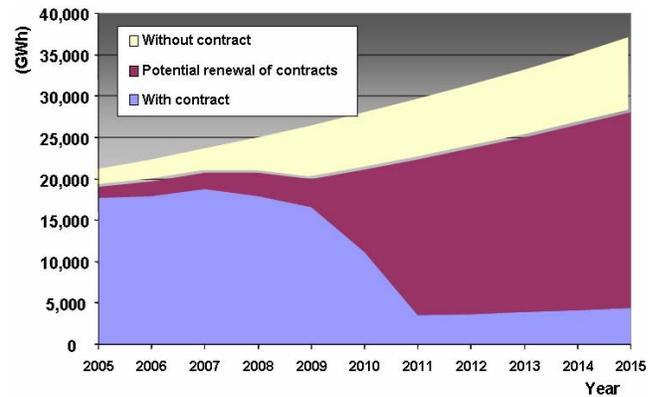


Figure 5. – Projection of contracts by distribution companies

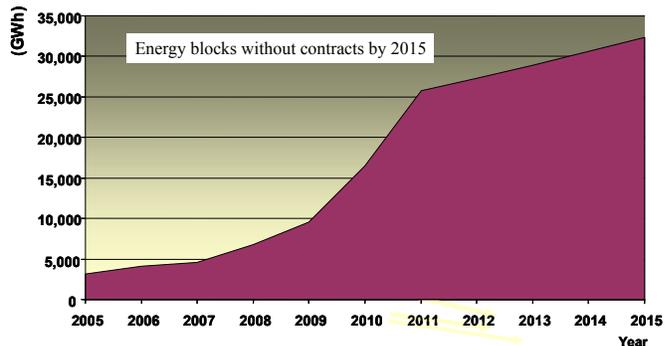


Figure 6. – Projection of uncontracted demand

VI. REFERENCES

- [1] Rudnick, H., "Energy risk in Latin America- the growing challenges", IEE International Conference on Energy Trading and Risk Management, 21 - 22 November 2005, City University, London
- [2] Rudnick, H.; Barroso, L.A.; Skerk, C.; Blanco, A., "South American reform lessons - twenty years of restructuring and reform in Argentina, Brazil, and Chile", IEEE Power & Energy Magazine, Volume 3, Issue 4, July-Aug. 2005, pp:49 - 59
- [3] Rudnick, H., "Risk Responsibility for Supply in Deregulated Electricity Markets- The Chilean Case", IEEE PES 2003 General Meeting, Toronto, July 2003
- [4] Pereira, M. V., Barroso, L.A. and Rosenblatt, J., "Supply Adequacy in the Brazilian Power Market", IEEE PES 2004 General Meeting, San Francisco, June 2004
- [5] Moreno, R., "Energy supply auctions in Chile", Workshop on Equilibrium Models in Wholesale Electricity Markets, University of Chile, Santiago, Chile, November 10-11, 2005
- [6] Universidad Catolica de Chile, International Seminar on Auctions in Electric Markets, <http://www2.ing.puc.cl/power/seminario/>, November 15, 2005, Santiago, Chile
- [7] R. Moreno, H. Rudnick, J. P. Montero, "Energy Supply Auctions to Stimulate Generation Investment", submitted to IEEE Transactions on Power Systems, December 2005