The New Governance Structure of the Brazilian Electricity Industry: How is it possible to introduce market mechanisms?

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Abstract

During the 1990s, the regulatory model of the Brazilian Electricity Supply Industry (ESI) started to be restructured with the aims to promote competition and to attract investments to the sector. The first market-oriented reform ran into trouble, leading to insufficient investment in generation expansion and higher consumer tariffs. As consequence, from June 2001 to February 2002, Brazil faced a supply crisis. The federal government established the Chamber of Management of the Electricity Crisis, with the aim to overcome short-term supply problems, to explain its causes, and to propose urgent corrective measures. Although the “reform of the reform” has made structural changes to improve the model, many problems still occurred and brought out the need to revise the institutional model of the Brazilian ESI. Under Lula’s administration (started in 2003), this revision was implemented and a new governance structure of the Brazilian ESI was created, based on two energy trading markets: a Free Contracting Environment (FCE), where free consumers and generators can freely negotiate their own bilateral contracts; and a Regulated Contracting Environment (RCE), where a pool of distribution utilities purchase energy contracts from generators through public auctions under cap prices set by government. This paper presents the main problems that occurred in the restructuring of the Brazilian ESI since the first reform and gives an overview of the current model, in order to explore the possibility of implementation of market mechanisms especially in FCE.

Key Words – Brazilian Electricity Market, Regulation, Wholesale Market Design and Organization, Market Reform, Market Mechanisms, Governance

1 - Introduction

During the 1990s, the Brazilian ESI regulatory model started to be restructured with the aims to promote competition and to attract investments to the sector. The previous vertical integrated model based on natural monopoly concepts was replaced by a new system of free price formation, competition and separation of generation, transmission, distribution and commercialization activities. This first phase of the sector reform was marked by the implementation of the RESEB Project: Restructuring the Brazilian Electricity Supply Industry, conducted by Ministry of Mines and Energy (MME), jointly with an international consulting firm and Brazilian technicians. RESEB’s basic aims were the introduction of competition in generation and retailing activities and the building of efficient regulation to transmission and distribution activities.

The most important innovations to Brazilian ESI regulatory framework established under RESEB Project were the creation of the National Energy Policy Council (CNPE) with the responsibilities to proposing national policies of energy; of the Brazilian Electricity Regulatory Agency (ANEEL), as an independent regulatory entity; of the National Power System Operator (ONS), as an entity to control power generation and transmission activities in the interconnected electricity system through a tight pool dispatch system; and of the Wholesale Electric Energy Market (MAE), as an environment to undertake all electricity purchase and sale transactions and to promote the accounting of the agents’ transactions in the multilateral short-term market under market rules.
In order to promote an efficient environment for power commercialization, the model adopted free access to the distribution and transmission grids; increased the action field of self-producers; and also created figures and roles such as the free consumer (which has the right to choose their suppliers), the Independent Power Producer (as an alternative to generators operating under public service concessions) and the trader (who can operate in the electricity industry just buying and selling energy without needing any facility such as generation plants). In this first phase of the Brazilian ESI reform the system expansion was supposed to be met through short-term price signals and contracting obligations.

Although the government had made efforts in creating a market environment, many problems occurred with the proposed model and the first market-oriented reform ran into trouble, leading to insufficient investment in generation expansion and to higher consumer tariffs. As a consequence, from June 2001 to February 2002, Brazil faced a supply crisis which culminated in an electric power rationing plan, bringing out the need to revise the institutional model of the Brazilian ESI. It is important to remark, though, that the determining factors that led to the State intervention in compulsorily reducing the consumption of electricity on behalf of the industry’s agents are not restricted to a mere crisis of supply, caused by the shortage of rain reducing reservoirs levels, which were responsible for about 90% of the energy generated in the country at that time. Other factors would then be the predatory use of the reservoirs, the reduction of supply since mid-1980, inadequacy of the price formation system and of the tariff structure, regulatory risk, the indefinite role of the State in the sector, and also the ineffectiveness of the Wholesale Energy Market.

In addition, as to the post-rationing period, the distribution companies faced a serious financial crisis, caused by the abrupt reduction in consumption, explained on one hand by the changes in consumption habits and, on the other hand, by the strong macroeconomic recession through which the Brazilian economy went, which caused, at that moment, an excess supply of electricity. These characteristics show the strong imbalance between supply and demand inherent to the electricity industry and worsened by the bad formulation of policies and of the sector planning. Such factors brought out the need to revise the institutional model of the Brazilian ESI which, despite having gone through a process of “revitalization” at the end of Fernando Henrique Cardoso’s government, was object of reformulation by Lula’s government (2003).

In summary, Brazilian ESI’s reform has gone through at least three phases: an initial scramble when privatization and reform followed nearly independent paths between 1995 and 2000, an attempt at mending things from 2000 through 2003, and a more substantial reform in 2004. The aim of this paper is to describe the main events occurred in the ESI’s reforms in Brazil. Section 1 consisted of this introduction. Section 2 shows an overview of the Brazilian ESI. Section 3 describes briefly the first phase of the industry reform marked by the implementation of the RESEB Project - Restructuring the Brazilian Electricity Supply Industry, the privatization program, the creation of the Wholesale Energy Market and its functioning problems and the supply crises faced in the period (2001-2002). Section 4 presents the second phase of the Brazilian ESI reform marked by the revitalization of the previous model, with emphasis in the main problems and solutions appointed by the Chamber of Management of the Electricity Crisis. Section 5 discusses the third phase of the reform initiated with the implementation of a new institutional model, comprising the creation of the Chamber of Electric Energy Commercialization and other entities, the establishment of regulated and free energy trading environments, and energy supply auctions. Section 6 presents the final remarks of this work and discusses the main challenges that should be overcome in the next stages, in order to cope with the challenge of introducing market mechanisms especially in the Free Contracting Environment.

2 – The Overview of Brazilian Electricity Sector

The Brazilian interconnected system which represents about 98% of the Brazilian electricity market has an installed capacity of almost 104 GW, with hydroelectric plants responding for 75.0% of the total installed capacity. Table 1 shows the main characteristics of the Brazilian interconnected system and Figure 1 shows the capacity of power plants currently under construction in Brazil.

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<tbody>
<tr>
<td></td>
<td>MW</td>
<td>%</td>
<td>Avg MW</td>
</tr>
<tr>
<td>Hydro</td>
<td>77,722</td>
<td>75.0%</td>
<td>45,108</td>
</tr>
<tr>
<td>Nuclear</td>
<td>2,007</td>
<td>1.9%</td>
<td>1,508</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>11,843</td>
<td>11.4%</td>
<td>2,995</td>
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<tr>
<td>Coal</td>
<td>1,455</td>
<td>1.4%</td>
<td>629</td>
</tr>
<tr>
<td>Oil</td>
<td>4,981</td>
<td>4.8%</td>
<td>180</td>
</tr>
<tr>
<td>Others</td>
<td>5,609</td>
<td>5.4%</td>
<td>830</td>
</tr>
<tr>
<td>TOTAL</td>
<td>103,617</td>
<td>100.0%</td>
<td>51,252</td>
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The hydroelectric generation base is mainly composed of large reservoirs, capable of multi-year regulation. Thermal generation comprises, on the other hand, nuclear, natural gas, coal and oil plants.

The interconnected system consists of 87,286 km of transmission lines from 230 kV to 750 kV, and 2 dc links connecting the binational Itaipu power plant (14 GW) to the grid. The Brazilian transmission system is shown in Figure 2.

3 – The First Phase of the Brazilian Electricity Sector Reform

The Brazilian electricity sector was formed by vertically integrated companies. The distribution activity was concentrated on companies owned by the federative states and the generation and transmission activities were mainly performed by state-owned companies belonging to the central government and to the federative states.

During the 1990s, the Brazilian ESI regulatory model started to be restructured aiming at replacing the previous vertical integrated model based on natural monopoly concepts, by a new system of free price formation, competition and
separation of generation, transmission, distribution and commercialization activities. The Brazilian ESI started to be restructured in 1995, with the promulgation of Law 9,074. The proposed new model should stimulate new investments in the expansion of the electric system, boosting the efficiency of concessionary companies, enhancing global competitiveness for the national economy and improving the quality of service. With this aim, the new model established the creation of the free consumer (who has the right to choose its suppliers) and the progressive increase of its operation; and of the Independent Power Producer; it also increased the action field of self-producers and adopted free access to the distribution and transmission grids as a basic principle.

In 1996, the Ministry of Mines and Energy (Ministério de Minas e Energia - MME) contracted international consultants under leadership of Coopers & Lybrand, jointly with Brazilian technicians, to study and to propose the Restructuring of the Brazilian ESI – the RESEB Project. RESEB’s basic aims were the introduction of competition in generation and retailing activities, building an efficient regulation to transmission and distribution activities and attracting private capital to new investments. The creation of an environment for commercialization based on transparent and not discriminatory rules comprising existing agents was also a goal of RESEB.

In December 1997, the basic documents of RESEB were concluded and culminated in the promulgation of Law 9,648 which completed the main legal framework of the first restructuring phase of the Brazilian ESI. Further legislation was the required to address specific issues:

- Law 8,631 (March, 1993) dealt with tariff issues, abolishing the former system of national uniform tariffs, the national compensation account and the guaranteed minimum return on investment;
- Law 8,987 (February, 1995) – the “Concessions Act” implemented the Constitutional requirement of bidding procedures for all new public service concessions;
- Law 9,074 (July, 1995) disciplined the Concessions Act for the ESI, introduced other important principles, such as the right of large consumers to choose suppliers and open access to transmission and distribution networks, subject to payment of a cost-based tariff;
- Decree 2,003 (September, 1996) addressed the concept of the Independent Power Producer, first introduced in Law 9,074, as an alternative to generators operating under public service concessions;
- Law 9,427 (December, 1996) created the Brazilian Electricity Regulatory Agency (Agência Nacional de Energia Elétrica - ANEEL1) as an independent regulatory entity;
- Law 9,478 (August, 1997) created the National Energy Policy Council (Conselho Nacional de Política Energética - CNPE) with the responsibilities of proposing national energy policies, including the rational use of energy resources;
- Law 9,648 (May, 1998) created the National Power System Operator (Operador Nacional do Sistema Elétrico - ONS2), established the Wholesale Electric Energy Market (Mercado Atacadista de Energia Elétrica - MAE), and created, among other providences, a new agent in the industry: the electricity trader. It also defined that the exercise of the trader’s activities, including imports and exports of electricity, depends on the authorization of ANEEL.

### 3.1 – The Privatization Program in the Brazilian ESI

Sector reforms took place in parallel with fundamental changes in economic policy aiming at establishing a new currency, opening markets to competition and reducing national indebtedness. The government also decided to focus on the role of the state as policy-maker and regulator, rather than as owner of economic assets, through the National Privatization Program (PND) created by Law 8,301 in 1990.

The first phase of PND was extended until the end of 1994 and was highlighted by the privatization of companies in industrial sectors (ironworks, fertilizers and petrochemical) and by the use, on a large scale, of the currency of privatization as payment. The second phase of PND began in 1995, when the “Concessions Act” (Law 8,987) was approved, providing the bases on which the government would grant to third parties the rights to explore public services; followed by the privatization of companies in the electricity industry later in that year. The first companies to be

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1 ANEEL was created under a special regime with financial and administrative autonomy, and with the mission to provide favorable conditions for the electric energy market to develop in an environment of balance among industry players and to the benefit of society.
2 ONS was created to allow open access to the transmission grid. In this sense all users contracted with ONS the regulated conditions to use the grid. ONS is also responsible to coordinate activities in the interconnected systems comprising the power generation and transmission control.
privatized in the ESI in this stage were two distribution utilities, belonging to Eletrobrás\(^3\), Escelsa (1995) and Light (1996). After that, the goal of the government was to sell the four generation companies of Eletrobrás (Furnas, Eletrosul, Eletronorte and CHESF).

The privatization calendar was changed in order to follow logic: to elevate the attractiveness of the federal generation companies through the privatization of the state distribution utilities.

The increase of the attractiveness of the federal generation companies depended, essentially, on putting in order the finances of the state distribution utilities. As Leal (1998: p. 9) argues, “since, in general, the state distribution utilities presented in their liabilities high indebtedness with energy suppliers, it made sense to privatize them before, so that this bad credit, current and future, would not reduce significantly the economic value of the generators.”

Considering that many of the state electricity distribution utilities constituted a valuable instrument of tax policy financing the state treasuries, it was necessary to create some incentive for these governments to sell their distribution utilities. In this sense, in the context of PND, the inclusion of the federative states in the privatization process occurred in 1996 with the launching of the State Privatization Programs (PED). Also in order to make the negotiations between the central government and state governments easier, the financing to state companies (federal and municipal, too) was favored, given that the privatization of the state companies was motivated by the effort of financial adjustment of these units of the public sector.

Moreover, to the states, according with Leal (1998), procedures to anticipate resources on behalf of future privatizations were created. Abarca et alii (2002) also remember that the operations to anticipate resources fit in the Federal Program of Support to the Restructuring and Tax Adjustment of the States. The operation of anticipation consisted of an evaluation, conducted by BNDES (National Bank of Economic and Social Development), of the company whose stocks would be given as guarantee to the anticipation. Based on this evaluation BNDES estimated the amount corresponding to the total of the stocks offered and made the loan to the federative states.

In her empiric study, Mota (2003) mentioned that the preparation process to privatize companies followed by their privatization resulted in efficiency gains. Based on a sample that represented 56% of the national distribution market (including most distribution companies privatized by 1998), the author concludes that the processes of restructuring and privatization, between 1993 and 1995, resulted in a sharp drop in manageable costs in the amount of R$ 1.2 billion, which represented a reduction of 43% of the manageable costs per kWh. Between 1995 and 2000, there was also a reduction in the amount of R$ 477 million, referring to a decrease of 37% in the manageable costs per kWh.

As a result from this process, ESI’s reform led also to the privatization of 80% of the total distribution companies and of 20% of the generation companies.

### 3.2 – The Wholesale Energy Market - MAE

After broad discussion within the scope of the RESEB Project, based on assumptions of competition promotion and market freedom, MAE was created as an environment to undertake all the electricity purchase and sale transactions in the interconnected electricity system and was established through a Market Agreement signed by its participants in August 1998.

Initially, ANEEL decided not to impose the working rules for this market unilaterally, transferring to MAE’s participants the task of preparing them, according to the guidelines consolidated in the “Basic Document” debated throughout RESEB. One of the market rules from the Basic Document determined that MAE was also responsible to promote the accounting and settlement of the agents transactions in the short-term market by calculating the difference between what was produced or consumed and what was contracted. This difference should be settled at a short-term price (PMAE) established by a mathematical model that takes account information received by ONS.

MAE started operating in September 2000 when accounting should be done every month, but the first balance sheet only appeared in the second half of 2002. Even worse, financial settlement only started being made, partially, in January 2003.

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\(^3\) Eletrobrás was created in 1962 as a holding company controlled by the Federal Government. Historically Eletrobrás has been responsible for implementing electric policy, conservation and environmental management programs. It controls CGTEE, Chesf, Furnas, Eletronorte, Eletroclear and Eletrosul, companies that generate and transmit electricity in the Brazilian market. In 2004, the new regulation of the ESI excluded Eletrobrás from the National Privatization Program (PND). Acting throughout the country, the companies of Eletrobrás group have installed capacity of 37.056 MW, including half of the Itaipu installed capacity that belongs to Brazil. It owes 56.622 km of transmission lines, representing more than 60% of the national total, 29 hydroelectric plants, 15 thermoelectric and 2 nuclear plants. Eletrobrás is also in charge of administering the existing power sector’s fees and sector’s funds.
This situation showed that the agents were not able to reach an agreement about the accounting rules, forcing ANEEL to indicate the President and Directors of MAE to regulate the accountings.

The first paralyzing conflict happened between a generator and distribution utilities. To start market operations, ANEEL had assigned Initial Contracts between generators and distribution companies (these contracts were progressively discontinued from 2002 onwards). According to MAE rules, generators had to deliver the amount of energy contracted with distribution companies, whether it had generated energy or not. If necessary, the generator had to buy energy in the short-term (spot) market to honor the contract. Initial contracts had been issued for the energy to be generated by Angra II nuclear plant, when this latter was still under construction. A four-month delay in the date when Angra II started operation made its contracts exposed to spot market prices during this period (which were then very low). Distribution utilities demanded that this energy was sold at spot prices, while the generator alleged that nuclear plants should not be commercialized at MAE, due to a special treatment granted by Law 9,648/98 (which was true, also for the binational Itaipu plant).

The consequences of this episode were very serious for the sector. First, divergence as to contractual engagement of the Angra II power plant paralyzed MAE only three months after it started operation, remaining so until January 2002, without settlement. This resulted in loss of credibility for MAE agents, jeopardizing competition. Another consequence was that agents themselves perceived that engagements could be broken, and this raised the specter of moral risk, further degrading market performance.

This affair called the attention of the regulator to the need for monitoring the behavior of agents in MAE, and in 2001, ANEEL introduced changes in rules and in governance, with a revision of the market agreement to include mechanisms for guarantees and penalties (inexistent till then). However, until August 2001 the new agreement had not been signed because of boycott by agents.

These impasses also impeded regular accounting and settlement, and other problems appeared, such as Annex V of Initial Contracts in the context of the rationing which started in June 2001. This was similar to the Angra II affair, and caused large losses to generators. The problems detected led the regulator to intervene a second time, appointing new councilors to MAE and restructuring again its governance mechanisms to avoid disproportionate decision power by vertically integrated agents.

3.3 – The Supply Crisis

In this first phase of the Brazilian ESI Reform the system expansion was supposed to be met through short-term price signals and through contracting obligations. ANEEL’s Resolution 249, of August 1998, established the conditions for the participation of agents in MAE and also determined that at least 85% of the amount of electric power sold by agents participating on the Wholesale Electric Energy Market to end-consumers should be covered by assured energy from their own power plants or by power purchase contracts with a duration of two years at least.

Although the government had made structural reforms to create a market environment many problems occurred with the model proposed and the market didn’t work out as expected. The system of self-regulation established to MAE hindered its functioning until April 2002 when the promulgation of Law 10,433 organized its operation. The contracting rule should induce the system expansion but short-term price volatility, among other problems, didn’t give the right signal to indicate new capacity entrance. Beside this, in 2001, the electric system underwent a serious supply crisis which culminated in an electric power rationing plan. These events generated a series of questionings about the course the electricity sector was undertaking.

From June 2001 to February 2002 the Brazilian ESI faced a supply crisis due to the scarce rains and delays in investments in the system expansion. The level of water in the reservoirs unexpectedly decreased in relation to historical levels. To solve this problem a Management Chamber for the Electricity Crisis (Câmara de Gestão da Crise de Energia Elétrica – GCE) was created. Consequently, a program of 20% reduction of demand was imposed to all classes of

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4 See Araújo (2006) for an account of the 2001 crisis and rationing.
5 In order to guarantee the energy supplying every load in the system must be covered with contracts and every contract must be backed up by plants based on their “assured energy” (also called physical guarantee). The assured energy for central dispatched hydroelectric plants considers a probabilistic approach based on a 5% risk of deficit criterion and for central dispatched thermo-power plants it is equivalent to the electric power associated with their available capacity (firm energy) and includes also forced output and programmed maintenance rates. The assured energy for non-centrally dispatched plants is based on the energy generation. This amount of energy represents the maximum amount that can be traded through contracts.
The main crisis faced by the electricity sector in the 2001-2002 period occurred seven years after the beginning of the implementation of RESEB’s model, which introduced to the Brazilian ESI major structural changes. However, the performance of the industry still proved to be little reasonable. Although, apparently, the formulators of the reform had intended an appropriate market drawing, the process of restructuring has not been completed. Moreover, the delay of the implementation process resulted in a severe supply crisis as mentioned before. Such crisis had extremely negative political consequences, evoking criticisms from the general society, which ended up generating disputes about the design of the restructuring of the ESI. In fact, the need to manage an on-going problem raised the possibility of evaluating a structural problem, allowing the revision of the institutional model and of the market model that were being implemented in the country.

For this reason, the federal government established the GCE, which should overcome short-term supply problems, and propose urgent solutions. The Chamber brought together well-prepared technicians and high officials of the government. In face of the perception that the problem in hand went beyond regular issues, GCE created the Committee of Revitalization of the ESI Model in order to detect the main flaws of the model. Therefore, the GCE operated in two fronts: in the short term, to manage the rationing, and in the medium term, to revise the restructuring model of the Brazilian ESI.

Regarding to the short term, with the intent to understand the causes of the crisis, the GCE hired a commission to analyze the hydrothermal electricity system, explaining the causes of the crisis. The report presented by the Kelman Commission described the critical problems found in the industry, which can be summarized in six main groups: i) Insufficiency in the economic signals to make investments viable; ii) Inefficiency in governmental action, iii) Insufficiency of preventive action to avoid deep rationing; iv) Inefficiency to correct market flaws; v) Lack of safety reserve of the demand in situation of crisis; and vi) Insufficiency of energy saving programs.

The conclusion presented by the commission confirmed the great fragility of the model designed for the Brazilian ESI and, above all, the serious consequences of its incomplete implementation. The main results are summarized as follows:

a) although the hydrology was unfavorable, the crisis was the result of other intervening factors, since hydrology itself would not be sufficient to cause the crisis;
b) there was not excess demand, the increase in consumption occurred within the expected range;
c) the imbalance between supply and demand was aggravated in the transition from a state model to a private model, where there was a relative deadlock;
d) delay of works and lack of investment in the expansion were preponderant;
e) assured energies were overestimated;
f) predatory emptying of the reservoirs took place during the 1980’s;
g) there was diffusion and indefiniteness of responsibilities between ANEEL and MME;
h) the exaggerated bet of MME in the Thermal Electric Priority Program (PPT) made the incentive in alternative expansion impossible;
i) flaws were detected in the flow of information among ONS, ANEEL, MME and CNPE;
j) there was a lack of institutional coordination to implement the national energy policy, mainly during the period of transition of the model;
k) regulation was not characterized by stable, clear and concise rules, so as to create an environment of credibility to encourage investments;
l) legislation was incomplete and insufficient;
m) ANEEL faced difficulties in implementing an appropriate regulatory environment;
n) the existing legislation was, in many cases, vague and conflicting, because it neither defined clearly the duties of

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6 The rationing comprised the period from June 1st 2001 to February 28th 2002 for the consumers in Southeast/Central West and Northeast regions and from July 1st 2001 to December 31st 2001 for the consumers in North region.

7 The Committee of Revitalization of the Electric Sector Model was created by GCE Resolution N. 18, of June 22, 2001, and it was coordinated by Francisco Gros (President of BNDES – National Bank of Economic and Social Development), with the participation of ANEEL, MME, MF (Ministry of Finance), MP (Ministry of Planning), AGU (General Advocacy of the Union) and others.

8 Such commission was coordinated by Professor Jerson Kelman (CEO of ANA - National Water Agency in that time), Altino Ventura Filho (Itaipu Hydro Power Plant), Sergio Valdir Bajay (Unicamp University), João Camilo Pena (Itaipu Hydro Power Plant) and Claudio Haddad (IBMEC Business School).

9 Eletrobrás, ANEEL, ONS and MME in May, 1999 were aware that there were very high risks of deficits for the years of 2000 and 2001. According to ONS, there were instructions from MME not to announce this information publicly.
each institution nor allocated specific responsibilities in the management of the industry;
  o) there was disobedience of contract conditions.

The conclusions of the referred commission’s work clearly showed that the main factors which contributed to the crisis process in the Brazilian ESI were essentially related to the industry administration structure, since the implementation process of the institutional apparatus had not been completed. For instance, although CNPE had been created in August, 1997, it only got regulated in December, 2000 and, therefore, until then its duties were exercised by the Department of Energy of MME. In addition, there was no institution capable of planning the expansion of the sector, what resulted in the lack of perception of a possible supply shortage in the medium and long terms.

The institutional, structural and administration indefiniteness, in conjunction with the interruption of the privatization process, has postponed the definition of government goals in the reform process, and it also granted state-owned companies with great power, as they maintained about 80% of the energy generating installed capacity. On the other hand, although ANEEL and ONS had great autonomy and economic independence, this was not enough for them to adopt a neutral attitude and present the fragilities of the system, as well as the possibility of shortage of supply. There were problems in the policy, in the planning and in the regulation of the Brazilian ESI, what ruined a structure that had barely been built.

Regarding the medium-term, the proposal of the Committee was guided by the mission to anticipate proposals in order to correct the dysfunctions and propose corrections for the industry model. There was a clear recommendation to keep the pillars of the model, initially designed by the RESEB Project. Keeping the pillars of the model meant to necessarily encourage private investments, to create conditions for competition in generation and trading business, and to keep the regulation in transmission and distribution segments.

The extensive agenda of the Committee of Revitalization enumerated 33 measures grouped into nine general goals: 1) to normalize the functioning of MAE; 2) to strengthen the market; 3) to guarantee the expansion of supply; 4) to monitor the reliability of supply; 5) to improve the interface between the market and regulated sectors; 6) to guarantee of competition; 7) to practice tariff realism; 8) to consider consumers’ interests; and 9) to improve institutions.

The Committee of Revitalization announced its agenda and the suggested reforms through reports, the Progress Reports. In addition, a series of regulatory instruments was edited, with the effective implementation of the proposals. We point out Law 10,433, of April 24, 2002, regarding MAE; Law 10,438, of April 26, 2002; Provisional Measure 64, of August 26, 2002; in addition to ANEEL’s and CNPE’s resolutions.

MAE was thus reorganized, under special legal status and with a specific management regime through Law 10,433/2002. MAE became a private not-for-profit entity, subject to ANEEL authorization, regulation and monitoring. Its General Assembly was also changed: vote by categories was abolished, meaning that one enterprise could vote only once (in the earlier model, an integrated company could vote both as generator and as distributor). Despite the reforms, MAE only started partial settlement in January 2003, even after the changes made by Law 10,433/2002 there were remained some conflicts and disputes among agents.

Both the short and medium-term issues presented have a strong institutional component and are often confused with each other. Such phenomenon lets us infer that the basics issues of the crisis were the lack of investments (shortage of supply) and the exercise of market power, which in their turn are associated with the lack of incentive mechanisms in the industry and with the regulatory risks.

The goals of the reform of the Brazilian ESI were based on a market model that would depend basically on the role of the regulatory agency and on the institutional apparatus. Considering the potential problems presented for this industry, which has very peculiar characteristics (e.g. the fact that supply is predominantly hydraulic and the dispatch system depends on a great complementarities and optimization among the plants), the role played by the system operator to keep the safety and the reliability of supply is essential. In addition, the competition was guided by an industrial chain where regulated and non-regulated segments share great coordination economies, a fact that indicates the need of a reasonably
complex administration structure.

In face of the "reform of the reform" process, implemented by the Committee of Revitalization, although many defects in the model have been corrected, it was not possible to guarantee that such measures would reach the designed goals, since many indefinite factors remained, such as the permanence market power of state-owned companies, which disobeyed the rules and exercised their own administration of MAE.

We must emphasize that the problems faced by MAE had no direct relation, neither of causality nor of consequence, with the electricity rationing. In fact, when the first signals of shortage of supply came up, the wholesale market was already interdicted. However, since the market already presented fragilities and a shortage crisis emerged, such issues cannot be observed separately.

5 - The New Model for the Electricity Sector

During the year of 2004, the Federal Government set the bases for a new model for the Brazilian ESI, supported by Laws 10,847 and 10,848, dated of March 15, 2004, and by Decree 5,163, dated of July 30, 2004. The electricity policy changed substantially, primarily to attract investment for a sustained development of the sector. It had five explicit purposes: i) to build a stable regulatory set-up; ii) to guarantee security of supply; iii) to achieve fair tariffs; iv) to respect contracts; and v) to reintroduce planning in order to cope with demand growth.

To this end, mechanisms were inserted into the market to enhance security of supply, among which: a) a requirement that distribution companies contract for 100% of their forecast demand over a five-year horizon; b) construction of realistic estimates for assured energy of plants; c) contracting hydropower and thermal plants in a mix that balances guarantee and cost; and d) permanent monitoring of the security of supply, in order to have detection of imbalances between supply and demand in advance and to take steps to restore security of supply at least cost to consumers.

One of the main components of the new electricity model was the creation of two energy trading environments, as showed in the Figure 3: a Regulated Contracting Environment (RCE), where a pool of distribution utilities purchases energy from generators through public auctions under cap prices set by government, and a Free Contracting Environment (FCE), where free consumers and generators can freely negotiate their own bilateral contracts.

In the pool system all sellers perform contracts with all distribution companies. Contracting in the RCE is formalized by means of regulated bilateral agreements called CCEAR, between selling agents (generators, independent power producers or self-producers) and purchasing agents (distribution utilities) which participate of electric power auctions.

![Figure 3 – Regulated Contracting Environment (RCE) and Free Contracting Environment (FCE)](image)

In the FCE, on the other hand, the negotiation among the generating agents, traders, free consumers, importers and exporters of electric power is freely accomplished through bilateral contracts.

Generating companies (public generation concessionaires, independent power producers or self-producers) and traders are allowed to sell electric power within the two environments, maintaining their competitive nature of the generation. The key of the present model to guarantee security of supply is the requirement that all demand in the FCE and RCE has to be 100% contracted. In the RCE the distribution companies must contract 100% of their forecast demand over a five-
year horizon with auction long-terms contracts. On the other hand, FCE’s consumers, that represent near 30% of the total demand, have also the same mandatory contracting obligation; however they are not obliged to be sign long-term contracts. It is worth mentioning that long-term contracting is a necessary condition to finance new projects in Brazil.

The Chamber of Electric Energy Commercialization (CCEE) replaced the Wholesale Electricity Market and was created by Law 10,848, of March 2004, as a private and not-for profit institution with the responsibilities of administrating both regulated and free contracting environments under regulation and inspection of ANEEL. CCEE absorbed the MAE’s functions and incorporated all its organizational and operational structures. CCEE has the following main attributions: to keep records of the energy contracting and to acquire on line measuring data of all agents in the Brazilian interconnected electricity system, to conduct energy purchase auctions for distribution companies under authorization of ANEEL and to determine the weekly prices and the monthly accounting and settlement of the short-term market in FCE and RCE environments, based on a set of commercialization rules established by ANEEL. In 2008, the settlement activities involved financial amount of US$ 3.4 billion.

The auction system implemented by CCEE in the RCE is related to the service of captive consumers by distribution utilities, and it ensures the provision of energy to these consumers in a reliable, equitable and economically efficient way (fair tariffs) through regulated pooled contracts. The auctions for existing plants cover the existing load while auctions for the new energy plants stimulate new capacity to cover load growth. Existing energy auctions comprise energy delivery one year ahead and contract durations from 5 to 15 years. New energy auctions comprise energy delivery five or three years ahead, with durations of 15 and 30 years for thermal and hydropower plants respectively.

The criterion of the least tariff is used to define the winners of a given auction and it stimulates economic efficiency while long-term contracting allows the project finance for investors usually in enough time to build hydro and thermal plants. CCEE also mediates the supply guarantee contracts that each distribution utility has to sign, in order to reduce default risks.

From 2005 to now, five auctions of existing power plants and eleven auctions from new power plants have occurred, including a specific auction for alternative energy and other for reserve energy. Taken together these auctions involved a sales volume of 37,362 averages MW, a financial amount in the range of US$ 280,31 billion and a signature of 6,545 long-term contracts. Up to now, considering only the new power plant auctions, 204 new power plants contracted 17,557 averages MW by distribution utilities, which guarantee the capacity expansion for the electricity sector.

Currently, there are more than 900 agents associated to CCEE. The electric energy commercialization in Brazil is stable and presents positive results that have never been seen in the country history; however several issues must still be solved to guarantee security of electricity supply and the current model still needs adjustments in many dimensions.

Besides the creation of CCEE, the new model created new institutions and determined new roles for existing ones. ANEEL keeps its roles of regulation and monitoring the working of the electricity industry, and ONS guarantees the centralized physical dispatching. Above these bodies, CNPE was maintained as a policy maker/ proposer and a Power Sector Monitoring Committee (CMSE\textsuperscript{14}) was created to monitor service condition in order to ensure continuous electricity supply. MME formulates energy policies and took ANEEL’s previous role of granting hydropower and transmission line concessions. The Energy Research Company (EPE\textsuperscript{15}) is a new entity created to elaborate the energy sector long-term planning in coordination with MME.

Figure 4 presents a diagram of the institutions that are active in the Brazilian ESI and Table 2 presents a summary of the major differences among the recent Brazilian electricity institutional models.

\textsuperscript{14} CMSE was created by Decree 5,175 of August 2004.

\textsuperscript{15} EPE was created by Decree 5,184 of August 2004.
Table 2 – Summary of the Brazilian Electricity Models

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing using public funds</td>
<td>Financing using public and private funds</td>
<td>Financing using private and public funds</td>
</tr>
<tr>
<td>Vertical Companies</td>
<td>Companies classified by activity: generation, transmission, distribution and commercialization</td>
<td>Companies classified by activity: generation, transmission, distribution, commercialization, imports and exports</td>
</tr>
<tr>
<td>Predominantly State-controlled companies</td>
<td>Opening up of the market and emphasis on the privatization of the Companies.</td>
<td>Coexistence between State-controlled and Private Companies</td>
</tr>
<tr>
<td>Monopolies – No competition</td>
<td>Competition in generation and commercialization.</td>
<td>Competition in generation and commercialization</td>
</tr>
<tr>
<td>Captive Consumers</td>
<td>Both Free and Captive Consumers</td>
<td>Both Free and Captive Consumers</td>
</tr>
<tr>
<td>Tariffs regulated throughout all sectors</td>
<td>Prices are freely negotiated for the generation and commercialization.</td>
<td>In a free environment: Prices are freely negotiated for the generation and commercialization. In a regulated environment: auctions and bids for the least tariffs</td>
</tr>
<tr>
<td>Regulated Market</td>
<td>Free Market</td>
<td>Coexistence between Free and Regulated Markets</td>
</tr>
<tr>
<td>Contracting obligation: 100%</td>
<td>Contracting obligation: 85% (until Aug/2003) and 95% (from Sep/2003 to Dec/2004)</td>
<td>Contracting obligation: 100%</td>
</tr>
</tbody>
</table>

5.1 – An overview of the Brazilian Short-Term Market

CCEE is also responsible to promote the monthly accounting of the agent’s transactions in the short-term market by calculating the difference between what is effectively produced or consumed and what is contracted in both RCE and FCE environments, as showed in Figure 5. These differences (imbalances) are settled at a short-term price (PLD) established by a mathematical model that takes into account technical information received by the ONS.
According to definitions obtained from RESEB Project in the first market-oriented reform, the generators dispatch approach in the Brazilian Interconnected System would be based on a tight centralized system and in the use of optimization tools. The reason of choice of such a trading arrangement rather than a bidding scheme was the peculiarity of the Brazilian system based on electricity produced mainly by hydroelectric plants located on the same river but with different owners, and subjected to stochastic inflows. Under this approach, the tight pool and short-term market price mechanism considers the following aspects:

- Hydro generators submit technical data on their plant including water levels in their reservoirs, rate of inflow and technical availability of their turbines;
- Thermal generators submit data on technical availability of their plant, thermal efficiency, fuel and operating costs, subject to regulatory oversight;
- Consumer agents submit data regarding their demand;
- Based on these data, together with forecasts of inflow in all reservoirs based on scenarios derived from historical data, demand and supply projections, technical characteristics and constraints of individual plants as well as of the overall system, ONS carries out the real centralized, cost-based dispatch using optimization models (NEWAVE/DECOMP). NEWAVE model computes the hydrothermal dispatch on a monthly basis while DECOMP establishes the hydrothermal dispatch on a weekly basis;
- In addition to the dispatch schedule for plants, this models set the marginal costs (implicit) for each sub-market, per scheduling period, reflecting the cost of the next MWh to be dispatched by the generating plant;
- For thermal plants, costs are essentially taken as variable operation costs. For hydro plants, costs equal expected opportunity costs (“water values”) calculated from a dynamic dual stochastic optimization model;
- The computation method is a so-called stochastic dual dynamic programming, where the state variables are reservoir levels and inflow over the past six months;
- The model is solved by minimization of the expected present value of operation costs over a five-year period. Operation costs essentially equal the sum of variable costs of thermal plants and penalties for unsupplied load (costs of rationing, which are represented by administratively set penalties);
- CCEE calculates the short-term price (PLD) based on the same optimization model used by ONS, omitting the effects of transmission constraints within the sub-markets;
- PLD is weekly calculated and published by CCEE, having for base the system marginal operational cost with floor and cap prices\(^\text{16}\), for three different load levels (“high”, “medium”, “low”) and for four different sub-markets (South, Southeast, North, Northeast).

Figure 6 presents monthly average spot prices from 2000 to now. The high prices from June 2001 to February 2002 can be explained by the Brazilian electricity supply crisis. The main result of the rationing was a reduced demand scenario related to the consumption (near 20%) that didn’t rise back to the previous levels. As consequence, an excess of supply occurred and led to lower short-term prices. Figure 7 shows the financial accounting at spot market from 2006 on.

\(^{16}\) The cap price for PLD is defined as the variable operation cost of the dearest thermal generation existing in the centralized dispatching program, and the floor price is established by ANEEL considering hydropower plant operation and maintenance costs, as well as financial compensation for the use of water resources (values).
It is worth noticing that in December 2007 emergency measures were introduced due to unusually dry conditions in the Northeast region. CMSE establishes the dispatch of thermal plants, effectively over-ruling the dispatch model. In January 2008 the delay of rainfall led marginal costs to exceed the cap price for PLD (US$ 287.68) causing a partial suspension of payments at the market. This fact intensified the discussion about the adequacy of the model used to set prices and the market collateral mechanism used to ensure the fulfillment of the agents obligation in the short-term market settlement. This all caused some improvements in the collateral mechanism. To calculate the monthly collaterals, the previous model considered the agent’s historical three last debts, while the mechanism adopted on January 2009 considers the uncovered energy requirements (loads and sells) estimated for the next six settlements, considering the contract information registered at CCEE, and the estimated generation and consumption at the calculating moment. This mechanism will stimulate an earlier contract registration at CCEE as a way to avoid collateral deposits.

5.2 – Overview of the Regulated Contracting Environment - RCE

According to the current Brazilian regulatory framework established by Law 10,848 of March 16, 2004, distribution utilities must ensure that their market demand has full contract coverage by purchasing electric energy through public
auctions conducted within RCE. Besides the general contracting rule formalized in regulated bilateral contracts (CCEAR), the distribution companies may also acquire energy for covering their demand from:

- The Binational Itaipu plant, the energy of which is traded by Eletrobrás, only for consumers in the South, Southeast and Central West;
- The Incentives Program for Alternative Energy Sources (PROINFA)\(^\text{17}\), the energy of which is also traded by Eletrobrás for distribution companies in the whole National Interconnected System;
- Distributed generation\(^\text{18}\) in order to alleviate the requirement for transmission investments, distribution companies are allowed to contract energy from distributed generation plants. This must be done through public bidding directly promoted by the distribution utility, and may not exceed 10% of its load;
- Bilateral contracts signed before March 16, 2004 (publishing data of Law 10,848).

The auction system in RCE may then be understood as an environment for regulated competition, with rules and institutions that make competition more transparent and minimize the use of market power. The existence of an official market for electric energy, operating through public auctions, may thus operate as an important instrument to consolidate the liberalization process of the electricity supply industry in Brazil.

The new institutional framework was thus designed to allow public and private firms to coexist in a competitive environment. Auctions play a central role in this design, since the existence of clear rules and a transparent trading process work as a guarantee to private firms against a possible abuse of power by public firms. In this sense, auctions for generation projects were thus instituted in Brazil with the following purposes:

- Create a long-term contract market that generates efficient and timely price signals to guide the expansion of installed capacity;
- Ensure that the purchase of energy to supply captive consumers is done in a competitive and transparent way, leading to fair tariffs;
- Provide clear, easy to audit trading rules, in order to hinder collusion and the use of market power to manipulate prices.

In this context, RCE may be considered as a buyers’ pool that aggregates the demand of the various distribution utilities in periodic auctions, in order for utilities to sign bilateral contracts with the generators who offer winning bids in each auction. By pooling distribution utility demands into a monopsony, RCE is expected to achieve gains of scale, since each generator signs contracts with every distribution utility, risks are spread out among sellers (as well as among buyers).

To attract investment in generation, energy auctions for long-term energy contracts (15 and 30 years) were created to direct energy contracting by distribution utilities. This scheme aims at reducing risks for investors, while the auction by least price stimulates economic efficiency and in principle gives correct signals for the system expansion cost through competition. These auctions contemplate blocks of hydro and thermal plants, auctioned separately in order to obviate the issue of thermal investment in a hydro-based system.

Finally, these auctions are fed by governmental planning studies to propose feasible (and with a preliminary environmental license) expansion projects for a forecast demand growth, together with demand forecasts by distribution companies, although investors may propose alternative projects in the auction blocks.

The RCE Auctions are classified as:

- Auctions of Energy from Existing Power Plants;
- Auctions of Energy from New Power Plants;
- Auctions of Energy Adjustment (just from Existing Power Plants).

\(^{17}\) PROINFA was created to diversify the supply of electricity, expanding the generation share of small hydropower plants, thermal plants burning biomass and wind parks in its first phase, although other sources may be contemplated in the future. The first phase is to have 144 power generation projects, totaling 3300 MW of installed capacity.

\(^{18}\) Article 14 of Decree 5,163/2004 qualifies as distributed generation in Brazil the production of electric power from generation plants directed connected to the buyer’s distribution system, except that from (I) hydropower plants with nameplate capacity above 30 MW; or (II) thermal power plants, including co-generation, with energy efficiency below 75%.
Auctions for “existing energy” aim to cover the existing load while auctions for the “new energy” aim to stimulate new capacity to cover load growth. The reason for the auction separation is concerned the different nature of risk allocation for existing and new plants. The “adjustment” auctions aim to perform the fine matching between contracts and load.

Existing energy auctions comprise contracts with energy delivery one year ahead (“A-1”) and contract durations from 5 to 15 years.

New energy auctions comprises contracts with delivery five (“A-5”) or three (“A-3”) years ahead, with durations between 15 (thermal) and 30 (hydropower plants) years. These contracts allow the project finance for investors usually in enough time to build mainly hydro (five years) and thermal (three years) plants.

In the “Adjustment Auctions” the contracts are signed between one seller and one distribution utility only, for up to one year ahead and may last no more than two years.

The auctions supply contracts in RCE may vary only between two modalities:

- Contracts for delivered energy, similar to Initial Contracts, in which all hydrologic risks are taken by generators to supply the energy contracted;
- Contracts for energy availability, in which all risks of production deviations relative to assured energy are assigned to the pool and passed through to captive consumers.

The Figure 8 shows the auctions occurrence in RCE.

![Figure 8 – Energy Supply Auction in RCE](image)

Table 4 presents a summary of existent and new power plants auctions, including the alternative energy and reserve capacity auctions. The Figure 9 presents the resulting matrix for these new power plants auctions.
These results show that RCE is a mature contracting market, capable of attracting private capital and of providing the expansion of generating capacity. However, special attention must be given to the demand contracting frustration in the existent power plant auctions that signals a tendency of energy migration to FCE environment where the prices are freely negotiated.

5.3– An overview of the Free Contracting Environment (FCE)

The Free Contracting Environment (FCE) is comprised of free consumers who have the right to choose their electricity supplier paying a rate for using the distribution or transmission grids. Besides free consumers, FCE may comprise concession holding generators, independent producers, power traders and power importers. In FCE agents are free to make bilateral contracts, defining prices, quantities, durations and hedge clauses, with one important exception: state-owned generators, even when contracting in FCE, must do it through public auctions approved and supervised by ANEEL.
The free market was created in Brazil more than one decade ago. The right to be a free consumer was established by Law 9,074/1995, afterwards altered by Law 9,648/1998 and complemented by ANEEL’s Resolution 264/1998. This Law determined that the market should be gradually liberalized to allow large consumers to become free. From July 1995 and July 2000 this possibility was restricted to consumers with an installed demand load of 10 MW or more, supplied at a voltage of 69 kV or more.

Table 5 shows the criteria to be a free consumer defined from July 2000 up to now. Law 9,074 also determined the possibility to expand even more this market by reducing the demand and voltage limits from 2003 on.

### Table 5 – Current criteria to be free consumer

<table>
<thead>
<tr>
<th>Minimum Demand</th>
<th>Minimum Voltage</th>
<th>Connecting Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 MW</td>
<td>69 kV</td>
<td>Before 08 July 1995</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>After 08 July 1995</td>
</tr>
</tbody>
</table>

According to Law 9,427/1996 afterwards complemented by Law 9,648/1998 and 10,438/2002, “special consumers” with an installed demand of 500 kW or more are allowed to purchase energy from alternative energy sources i.e. supplied by small hydroelectric plants with installed capacity from 1 to 30 MW or from wind, solar, biomass (with installed capacity lower than 30 MW) or other plants with installed capacity equal or lower than 1,000 kW).

In 2004, with the definition of commercial rules under the new model framework, the medium sized industrial consumers got aware of the gains they could obtain in their electricity bills. The scenario of short-term prices caused by demand reduction and supply excess after the rationing also motivated the migration of captive consumers to the free market.

Before April 2004, there were tributary barriers hindering the ingress of consumers at CCEE (the VAT on the circulation and consumption of merchandise and services - ICMS comprising multilateral transactions was not defined). Only after the publishing of the ICMS agreement by the National Council of Finance Policy – CONFAZ, the tributary duties in electricity transactions including that performed on the short-term market were regulated.

Besides these facts, Law 10,848/2004 established new rules allowing captive consumers (potentially free) who had contracts with distribution companies to migrate to the FCE. Later, the Decree 5,163/2004 determined that once a consumer expressed the intention to migrate to the free environment, the deadline in these cases would be one year after a formal notification from the consumer to the distribution agent (the previous regulation, ANEEL’s Resolution 264/98, determined that the deadline was a maximum period of 36 months). To return to the condition of a regulated consumer, the free consumer must notify the distribution company of its concession area 5 years in advance, and the deadline can be reduced according to a criterion set by this distribution company.

Figure 10 shows the evolution of free consumers associated at CCEE. Up to 2008, there was a high growth rate of consumer migrations from RCE to the FCE. This occurred due to the low prices in the short-term market caused by the energy surplus after rationing. However, this scenario has become a past scene and the current tendency is a tighter energy balance between supply and demand.
Figure 10 – Evolution of Free Consumers Agents FCE

Figure 11 shows agents’ participation in the consumption measured (51,067 averages MW) at CCEE in 2008. Comparing the consumption measured in 2008 to the consumption measured in 2007, the free market presents an increase of 34.5%.

Currently, an important issue about the FCE environment in discussion in Brazil is related to the prohibition to free consumers to resell their contracts. The surplus of free consumers’ contracts may only be settled in the short-term market. Associated to this fact, the demand prediction used to estimate the long-term contracting is uncertain, mainly for free consumers. This situation increases the risk of free consumers to be exposed to higher prices in the short-term market and being penalized in reduced energy/contract offering scenarios. Considering that FCE represents a significant part of the market and that it is based on shorter contracts, there are also financial constrains stimulates the active expansion of generation capacity for this environment. Some new power plants auctioned in the RCE have directed part of their assured energy to FCE, as a way of compensating the lower auction prices at RCE, but considering FCE’s willingness to pay. Figure 12 shows the not contracted energy from the auctioned power plants that can be addressed to FCE.
In the most recent reform of Brazilian ESI its new governance structure was designed to attract investments in generation, both hydro and thermal, and to obtain fair prices for consumers. Central to these arrangements were new contracting procedures between generators and distribution utilities, based upon auctions. The regulatory model of the Brazilian ESI based on two contracting environments has proven so far to be successful in attracting long-term investments, guaranteeing the supply of captive consumers and flexibility to free consumers.

From this point of view, the energy auctions carried out were successful because they have signaled expected future prices for new energy compatible with investment costs and capital remuneration. However, there are some issues must which still be solved and still needs adjustments. Actually, the major challenge for the current new model is to keep the supply balance between free and regulated market. And the best way to achieve this is by introducing more markets mechanisms, in order to admit a checking-balance for the trading in the two environments.

It is also reasonable to suggest the execution of specifics auctions comprising certificates or titles of energy that could contribute to the expansion of the system’s capacity. Property’s rights and the possibility to transfer these rights with flexibility and liquidity could offer an interesting alternative to deal with time and commercial guarantees while inducing new investments in the industry, enabling new different financing options, considering a diversity of investors’ profiles. A specific market to trade these energy certificates, which would work as an instrument to manage risks and investments, could also be developed. As the country’s financial markets become more mature, financial hedge may also become useful in the ESI.

The implementation of a contracting platform for energy negotiation may result in providing simpler, more efficient and more transparent short-term price signals to the market.

And, as mentioned, in order to guarantee more liquidity to this market, it is important to strengthen the contracting in the FCE, which could be done by allowing free consumers to sell their contract surplus, stimulating long-term contracting. Providing a mechanism of Demand-Side Bidding is also desirable. The financing criteria should be structured in order to adequate the FCE features, e.g., considering also contracting of shorter terms.

And, concerning other aspects of the reform, one may notice that one of the results of the recent auctions (Figure 9) is that Brazil is becoming a country with an increase of thermal electric power generation. Although Brazil has more than 62% of its Hydro generation potential to explore, the cost of developing new hydro plant is rising. The remaining potential is mainly in Amazon region, far away from the major consumption markets, demanding substantial investment in transmission lines. Environmental licensing of hydro generation plants face severe environmental regulations and it is becoming a real challenge to the governments and private investors. An urgent issue is the definition of efficient, integrated procedures of municipal, state and federal organisms to carry out the process of environmental licensing for
new projects. Constant delays in granting operating licenses for hydropower plants or for gas pipelines, while granting easier terms for oil-burning power plants, may lead to more expensive and more polluting electricity.

Due to these facts other expensive sources of generation is becoming crucial to complement the energy supply in Brazil such coal, diesel, fuel oil, and gas power plants. This evidence has been proved from the results of the last new plants auctions, where the selling of these kinds of thermal plants was predominant.

Historically, fuel-oil power plants were only used to guarantee the supplying during the dry periods. They were also used during the rationing as part of Emergency Plan. Recently, the gas lacking for power plants indicates an opportunity for new diesel and fuel oil power plants or dual fuel power plants.

The development of natural gas market is a critical challenge for the Brazilian electricity sector. The government’s policy for the natural gas sector still needs to be defined within the electricity sector.

BIBLIOGRAPHY


