AN ELECTRICAL ENERGY DISTRIBUTION UTILITY ADAPTED TO THE NEW REGULATION MODEL OF THE BRAZILIAN ELECTRICITY INDUSTRY

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SUMMARY

The paper focuses on the 8-year transition period (1999-2007), marking the migration from the present cooperative to the new competitive model in Brazil. Through study cases, the paper considers the consequences to a distribution utility of the new regulation on open access and competition in retail. As the energy supply ensured by the initial contracts starts reducing, the study considers replacing it with new hydro plants, long-term bilateral contracts, and a natural gas plant. Price simulations show that the future of the utility depends on the strategic decisions it will take today.

INTRODUCTION

During the last 3 years, the Brazilian Electricity Industry has undertaken a major and deep restructuring process, started with an important privatizing program. The main steps in this process are: introduction of competition in generation, deverticalization of utilities, open access to the transmission and distribution grid, and introduction of retail competition.

Following the wheels towards competition, the distribution utilities, usually at government level, should adapt themselves to this new competitive environment. For example, they must unbundle its services; e.g. creating a new independent distribution (grid) company. In parallel, utilities should enhance their commercial activities since they no longer have the monopoly of the service.

In the old model, utilities energy supply were ensured by means of supply contracts signed with the government energy company supplying the corresponding region of Brazil. Two coordination groups, organized at federal level, were responsible for the generation planning (GCPS) and for the operation of the system (GCOI). Inside these groups, planning and operational decisions were taken with a narrow cooperation among all government companies and utilities.

The new model, however, primes for competition. The regulatory framework has been set through Federal Acts (Acts 9427 of 1996, and Act 9648 of 1998) and is in the responsibilities of ANEEL (The Brazilian National Commission for Electrical Energy). In this task, ANEEL is helped by a system operator (NOS, created on October 15th, 1998). As well, the introduction of competition in generation led to an energy market (MAE, created on August 26th, 1998) [1, 2]. In order not to expose the utilities and consumers to the volatility of prices that may arrive following such a great change, a 8-year transition period have been established [1]. During this transition period, utilities will gradually be exposed and should adapt themselves to the new competitive environment.

This paper focuses on this 8-year transition period (i.e. 1999-2007), marking the transition from the present cooperative model to the new competitive model. Special emphasis is given to the solutions available to compose the energy portfolio of a utility in replacement of the old supply contracts. Initially the paper presents an overview of the old cooperative model and of the regulatory framework that is leading the Brazilian Electricity Industry to the new competitive model. Then, in the particular case of CEB, it presents the supply alternatives that will be available in the future. In the sequence some case studies are presented, concerning the effects of the new policy on open access and competition in retail. The paper also presents a detailed study on the composition of the energy portfolio of the utility. Finally, an economic assessment of all supply alternatives shows how the price of the energy will be affected by different scenarios.

THE COOPERATIVE MODEL

During the last decades, the Brazilian Electricity Industry developed under a government owned monopoly. At the federal level, the country have been divided into five regions. To each region corresponds one energy company charged of the production and transmission of energy. Generally, they commercialize their production to local utilities. However, depending on the supply voltage (i.e. 230 kV and above), they may directly supply large consumers.

At the distribution level, there are many different utilities. It should be mentioned that their concession area coincides with the administrative boundaries of the local government. Usually, they buy the energy they need to meet the market from the government energy companies. However, many of them possess their own hydro and, occasionally, thermal plants.

In this model, the energy market requirements are met cooperatively. In fact, all companies act as if they participate in a monopoly. Energy supply and demand of

all companies are considered altogether and the dispatch is determined aiming the overall optimization of the system. Finally, the prices are fixed through a Federal Order and do not reflect market forces. Also, the values are bundled, i.e. energy and transmissions costs are not explicit. A typical "Model 1" as described in reference [3].

THE COMPETITIVE MODEL

The state monopoly and cooperative model described above no longer exists. The Brazilian Electricity Industry is now on its way towards a competitive model. Describing this new model in detail is beyond the scope of this paper. The main ideas can be found in [4] and we can say that it seems like a mix of "Model 3 and 4" of reference [3]. However, some aspects might be presented, as they are of vital importance to determine the actions of the utilities in this new model.

Initial Contracts

During the transition period, the energy supply of the utilities is ensured by special contracts (i.e. Initial Contracts). They ensures the supply of the energy market at the same present contractual conditions until the year 2001. That means that the utility will continue to receive the energy necessary to supply its market (except for its own generation). In 2002, the value of 2001 is maintained, therefore requiring the utility to look for a new energy supply to meet its market growth. Starting in 2003 the amount will be linearly reduced until 2006. The difference between the amount in the contract and market requirements of the utility should be compensated through either new generation plants, new bilateral contracts or at the short run market [1].

Open Access and Transmission Pricing

The Order 459 of ANEEL [5] sets the conditions to access the transmission and distribution grid. It also determines the costs to move any amount of power all over the system grid as well as the costs of the associated losses. Although available since 1997, no contract has been signed under this Order.

Competition in Retail Sail (Commercialization)

As a consequence of the introduction of competition in commercialization, some consumers (e.g. above 10 MW) are now free to choose their energy retailer. For reasons such as better economic and administrative organization and volume of energy trades, large consumers are more likely to consider this possibility. So utilities should be aware, in order not to loose customers. Moreover, in the new competitive model, the contracts must take into account the costs associated with the utilization of the distribution grid (i.e. the wire) of the local distribution company.

CASE STUDY

During the transition period the utilities will have the amounts of energy ensured by the initial contracts gradually reduced. As a consequence, they should replace them with other sources of energy. Considering all the alternatives is a complex matter that depends not only on the available energy sources (present and future), but also on the strategy adopted by the utility to supply its energy market. As part of its new strategy for the competitive model, CEB became a party in two new hydro plants under construction. In the Queimado hydro plant it possesses 35%, while in the Lajeado hydro plant it possesses 20% (See Fig. 1).

Present Situation

Presently, CEB receives most of its energy from Furnas and Itaipu. It possesses a diesel thermal plant and a hydro plant (see below). Two hydro plants are now under construction and should come to service in 2002. Also, there is a possibility of constructing a gas pipeline and a gas thermal plant by 2005.

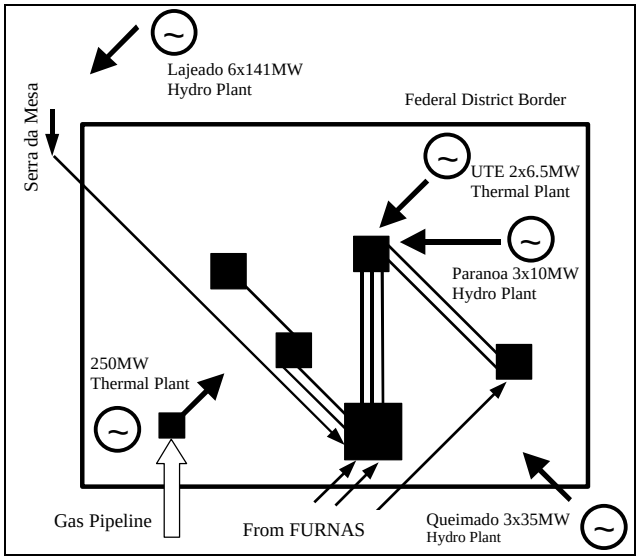

Fig. 1. Main grid of the Brasilia System.
Present and future supply alternatives considered in the study.

Market Forecast

The Market Division of CEB forecasts a market growth of about 5% a year in the period 1999-2007 (Fig. 2).

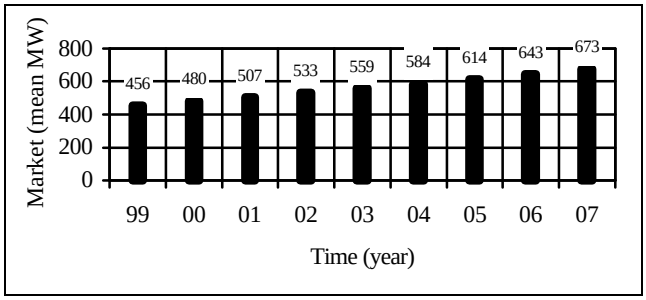

Fig. 2. Market forecast for the period under study.

Consequences of the Open Access

With the open access policy, the price of moving the energy from one point of the system to another is unbundled with the price of energy itself. Those costs increase the price of the energy delivered at the utility system and will obviously affect any energy contract. For example, the Order 459 [5] sets the transmission cost from FURNAS to CEB as $0.79/kW (i.e. $1.69/MWh assuming a 65% load factor). Now suppose that the Serra da Mesa Hydro Plant (Fig. 1) owner contacts CEB willing to sell energy. Assuming the same load factor, the transmission cost from this plant to CEB would be $6.43/MWh. Since CEB now pays about $36.00/MWh for the energy it buys from FURNAS, the new producer must offer its product at least 19% cheaper to become competitive.

Consequences of the Competition in Retail

Suppose now that a new retailer proposes its services to a large consumer already being supplied by CEB. The total load of a category of consumers (i.e. supplied at 88kV to 138 kV) is 16.7 MW and 57.1 MW during peak and off-peak hours, respectively. If this load profile repeats every day, its monthly energy consumption will be 37.5 GWh. It is worth remarking that this value corresponds to an average power of 52 MW, what represents about 11% of the total average load of CEB (Fig. 2). Based on the tariffs being used by CEB [6], this consumer's invoice would total $1.67 million per month. Also, if the market price of the energy is $40/MWh, thus CEB would expend $1.50 million to acquire the energy to supply these consumers. In the concession area of CEB, Order 459 fixes the cost of distribution as $2.41/kW per month. Thus, from the margin profit for these consumers ($170 thousand), $117 thousand corresponds to the grid remuneration and $ 53 to the commercialization.

Let us consider now these consumers being supplied by a new retailer. Based on the energy price and the distribution cost, the new retailer would expend $ 1.5 million of energy and $ 117 thousand for the grid utilization. Considering that its tariffs might at most equal those of CEB, the new retailer has only a narrow margin of 3.1% (i.e. $53 thousand) to make an attractive proposal to the consumers. From the analysis performed above, it is hard to believe that a consumer or group of consumers will change suppliers for such a narrow margin. On the other hand, the market price of the energy is the major component of its price. If the new supplier has access to a cheaper source of energy, it will expand its margin and would be able to propose more attractive prices to the consumers. It is then clear that the price of energy in the new forming market is a key issue in this matter and should be followed with due attention.

Supply alternatives

Initial Contract (IC). As the amounts of energy ensured by the initial contracts reduce down to zero, CEB may replace them with energy contracted from FURNAS through bilateral contracts. This alternative is quite attractive since both FURNAS and CEB will be interested in selling and buying the amount no longer compromised by the initial contract.

Itaipu Binational (ITA). The contract with Itaipu will not be affected by the restructuring process, since Itaipu is a Brazil-Paraguay joint project. The study will thus consider the values as they are now established in the international contract.

Paranoa Hydro Plant (UPA). This hydro plant has an installed capacity of 30 MW (i.e. 3x10MW) and a firm energy of 13 mean MW. Since it was constructed over 30 years, most of its cost has been payed in. Therefore, it produces energy at a low cost (i.e. $10/MWh).

Diesel Thermal Plant (UTE). This diesel thermal plant has an installed capacity of 13 MW (i.e. 2x6.5 MW) and a firm energy of 8 mean MW. In this study its energy production was consider at $10/MWh, which does not really correspond to its production cost. In fact, this plant is considered as a technical reserve for the Brazilian Interconnected System and it only generates during emergency situations. As a prime for maintaining it available as a reserve, CEB receives the same amount of energy (i.e. 8 mean MW) from other hydro plants in the Interconnected System.

Queimado Hydro Plant (QUE). CEB is a party (i.e. 35%) of this hydro plant, planned to have an installed capacity of 105 MW (i.e. 3x35 MW) and a firm energy of 61 mean MW. Presently under construction, its generators will come into service during 2002. In this study, its energy price is considered as $40/MWh included the transmission price.

Lajeado Hydro Plant (LAJ). CEB is a party (i.e.20%) of this hydro plant, planned to have an installed capacity of 850 MW (i.e. 6x141.7 MW) and a firm energy of 539.3 mean MW. Presently under construction, its generators will come into service during 2002. In this study, its energy price is considered as $40/MWh included the transmission price.

Natural Gas Thermal Plant (GAS). Finally, the study considers the construction of a gas pipeline from Campinas (SP) to Brasilia and the installation of a thermal plant of an installed capacity of 250 MW and a firm energy of 150 mean MW. Preliminary studies state this should be available in 2005.

Energetic Balance

If we consider the supply alternatives altogether to supply the market, it is possible to determine the amounts of energy to be contracted (TBC) by CEB either through bilateral contracts or in the short run market (Table I and Fig. 3). Fig. 3 shows the relative amounts of each supply alternative. It is interesting to remark that only in 2002

CEB has a surplus of energy. From 2003 till 2007, CEB has to contract increasing amounts of energy of energy to supply its market.

TABLE I
BALANCE OF THE SUPPLY ALTERNATIVES (mean MW)

YEAR	MARKET	IC	ITA	SELF PRODUCTION				GAS	TBC
				UTE	UPA	QUE	LAJ		
1999	456	329	106	8	13	-	-	-	-
2000	480	354	105	8	13	-	-	-	-
2001	507	382	104	8	13	-	-	-	-
2002	533	382	93	8	13	16	65	-	-44
2003	558	287	91	-	13	21	102	-	45
2004	584	143	92	-	13	21	102	-	212
2005	613	107	90	-	13	21	102	75	280
2006	643	0	88	-	13	21	102	150	419
2007	673	0	88	-	13	21	102	150	449

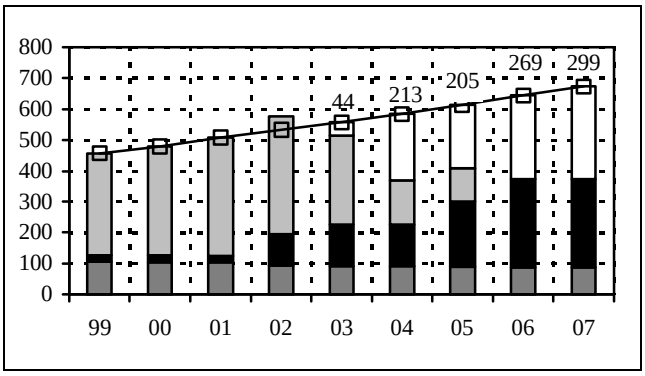

Fig. 3. Market and balance of energy with the gas supply alternative.
Itaipu; Self-production; Initial Contract; To Be Contracted.

ECONOMIC ASSESSMENT

In order to determine the value of the energy to CEB, simulations have been carried out based on the energy prices of the portfolio composed by the energy suppliers considered above (Table II).

TABLE II
ENERGY PRICES FOR EACH SUPPLY ALTERNATIVE

	ENERGY SUPPLIER					
	IC	ITA	UTE	UPA	QUE	LAJ
$/MWh	36	38	10	10	40	40

At present, it is difficult to make a precise guess for the price at which CEB will buy the energy necessary to cover the deficit expected in the next years. Therefore, the study was carried out considering three different prices for this energy: $35, $40, and $45 per MWh.

Without the Gas Supplier

Since the Gas alternative still has many uncertainties associated to it (e.g. construction of the Gas Pipeline and the Gas Plant), in the first part of the study, the price of the energy to the portfolio have been determined without considering this supplier available. Table III presents the energy cost for CEB for each year.

It is clear that the three scenarios have essentially the same price until 2003. This is quite evident, since until this year, CEB maintains about the same contractual conditions. From 2004 to 2007, the prices increase accordingly to the price of the new contracted energy. The greater this price, the greater the price of CEB energy portfolio.

TABLE III
ENERGY PRICE FOR CEB WITHOUT THE GAS ALTERNATIVE

YEAR	ENERGY PRICE ($/MWh)		
	35	40	45
1999	35.27	35.27	35.27
2000	35.30	35.30	35.30
2001	35.33	35.33	35.33
2002	36.01	35.60	35.19
2003	36.52	36.92	37.32
2004	36.30	37.71	39.12
2005	35.70	37.47	39.24
2006	35.16	37.25	39.34
2007	35.16	37.38	39.60

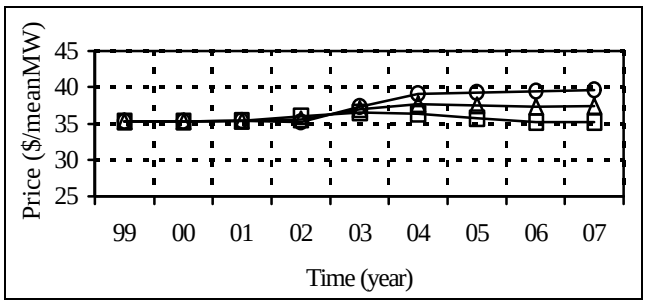

Fig. 4. Energy price without the gas supply.
$35/MWh; $40/MWh; $45/MWh

From the analysis of Fig. 4, one can see that the strategy of CEB in becoming a party of new hydro plant projects limited the price of the CEB energy portfolio into a narrow range even considering a large variation in the prices of energy in the future contracts.

With the Gas Supplier

In order to determine the influence of the Gas Supplier Alternative, the second part of the study considered the cost of this new supplier in the energy portfolio. Considering the construction of the gas pipeline and the gas plant, the later will start commercial operation during 2005 (i.e. 75 mean MW) and will reach full operation in 2006 (i.e. 150 mean MW). Preliminary studies pointed out that the price of the energy produced by the Gas Plant will be around $32/MWh and this was the value adopted in the study.

TABLE IV
ENERGY PRICE FOR CEB WITH THE GAS ALTERNATIVE

YEAR	ENERGY PRICE ($/MWh)		
	35	40	45
2005	31.79	33.56	35.33
2006	27.70	29.79	31.88
2007	28.03	30.25	32.47

Comparing Table IV with the corresponding values of Table III, one verifies that the values considering the Gas Supplier are lower. This is quite evident, since part of the energy to be contracted has been supplied by a cheaper energy source. It is worth remarking that the gas alternative is even cheaper than the lower price assumed to buy the energy (Fig. 3 and 4).

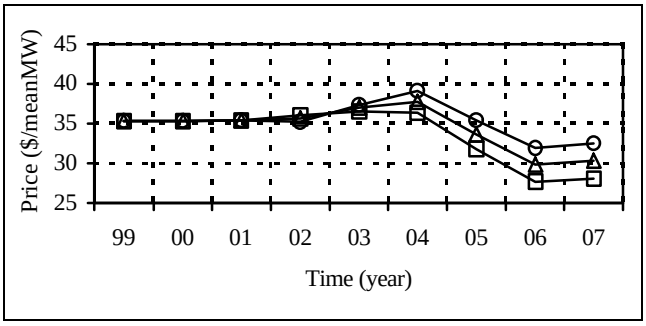

Fig. 4. Energy price with the gas supply.
□ $35/MWh; △ $40/MWh; ○ $45/MWh

CONCLUSIONS

The Brazilian Electricity Industry restructuring process has many important consequences to the energy market and to utilities. Therefore, utilities must make a major effort to adapt themselves to this new competitive environment. Retail competition is a key issue in this process. If utilities do not become competitive rapidly, they risk to loose part of its market to the agents acting in this environment.

Although prices still contain a large degree of uncertainty, strategic decisions must be taken right now for the utilities to compose their energy portfolio and to ensure hedging to its prices.

In this context, natural gas seems to be an attractive solution, specially if the utility has access to a nearby gas source.

In the case of CEB, simulations of price considering the strategic decisions already taken showed that the prices of energy are limited into a narrow range.

ACKNOWLEDGMENTS

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