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ALTERNATIVE SOURCES OF ELECTRICITY
IN BRAZIL: Opportunities for Investment

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Abstract

We believe that electricity will play an increasingly important role in the world. The production of electricity always brings harmful consequences to the environment. Then there is the need to minimize such damage. The production of electricity from alternative sources contributes greatly to this goal.

In this paper we evaluate the potential for investments in enterprises of electric power generation in Brazil from alternative sources: small hydroelectricity plants, biomass power plants and wind power.

To achieve this goal, we did a historical analysis of the Brazilian electric sector to demonstrate the maturity of the current moment, we talk about the forecast for the next ten years and about the availability of capital in the country and abroad.

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Introduction

We believe that the electricity might increasingly assume an important role in the world energy matrix, either because of the exhaustion of other sources or because of the need to reduce pollution of the planet. The question that arises is how to produce electricity with low rate of environment degradation? Alternative sources of electric energy production will be more and more important.

In Brazil, the generation of electricity from water resources reaches levels around 80%, a situation that puts it in a privileged position in the world, because this water profile of the generator ensures the supply of electricity at competitive prices and with reduced emission of gases impacting on the greenhouse effect.

Although it is estimated that there are still more than 150,000 MW of hydropower potential to be exploited, expanding Brazilian water area, based on large and medium project, has been suffering gradually increasing restrictions in the sphere of environmental legislation. Moreover, the installed capacity expansion through hydroelectric plant requires necessarily a required equivalency to complement other sources of energy. This basic condition is that justifies the studies on the potential, economic viability and increase the participation of alternative and renewable sources in Brazilian energy matrix.

This study aims to analyze the generation of electricity in Brazil from alternative energy sources that in this study are summarized in Small Hydroelectric Plants, Wind Power and thermoelectricity by biomass (mainly bagasse from sugar cane and pig manure). The paper is divided into four parts four, in addition to this introduction.

Initially, it is analyzed the historical evolution of the Brazilian electrical sector. The purpose is to demonstrate the maturity reached by the sector and place the current moment, as an only moment for the sector and for the country. The second part evaluates Brazilian market for alternative sources, raising the

projected supply and the need investment to next decade. The third part is dedicated to raising the main sources of internal and external funding for the projects under study. Finally it is presented the main conclusions of paper.

Chapter I: Evolution of the Brazilian Electric Sector

To understand the funding of alternative energy plants in Brazil, as in case of small hydroelectric plants (SHP), thermoelectricity by mass and wind power plants, it is necessary to place the Brazilian electric sector in the historical and economic context of the Country. Accordingly, we will make a brief approach on the evolution of Brazilian electric sector.

We can divide the evolution of Brazilian electric sector in five periods, according to the economic and historical moment in which the country has passed over the years.

First Period: 1879 to 1930

The first period, which goes with the advent of electricity in Brazil in the last decades of the nineteenth century until the 30s of the twentieth century, the country was eminently agrarian, which main product of the economy, coffee, allowed some accumulation of wealth and required improvements in infrastructure such as transport (railways and ports), telecommunications (telegraph and telephone), urban services (trams, public lighting, water, sewer, electricity).

In this context, the first hydroelectric plants and the cities with public lighting appeared. We also saw the installation of foreign companies, mainly Amforp (USA) and Light (Canada) in major urban centers of Brazil.

In terms of regulation, there was no centralizing claim, and control of the electricity services was basically under the responsibility of city councils.

From 30s the global economic crisis and domestic political changes, which influenced the different directions of economic activity, caused significant changes in the Brazilian electric sector.

Second Period: 1930 to 1945

In the first three years of the 30s, there were a few incipient regulatory initiatives: the suspension of authorization of new procedures for new uses of watercourses, the prohibition on purchasing companies; and the extinction of the gold clause, a mechanism that was used since the first contract with the São Paulo Light and that guaranteed companies the systematic adjustment of fees by the gold price.

In 1933 was created the National Department of Mineral Production¹ with a Water Board of Directors which would be responsible for matters relating to hydropower exploitation, irrigation, concessions and water legislation.

On July 10, 1934, was promulgated, through Decree no. 26,234, the Water Code and after that, on July 16, was promulgated the New Constitution. While the Constitution legitimized the intervention of the State in the exploitation of mines and waterfalls, the Water Code was far more specific and it had the basic features:

- a) waterfalls and other sources of hydropower were declared distinct goods and not integrated to the land;
- b) waterfalls and other sources of hydropower have been incorporated into the patrimony of the Nation, as inalienable and not expirable property;
- c) the industrial exploitation of waterfalls and other sources of water power began to be made by concession;
- d) companies were audited by the government, including in their accounts;
- e) the price of electricity became established on the basis of service provided at cost;

¹ In Portuguese: Departamento Nacional de Produção Mineral – DNPM.

- f) the capital of companies was assessed on the basis of historical cost;
- g) the concessions would only be granted to the Brazilians or companies established in Brazil;
- h) most of the directors of companies should be Brazilians or living in Brazil or the boards of these companies should delegate powers of management exclusively to Brazilians;
- i) these companies should keep their services in at least two-thirds of engineers and three-quarters of Brazilian workers;

From that, the Union began having power to legislate and granting concessions of public services of electricity, before governed only by signed agreements with states, city councils and the Federal District.

The Water Code changed the relationship of the state with the business executives of the electricity sector and established regulatory principles more rigid, causing dissatisfaction and resistance of the main companies. The Light, for example, focused its criticism on the fee issue. The company opposed to the return of capital by historical cost of investment, defended that it would be adopted the cost of reproduction or replacement. Although there was resistance to adopting the historical cost, in practice this principle had no influence on the determination of fees due to political pressures, and operational and regulatory difficulties to implement it.

Even though the Code was not totally implemented, his nationalist inspiration caused regulatory uncertainties that discouraged investment of one of foreign groups established in the country. The discouragement of business men and restriction on imports of machinery and equipment during World War II lagged the growth of installed capacity with market growth. This situation degraded the quality of service in the main country centers.

These were the main changes in the institutional field, suffered by the sector in the first phase of Vargas government. In spite of not including the generation to thermoelectric power plant, the Water Code covered 80% of electricity generation in the country.

From the New State (1937), there was a new phase of power centralization because of ideological nationalist character of government. In this sense, the Constitution approved in 1937 expressly prohibited the hydroelectric utilization by any foreign company, making concession only to Brazilians or companies whose shareholders were Brazilians.

In 1938, the Decree-Law no. 832 regulated the installation of lines and nets of transmission, set a period of 8 years for the national frequency was standardized at 50 cycles and suspended its previous authorizations given to states of Sao Paulo and Minas Gerais to exploit waterfalls. The Decree was the aim towards the resumption of the reins of political power by the Federal Government.

Next year the government created the National Counsel of Water and Electricity² subordinating it directly to the presidency. As the main tasks, the National Counsel should keep the sector statistics, organize the plan for the interconnection of the system, regulate the Water Code and examine the fee issues between utilities and public administration.

This attempt to sector regulation is similar to policies adopted by the New Deal of President Roosevelt in the United States, respecting the appropriate proportions.

The generation by thermoelectric power plants was regulated on July 5, 1940, through Decree-Law No. 2281.

The 40s started tough for the electric sector. As much as the government wanted to regulate the sector through power concentration, the country faced a crisis of new investments, worsened by a lack of participation of foreign capital and the Second World War. Lacking other means, in 1942, the government relaxed some rules to the foreign capital.

Also in 1942 it began working in Brazil the so-called Cooke Mission³, an American technical assistance which, together with Brazilian experts produced a diagnosis of the electric problems in the country, characterizing it as a result of reduction of prices and a ban on investment by foreign companies. The

² In Portuguese: Conselho Nacional de Águas e Energia - CNAE

³ This was the name of coordinator of the mission Sr. Morris Llewellyn Cooke.

studies of Cooke Mission also concluded that the crisis in the supply of electricity was in a problem to the development of Brazil.

Given this situation and following the policy applied to other strategic sectors of the economy, the state expanded its role beyond the regulatory and supervisory functions: began investing directly in production. The first decision is taken in 1945, when the Hydroelectric Company of São Francisco⁴ (Chesf) appeared to exploit the hydroelectric utilization of São Francisco River.

In 1946, the federal government presented a National Electrification Plan, which incorporated the recommendations of the Mission Cooke. The plan did not have a series program of works, but proposed the concentration of investments in power plants of small and medium-sized, and the State as coordinator.

Third Period: 1945 to 1962

The third period began with the government of General Eurico Gaspar Dutra and went until the creation of ELETROBRÁS, in 1962.

In the first phase of this period, regarding the institutional field, we can highlight three points: the Constitution of 1946, which made no significant changes in the electric sector; the SALTE⁵ Plan (Health, Food, Transport and Energy), which constituted itself in the first attempt to integrated planning of national development, and, finally, the Brazilian-American Committee for Economic Studies, also called the Abbink Mission⁶.

The SALTE Plan provided that the total investment, 57% was used to the transport, 16% to the energy, 14% to the food and 13% to the health. Regarding to energy, 52% were for electricity, 47% to oil and 1% for coal. To electricity, more than half the funds were intended to CHESF.

The plan was fulfilled only in part and in 1952 it was virtually closed.

At the same time the SALTE acted, the Brazilian-American Committee for Economic Studies was a mission of economic cooperation between Brazil and

⁴ In Portuguese: Centrais Hidroelétricas do São Francisco – CHESF.

⁵ In Portuguese: Plano SALTE – Saúde, Alimentação, Transporte e Energia

⁶ The head of the mission was called John Abbink.

the United States that recommended development of the electric sector based on private savings, keeping the State in the position of regulatory and supervisory concessions.

The committee suggested the creation of a fund of specific resources and a bank to manage these resources. Few of the proposals of the Mission Abbink materialized.

The 50s brought significant changes in Brazilian industrialization. Until then, the industry developed replacing imports in response to external constraints. The continuity of industrial expansion should focus autonomously in the internal market. Thus, the new stage depended on the structural changes that would enable the deployment of heavy industry, industry of intermediate goods and industry of capital goods.

To achieve this goal, Vargas government in 1951, negotiated with Washington the creation of the Brazil-United States Committee for Economic Development⁷ (CMBEU), composed of experts, politicians and businessmen from both countries. Promoted studies indicated structural imbalances in Brazilian economy, especially in strategic sectors such as transport and energy.

Also in 1951, Brazilian government negotiated an agreement on financial cooperation with the International Bank for Reconstruction and Development (IBRD) and the Export-Import Bank (Eximbank) to finance imports of machinery and equipment needed for development projects suggested by CMBEU. On the other hand it created the Program of Economic Renovation Fund. The funding for this program came from the Economic Renovation Fund (ERF), formed with tax revenue raised by a compulsory loan of taxpayers' income tax and by borrowing abroad. In 1952 the National Bank for Economic Development⁸ (BNDE) was created under the Ministry of Finance, its main task was managing the ERF resources.

The plan for the electric sector predicted an expansion of 682.9 MW in the installed capacity in the period from 1952 to 1957. However, due to insufficient resources, not all projects suggested by CMBEU were implemented.

⁷ In Portuguese: Comissão Mista Brasil-Estados Unidos para o Desenvolvimento Econômico – CMBEU.

⁸ In Portuguese: Banco Nacional de Desenvolvimento Econômico – BNDE.

The government also developed some initiatives to equate the expansion of generation capacity of Brazil, highlighting the referral to the National Congress of bills designed to:

- a) establish the Single Tax On Electricity (IUEE), in accordance with the provisions of Article 15 of the Constitution of 1946;
- b) create the Federal Electrification Fund (FFE);
- c) regulate the distribution and implementation of portions of the tax levied that would fit the states, the Federal District and the municipalities;
- d) establish the National Electrification Plan, and
- e) provide the Company to development of electricity (ELETROBRÁS).

The National Electrification Plan failed in being approved, but later its proposals were incorporated into government policy of sector development.

In Juscelino Kubitschek (JK) government (1956-61), with the foundations laid in the second Vargas government, was outlined in the project development of the electric sector under the control of public companies, with the creation of most state companies of electricity and one more generator – Furnas Central Electric, controlled by the federal government and the state of Minas Gerais. Juscelino planned to adopt a developmental strategy of modernization and rapid expansion of Brazilian industrial production.

The Plan of Targets of JK government incorporated the contributions of CMBEU programs and of the National Electrification Plan of Vargas and had as supporting base the work developed by the Mixed Group consisted, in 1953, of employees of the Economic Commission for Latin America and the Caribbean (ECLAC) and BNDES. The studies again showed the need to overcome "bottlenecks" that became obstacles to modernization and expansion of the country. The growth model combined state action with the private national company and foreign capital. Of the proposed investment in the Plan of Targets 43.4% were for the energy area, and 23.7% for electric projects and 19.7% for other forms of energy.

In the electric sector, the target was to increase the installed capacity of 3148 MW in 1955 to 5595 MW in 1961. The goals of expanding the supply of power outlined in the Plan of Targets were for the most part, achieved.

To summarize, the period that lasted from 1946 (post war) and 1962 (creation of ELETROBRÁS) was marked by a profound change in the Brazilian economic development model that began focusing on state participation in productive functions, financial and planners. In this context the establishment of the BNDES created the conditions to make up the funding of utilities for modernization of infrastructure (notably energy and transport) and installation of basic industry.

Fourth Period: 1962 to 1995

With the end of Juscelino Kubitschek government and straight afterward with the installation of military governments consolidated the new organizational structure that would plan, regulate, audit and expand electric services to the early 90s. This is an important period in the electric sector where was created the main institutional arrangements and financial instruments for change in the level of the Brazilian economy.

The main points to highlight the period are:

- a) the creation of the National Commission of Public Services Companies⁹ (CONESP) to fundamentally managed to the nationalization of the companies of Amforp Group;
- b) the creation, on June 1962, of ELETROBRÁS, linked to the Ministry of Mines and Energy, with the mandate to plan and to coordinate the sector; acting as a holding company for various utilities and managed the financial resources (including the existing compulsory loan from 1964) destined to works for the expansion of the productive sector;
- c) the transformation of Water Division and Energy of DNPM in the National Department of Water and Energy¹⁰ (DNAE), local authority under the

⁹ In Portuguese: Comissão de Nacionalização das Empresas Concessionárias de Serviços Públicos (CONESP).

Ministry of Mines and Energy. With the extinction of CNAEE, in 1967, its functions went to DNAE, which changed name to Department of Water and Electricity;

- d) the creation in 1962, the Coordinating Committee for Energy Studies (CCEE) in the Mid-South;
- e) the hiring, in 1962, the Consortium Canambra Consulting Engineers Ltd., to provide a solution to the problems of electricity supply in the cities of São Paulo and Rio de Janeiro.

In the second military government in the late 60s, began a new and strong cycle of economic expansion, with GDP growing at rates above 10% a year and the resumption of government investment and aid in construction of infrastructure. In the group of state enterprises were relevant hydroelectric investments, now they are realized in both internal generation of resources of own activity and with external loans.

The increasing complexity of the operating system because of the interconnections, led Ministry of Mines and Energy to support the technical principles that in the next decade, would create a specialized agency in the optimal operation of generating facilities: the Coordinating Group for Interconnected Operation (GCOI), which was of vital importance for the Brazilian electric sector.

Thus, in 1971, the government promoted improvements in fee legislation to give financial support to the sector. The Law 5655/71 established a guarantee of 10% to 12% over invested capital, to be computed in the price. Thus, the sector did not only generate resources to work properly, but also to self-finance its expansion. The Global Reversion Reserve (RGR), the Single Tax on Electricity (IUEE), the compulsory loans to ELETROBRÁS and the entry of foreign loans complemented the funding model. It was therefore a step in which the industry developed in solid financial basis and that allowed it to expand economic and healthy financial conditions during the following period.

To establish equal prices all over Brazil was instituted the so-called fee equalization. This artificial mechanism adjusted the pay of all the utilities

¹⁰ In Portuguese: Departamento Nacional de Águas e Energia - DNAE

through the transfer of excess resources of companies with higher earnings to pay for legal loss, in the mechanism of the Global Reservation Guarantee (RGG).

The inadequacies or excesses of earnings for each dealer were recorded at the time of their annual reporting, the Account of Profit and Loss Compensation (CRC), which is then incorporated into the price fixed in the next fiscal year.

With the oil shocks and economic crisis financial problems appeared. If by the end of the 70s was observed a balanced and self-sustaining growth, the early of 80s brought a sad reality for the industry: the use of sector in policies for attracting external resources and for controlling of inflation through strong containment of the prices.

This new time distorted the criterion of the service per cost and current fee structure. A gradual process of deterioration of economic and financial dealers began.

Large enterprises were initiated in this period aggregating to remunerable investment major portions, which, under the restraint of fee, could not receive proper remuneration. To worsen the case, settled charges encouraged the installation of electro-intensive industries and for the replacement of energy derived from oil.

While profit margins were reduced with the change in the scheme to set fees, transfers between companies in the federal and state did not fail to occur until the first half of the 80s, favored by the current political regime. This combination of factors caused the gradual breakdown of the economic -financial sector. From 1987 to exacerbate this situation, access to domestic financing was practically sealed by successive editions of restrictive rules of the National Monetary Council in order in scheduling the Public Sector.

With the rupture in the self-finance model, the investments started depending increasingly on attracting external funding. At that time, it was witnessed the deterioration of the country's external accounts, a scenario of rising interest rates. After withdrawal of credits from international organizations, the sector began having negative flow of foreign loans and payment of debt service. Debt

service, which corresponded to 20% of the sector applications in 1975, reached 50% in 1985.

Add to this picture the effects of Federal Constitution of 1988, which abolished the Single Tax on Energy (IUEE) and increased the rate of income tax of energy companies, deepening further the crisis.

In this context, it was observed a large-scale default among the state companies and the suppliers of ELETROBRÁS Group and stop the investment capacity of the sector.

Fifth Period: 1990 to today

The bankruptcy of the funding model for the sector generated constant discussions in the attempt to overcome the crisis and undo the institutional problems, that jeopardize any project of revitalization of economic growth.

An important result of these discussions was the adoption on March 1993, Law 8631, which established profound changes in the rules of operation of the sector.

The new legislation finished with the only fee for each consumer class in the country, promoted a broad "settling of accounts" between utilities and Union. The use of the balance of the Profit and Loss Compensation (CRC) not only served to pay off debts of power supply and the purchase of fuel from the Global Reversion Reserve (RGR) and Rencor, but also abolished the guaranteed remuneration and, consequently, the generation of new sales.

Ultimately, measures of intra-sector financial restructuring resulted in the assumption by the National Treasury debt of about US\$ 20 billion remaining for future compensation another \$ 6 billion. At the time of enactment of Law 8631, fees reached low prices (US\$ 37.6 / MWh, the prices of April 1993) which justified, along with the application of the Law, the grant of increases to nearly double the nominal price. On December 1993, the fee had already reached US\$ 60.0 / MWh in nominal terms. But straight afterward, the adjustment of the

Economic Stabilization Program (Plano Real) controlled the process of real recovery in prices.

The extraordinary rate, although it was prerequisite to restoring the economic financial balance of utilities, would not be sufficient on its own. The sector had accumulated a large stock of debts, and unrealized investments that, at least in the short term, the provided internal generation by the rate revenue became insufficient to finance the new cycle of expansions.

The gradual dismantling of the sector resulted in the shutdown of a generation program that would add 10 thousand MW to the system and which had already been granted approximately \$ 11 billion, with annual financial cost of about \$ 1.9 billion. The situation was characterized by:

- a) the building of different-sized plants were totally paralyzed;
- b) standards of maintenance of systems were damaged, and
- c) to accumulate debts with contractors and equipment suppliers.

In the 80s, the investment sector had remained at levels above US\$ 8 billion a year, however, from the 90's, and had deepened the economic crisis and sold out the pattern of financing the sector, the investments suffered drastic reductions, reaching down at levels of \$ 4 billion.

Law 8031/90 established the National Privatization Program (NPD) and created the National Privatization Fund (FND). The BNDES was appointed manager of the Fund, accounting nature fund which are deposited the shares of privatizing enterprises. As such the fund manager, the Bank started managing, monitoring and carrying out the sale of the companies included in the NDP.

The precondition for that they implemented the model was the unbundling of the production chain, separating the generation, transmission, distribution and commercialization, from that moment characterized as unrelated business areas. The generation and commercialization were gradually deregulated, since the transmission and distribution (which, by its nature, are natural monopolies) continue to be treated as regulated public services.

Laws 9074/95 and 8987 also added these profound changes:

- a) the bidding of new generation projects;

- b) the creation of the Independent Power Producer;
- c) the determination of free access to transmission systems and distribution, and
- d) freedom for large consumers to choose their electricity supplier.

In addition, Decree 1717 of 11/24/1995, established the conditions and made possible the extension and regrouping of public service concessions and approval of Completion Plans of unfinished projects. Decree 2003 of 09/10/1996 regulated the rules for activities of independent producers and compounders.

Another major sector milestone was the Law 9,427 of 12/26/1996 which instituted the National Energy Agency (Aneel), as regulator of the Electric Sector.

Other regulations occurred in 1997 and 1998, with emphasis on:

- a) Law 9433 of 01/08/1997, which established the National Policy of Water Resources and created the National System of Water Resources Management;
- b) Law 9648 of 05/27/1998, which established the Energy Wholesale Market (MAE) and the figure of the National System Operator (ONS);
- c) Decree 2335 of 10/06/1997, which constituted Aneel and approved its Regimental Structure; DNAEE 466 of 11/12/1997, which consolidated the Terms of Electricity Supply, harmonized with the Code of Consumer Protection (Law 8078 of 09/11/1990); and
- d) Resolution ANEEL 94, 03/30/1998, which defined the limits of concentration on activities of distribution and generation.

Before the beginning of the privatization of the electric sector, some important changes were made by Laws No. 8987 and No. 9074, both published in 1995, among them stood out:

- a) the need to conduct bidding for new generation projects;
- b) freedom for large individual consumers to choose their energy suppliers;

c) the determination of free access to transmission systems and distribution, and

The insertion of electric sector companies in PND happened in two phases: initially, in June 1992, were included in the program some companies through Decree no. 1503, the PDN began including Eletrobrás and Eletrobrás system, so totally controlled by state governments. Afterwards, in May 1995, already in Fernando Henrique government.

After the necessary support of relevant legislation, privatizations, regarding the electric sector were also initiated in 1995 with the sale of some dealers that worked in federal distribution segment. The pioneer was in charge of Escelsa, which was sold in a privatization auction held in July 1995, a Consortium formed by some banks and pension funds. Then it was the turn of the Light, in May of 1996, was acquired by consortium of some foreign companies, BNDES Participators and CSN.

In the generation segment, the privatization process of utilities under federal control was preceded by the publication of Law No. 9648 of 05/27/1998, which determined the need of re-organization, through split, fusion, merger, reduction of capital and establishment of subsidiaries, as appropriate, all with the purpose of facilitating sales, seeking to awaken the interest of private investors. However, there was one problem: these companies sold power to the state distributors, many of which did not honor their commitments to the generating subsidiaries of ELETROBRÁS. This caused an obstacle to negotiations, because private investors would not buy generators, with the possibility of the distributors did not pay for received energy. The solution found by the federal government was privatizing state distributors, which involved complex and long negotiations with state governments. With the privatization of most distributors, it was felt that the necessary conditions for the sale of generating companies of Eletrobrás would be created.

It is in this context that the state utility, even in Fernando Henrique government, followed the same path of restructuring their businesses, through the privatization process, between the years 1996 and 2000, in whole or in part, the following companies: CEEE (RS); Eletropaulo, CPFL and Cesp (SP); Cemig

(MG); Cerj (RJ); Coelba (BA); Energipe (SE); Celpe (PE); Saelpa (PB); Cosern (RN); Coelce (EC); Cemar (MA); Celpa (PA); Cemat (MT); Enersul (MS); Cachoeira Dourada (GO), and Borborema (PB).

The intense process of privatization made most of the companies that made up the sector to return to belong to the private sector. At the end of 1997 happened the beginning of privatization in the sector of power generation in the country, at the federal level with the split Eletrosul gave rise to Gerasul which was privatized in September 1998, acquired by Tractebel, from Belgium, keeping only the original company active in the transmission segment.

The scenario of uncertainty created due to constant changes in laws which regulated the sector of national power and lack of medium and long term¹¹ planning caused concerns to investors and, as a result, the funds for new enterprises in the sector were insufficient to fulfill the demand arising from the company earlier this century.

The insecurity of private investors and falling state investment in the sector contributed to that in 2001 the country faced in all sectors of society, a severe energy crisis that lasted until the end of the first two months of 2002. It was established since then, energy rationing, the Emergency Plan for Reduction of Energy Consumption, by Provisional Measure no. 2147 of 05/15/2001, in the most regions affected by lack of electricity, namely, the Southeast, Midwest and Northeast of Brazil. This Rationing Program was suspended in March 2002 because of increased supply, thanks to the significant increase in reservoir levels, and moderate reduction in demand for energy. The occurred crisis caused a series of discussions regarding the revision and the urgent need for investment in the sector and diversifying the national energy matrix.

After the energy crisis, now in President Lula government, several measures were taken to facilitate access by private investors to the electric sector. In December 2003, it was issued Provisional Measure no. 144 that was on the energy marketing, and Provisional Measure no. 145, which was on the creation of the Energy Research Company - EPE. Although there were some challenges

¹¹ There was that time a body responsible for planning medium to long term, where as the expansion of the decision submitted to ANEEL, which had no structure or responsibility to plan. Among other shortcomings of the model then installed this lack of planning is in a large gap that will be corrected later with the creation of the Energy Research Company (EPE).

before the Supreme Court concerning the constitutionality of laws, were published on 03/15/2004, the Laws no. 10,847 and no. 10,848.

These laws were the pillars of the restructuring of the new model of electric sector, and had as guiding principles: security of energy supply, promote low fees and universal service, and ensure regulatory stability for the participating agents. Among his contributions are:

- a) the creation of two parallel environments for energy trading, the Regulated Contracting Environment (ACR), understood as a market for electricity sales to distributors, to ensure the provision of electricity to retail consumers, and the Contracting Environment Free (ACL), where the market is specifically designed for other agents of the electric sector - for example, independent producers, consumers and free trading agents - that will allow some degree of competition in the generation segment, in relation to the Regulated Contracting Environment;
- b) the creation of agents aimed at planning and monitoring sector, the Energy Research Company¹² and Monitoring Board of Electric Sector¹³, both linked to the Ministry of Mining and Energy, the extinction of the Wholesale Electric Market and the creation of the House Energy Trading¹⁴, with broader functions to redefinition of the roles of Ministry of Mining and Energy, who becomes the executor of energy policy emanated from the National Council of Energy Policy and ANEEL, which shall have the sole purpose of regulating and monitoring purposes;
- c) the creation of the old energy and new energy projects, also called the new energy, creating different forms of marketing these energies. The responsible institutions for drafting the new model, introduced by Law no. 10,848 and no. 10,847, had the premises: to minimize risks with new model, through public and private participation, with planning and marketing; to respect existing contracts; to preserve the institutions that are well established; to improve their governance; to plan for expansion of energy supply and integrated management of production, according to

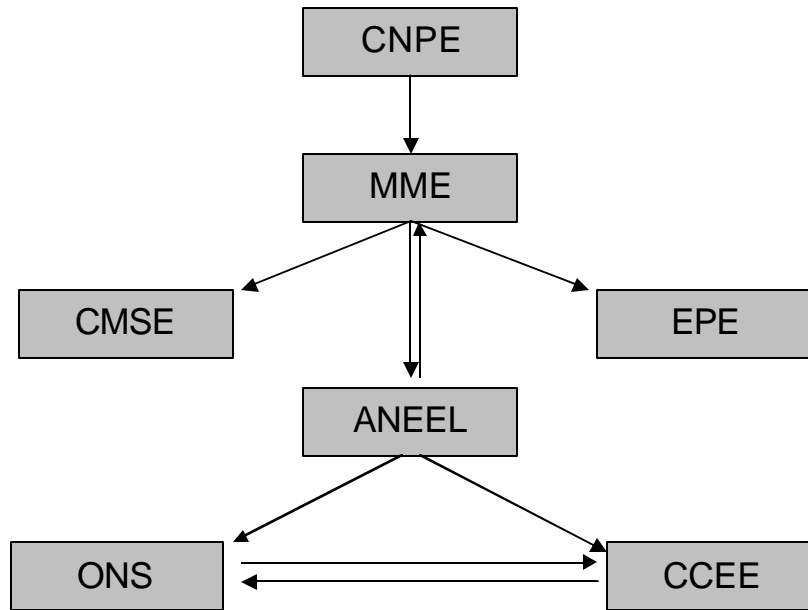
¹² In Portuguese: Empresa de Pesquisa Energética – EPE.

¹³ In Portuguese: Comitê de Monitoramento do Setor Elétrico - CMSE

¹⁴ In Portuguese: Câmara de Comercialização de Energia Elétrica - CCEE

the vocation of the sector and supply security; and to diversify the mix of power, considering the complementary nature of other sources.

After institutional reform, the new model of the electric sector had the format shown picture I below:



CNPE – National Council of Energy Policy
MME – Ministry of Mines and Energy
CMSE – Monitoring Board of Electric Sector
EPE – Energy Research Company
ANEEL – National Energy Agency
ONS – National System Operator
CCEE – Commercialization Council of Energy

When happened the sector restructuring, with respect to the premises set out when the idealization of the new model, Lula government determined by Law 10.848 of 03/15/2004, the exclusion of Eletrobras and its subsidiaries for the national program of privatization. The same law also allowed Eletrosul to act in generation of electricity.

Despite the drawbacks observed during these 120 years of history, the electric sector played a key role in the development of the country, with installed capacity reaching 115 thousand MW in 2010, according to Table I below:

**Table I: EVOLUTION OF THE CAPACITY OF ELECTRICITY
1890 to 2010, in MW**

Year	Hydro- electric	Thermo- electric	Others	Total	Growth %
1890	0	1	-	1	-
1900	5	5	-	10	789,3
1910	124	28	-	152	1.520,0
1920	301	66	-	367	241,4
1930	630	149	-	779	212,3
1940	998	246	-	1.244	159,7
1950	1.536	347	-	1.883	151,4
1960	3.642	1.148	-	4.790	254,4
1965	5.391	2.020	-	7.411	154,7
1970	9.088	2.372	-	11.460	154,6
1975	16.323	4.801	-	21.124	184,3
1980	25.584	5.768	-	31.352	148,4
1985	37.437	4.359	-	41.796	133,3
1990	44.924	5.231	402	50.557	121,0
1995	53.909	6.277	687	60.873	120,4
2000	64.691	7.532	1.174	67.204	110,4
2005	73.279	20.770	2.007	96.056	142,9
2010	89.914	22.140	3.430	115.484	120,2

Source: Adapted from ELETROBRÁS

Chapter II: The Brazilian Market for Electricity from Alternative Source

During the years 2003 and 2004 the federal government laid the basis for a new model for the Brazilian Electric Sector, supported by Law No. 10.847 and 10.848 of March 15, 2004 and also by Decree No. 5163 of July 30, 2004.

In institutional terms, the new model set to create a responsible entity for planning the electricity sector in long term (Energy Research Company – EPE), an institution with a role in evaluating the ongoing safety of the electrical power supply (Monitoring Committee of Electricity Sector - CMSE) and an institution to continue MAE activities (Wholesale Energy Market) on the marketing of electricity in the Interconnected System (Electric Energy Trading Chamber – CCEE).

Other important amendments include the definition of the Office of the Granting Authority to the Ministry of Mines and Energy (MME) and increased autonomy from the National Operator System (ONS).

In the marketing power, two settings were set to enter into contracts for the purchase and sale of energy: the Regulated Contracting Environment (ACR), with the participation of Power Generation and Distribution Agents, and the Free Contracting Environment (ACL), which involved Generation agents, Traders, Importers and Exporters of energy and Free Consumers.

The new model of the electricity sector aims to achieve three main objectives:

- a) Ensuring security of electricity supply;
- b) Promote low prices;
- c) Promoting social inclusion in the Brazilian Electricity Sector, in particular the programs of universal service.

The model provides a set of measures to be observed by agents such as the requirement of hiring all the demand from utilities and consumers free, new methodology for calculating the ballast to the sale of generation, employment of hydroelectric and thermoelectric plants in proportions that better balance

between security and cost of supply, and the permanent monitoring of the continuity and security of supply in order to detect cyclical imbalances between supply and demand.

In terms of low price, the model provides for the purchase of electricity by distributors in the regulated environment through auctions - observing the lowest price criterion, aiming the cost reduction of electric energy acquisition to be passed on to the captive consumers rate.

The inclusion promotes universal access and use of electric power service, creating conditions for the benefit of energy to be available to citizens who still do not have this service, and ensure benefits for low-income consumers, such so they can afford the cost of your electricity consumption.

Alternative sources of power constitute this model.

One of the major problems of lack of investment in the electricity generation segment lies in the fact that there have been no guarantees and incentives for capitalists. Guarantees, regarding the issue of hydrological risk and the existence of winds, for instance, and encouragement to those enterprises that can not compete with large hydroelectric where the economy of scale allows much more competitive prices. The solution has been specific auctions to these modalities, where the competition is between enterprises with similar characteristics.

Before proceeding on Energy Brazilian Market from alternative sources, it is necessary to clarify what kind of energy makes up this segment.

Alternative sources are those viewed as low environmental impact for a number of characteristics of these enterprises. For this study, we are working with three types of alternative energy: Small Hydroelectric Plant- SHP, Thermoelectric Biomass¹⁵ and Wind Power.

Let's evaluate each source:

¹⁵ Regardless of the primary source, but mostly bagasse from sugar cane and pig manure.

Small Hydroelectric Plants – SHP

The Small Hydroelectric Plants - SHP, identified by having an installed capacity exceeding 1 MW and less than or equal to 30 MW for independent production, self-production or autonomous independent production with tanks in areas lesser than 3.0 km².¹⁶

These plants represent a type of hydraulic expansion widely used in the country. The attractiveness of these plants is based, mainly, due to their lower environmental impact, when viewed in isolation, lower investment, short maturation period and encouraged treatment by ANEEL Resolution No. 652, of 09/12/2003 and regulations in force.

An important feature of the SHP is the exemption of the concession bidding, the entrepreneur simply obtains permission from ANEEL. Add to this attractive, incentive mechanisms such as:

- a) exemption from Commonwealth¹⁷ use tax;
- b) exemption to apply, annually, the amount of at least 1% (one percent) of its net operating revenues in research and development for the electricity sector;
- c) exemption for compensation paid to states and municipalities out of using water resources;
- d) possibility to immediately sell the electricity produced with consumers whose charge is greater than or equal to 500 kW;
- e) possibility of subrogation of Fuel Consumption of Fossil Fuels for installed projects in isolated systems;
- f) reduction of at least 50% off in charges payment for using of networks transmission and distribution.

¹⁶ In the case of the reservoir area larger than 3.0 km², while the power mentioned that satisfies the following inequality: $A = 14.3 \times P / H_b$, where A = reservoir area (km²), P = electric power installed (MW), H_b = total head (m), defined as the difference between the water levels in most normal amount and normal users. In this case, should be respected to a maximum of 13.0 km² area of the reservoir and the power of 30 MW.

¹⁷ This is an existing tax in Brasil.

Biomass Thermoelectric

The physical principle of biomass thermoelectric does not differ from conventional thermal power plants by gas, coal or oil. What differs is the fuel. While the latter use derived Fossil from large-scale, the former uses waste from other processes such as sugar cane bagasse, waste from pig farms and even gases from the waste.

In Brazil there is a significant potential for electricity generation from biomass, "bioelectricity", produced especially from sugarcane industry waste, especially crushed sugar cane, but also other wastes such as pig manure and gas from garbage.

Exploiting its potential benefits the environment because it is a renewable energy source, and also contributes to low prices because it is a low-cost thermoelectric generation with dominated technology, and can be found in relatively short deadlines with Brazilian manufactured equipment. This thermoelectric generation can complement the hydro generation. Another advantage is that much of this potential is located close to major consumption centers, there is no need to incur high costs of transmission and/or connection to low voltage networks distribution, reducing electrical losses.

Furthermore, the sugar-based ethanol is in an extremely peculiar period, because the steam systems of many plants built for the National Alcohol Program (PROÁLCOOL) are at the end of its useful life. Thus, in the coming years, many plants may be retrofitted and can install more efficient systems, allowing the generation of electricity surplus to the National Interconnected System.

To enhance this process there must be conditions for the electricity marketing in regulated and free environments. Another reason to support this potential power is the specific credit lines that have recently been made available to fund such enterprises.

According to recent reports, the National Sugar Industry Facility has had until July 2008, 393 plants in activity, with 313 in the South Central region and 80 in

the north-east, and still has about 91 projects under implementation and development and 23 in a study by the year 2010, i.e., the sugar cane industry is developing rapidly, due to the growth of domestic and foreign, sugar and alcohol market. The production of cane in 2007 has been around 500 million tons and it is estimated to reach about 1075 million tons in 2017, representing a national growth average of around 8% per year, during this period, demonstrating the relevance of this potential energy for planning the expansion.

It should be also noted that this potential is not uniformly distributed in the country, being concentrated about 80% in South Central region, especially in the states of Sao Paulo, Minas Gerais and Goias, and 20% in the North-Northeast, mainly in the states of Alagoas and Pernambuco, Maranhão also highlighting in the end of the period.

Brazil has encouraged the use of this potential. Besides PROINFA, we have the example of Reserve Power Auction (LER), organized to purchase energy produced from biomass, mainly sugar cane bagasse cane. The goal is to increase the safety and security of electricity supply to the integrated national system.

The energy Reserve Power Auction had two products for trading, one for beginning the delivery in January 2009 and another to start from January 2010. According to Ordinance No. 20/2008 of Minas and Energy Ministry (MME), the contracts of the public sale are in the mode of energy supply, with duration of 15 years.

In the case of Reserve Power Auction mentioned above also points out that in order to improve conditions of connection of renewable generation biomass to electricity system was instituted what is called Installation of Transmission of Interest Unique Generation to Central Connection Shared (ICG). This type of connection applies in cases where there are significant generators of agents and there is no facility in the Basic Network Connection, and also when the distribution system in the region, if any, does not admit the central generation who want access to the grid.

Wind Power

Wind power or Wind energy, in turn, consists of taking energy from wind to produce electricity using wind turbines¹⁸.

The Brazilian potential for wind energy use has been the subject of studies and research since the 1970s, culminating in 2001 the publication of Brazilian Wind Potential Atlas.

Atlas pointed out that there are areas with average wind regimes, suitable for wind farms, mainly in the Northeast (144 TWh / year), South and Southeast, (96.04 TWh / year). It is noteworthy that in the South and Southeast are the major consumer centers, greater need for security and increase the electricity supply.

The main incentive for that energy source has been established by Law 10,438 of April 26, 2002, which was a milestone in the regulatory framework in electricity sector, to create PROINFA¹⁹, whose goal is to increase the electricity produced from alternative sources (wind power, small hydro - SHP and biomass) to generate electricity. With regard to the consideration of wind generation projects in the reference configuration of this plan, we included all projects included in the first phase of PROINFA, which have been into operation from 2008/2009. For the remaining years of the ten-year horizon, although the wind energy has been used in all the alternative sources, generation projects that will comprise the future integrated national system generation facility have not been specified. These projects will be implemented as they carry out bidding procedures that will enable the country to increase the participation of this source in the energy matrix, which is the subject of review by MME, by viewing the first execution of an auction designed specifically for wind farms to late 2009.

¹⁸ On this subject we recommend the excellent work of the Engineer Ronaldo dos Santos Custódio entitled "Wind Energy to Produce Electricity.

¹⁹ In Portuguese: Programa de Incentivos a Fontes Alternativas de Energia PROINFA.

The Market for Alternative Sources of Energy in Brazil

Studies of EPE, that support this research, the installed capacity of alternative energy (SHP, Biomass and Wind Power) in 2007 has been 2954 MW, as shown below:

**Table II - SHP, Biomass and
Wind Power in Brazil 2007**

Plants	Power MW
SHP	2.236
Biomass	499
Wind Power	219
Total	2.954

Source:: Empresa de Pesquisa Energética - EPE

In 2017 the so-called alternative energy will have an increasing involvement, from 2954 MW in 2007 to 13,327 MW in 2017, so an increase of 451%.

In terms of relative share, installed capacity in Brazil in 2017 may reach 154,646 MW, being 13,327 MW alternative sources. So, a percentage of 8.6% against 5.1% in 2008. Table III shows this evolution.

Table III - Evolution of installed capacity for power generation (MW)

Type	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Hydro	80.961	81.669	83.653	85.386	86.044	88.505	90.491	95.888	103.230	109.766
SHP	3.951	5.157	6.261	6.415	6.445	6.859	7.734	7.734	7.734	7.734
Nuclear	2.007	2.007	2.007	2.007	2.007	2.007	3.357	3.357	3.357	3.357
Fuel Oil	1.369	1.673	3.405	4.845	5.271	8.889	8.889	8.889	8.889	8.889
Gas	8.997	9.107	9.323	9.818	10.382	12.059	12.059	12.059	12.059	12.059
Diesel	1.657	2.516	2.691	2.691	2.127	1.574	1.574	1.574	1.574	1.574
Coal	1.415	1.415	1.765	2.465	2.815	3.175	3.175	3.175	3.175	3.175
Biomass	982	1.637	3.997	4.056	4.056	4.170	4.170	4.170	4.170	4.170
Gas of Process	197	687	687	687	687	687	687	687	687	687
Termo Indicate	-	-	-	-	-	-	-	900	900	900
Steam	272	272	272	272	272	272	272	272	272	272
Wind Power	274	1.045	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.423
Others Indicate	-	-	-	-	-	-	-	320	640	640
Total	102.082	107.185	115.484	120.065	121.529	129.620	133.831	140.448	148.110	154.646

Source: Empresa de Pesquisa Energética (Plano Nacional da Expansão de Energia 2008-2017).

The Potential for Investment in Brazil

In Brazil, the generation expansion from 2009 to 2017 will require investments of about R\$ 142 billions. Since most of these investments relate to the plants already granted and authorized. The amount to invest in new plants, has not granted or authorized (indicative), is approximately R\$ 79 billions, with approximately R\$ 70 billions in hydroelectric plants.

According to EPE Ten-Year Expansion Plan from 2008 to 2017, the prospect of deployment of alternative energy plants in Brazil is 10,373 MW, which added to the existing 2954 MW, have a total of 13,327 MW which has referred to earlier. Table IV details this need by source and year.

Table IV -Increase Alternative Energy (MW)

Type	2008	2009	2010	2011	2012/17	Total
SHP	1.715	1.206	1.104	154	1.319	5.498
Biomass	483	655	2.360	59	114	3.671
Wind Power	55	771	378	-	-	1.204
Total	2.253	2.632	3.842	213	1.433	10.373

Source: adapted of Empresa de Pesquisa Energética (Plano Nacional da Expansão de Energia 2008-2017).

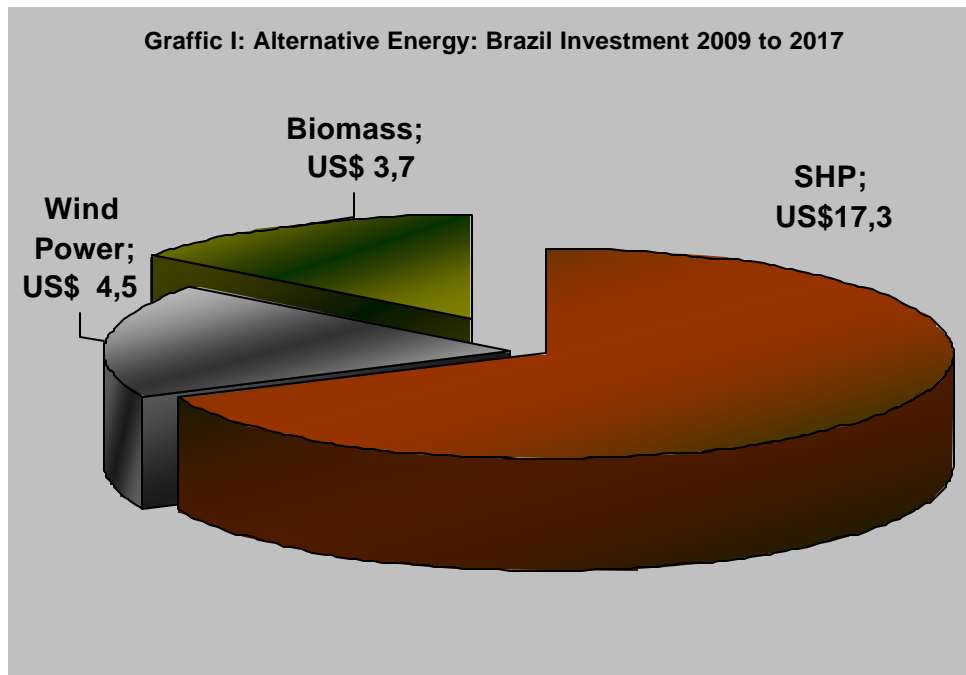
From these data, we have begun to research the cost of deployment of alternative energy plants. We have been finding many different numbers for each source. Thus, considering the research that has been undertaken by Eletrosul to these developments, we have adopted the average cost provided between variations reported by the Company. Table V below shows the values considered.

Table V - Cost of Projects Implementation of Alternative Energy (US\$/kW)

	Mínimum	Máximum	Average
SHPs	2.600	3.700	3.150
Biomass	900	1.100	1.000
Wind Power	3.150	4.300	3.725

Source: Eletrosul Centrais Elétricas S. A.

Thus, considering the above average cost of deployment to developments of alternative energy, opportunities in alternative energy sources in Brazil will reach figures of US\$ 25,5 billion from 2009 to 2017. Graphic below details this value.



It is noteworthy that the remuneration of these developments are consistent with the average of the market and can vary from 12% to 20% on the actual capital invested. It certainly presents an interesting alternative of earnings at a time when interest rates of financial markets tend to much lower levels. Considering the Interest Rate Term in force in Brazil's 6% per year, in nominal terms, there is no doubt that these investments suggest a way for those investors that want safety and profitability being not worried about short term.

Chapter III: Financing for Investments in Plants of Electricity from Alternative Source

As demonstrated in the previous chapter there is great potential for investment in power generation from alternative sources. These new developments are feasible, safe, profitable and environmentally friendly.

Like most developments in capitalist countries, the feasibility to leverage them has been considering. On average, the structure capital adopted for these investments is 30% equity and 70% debt. There are numerous sources that can fund part of the debt. This is what we will examine in this chapter.

Financing in Brazil

Banco Nacional de Desenvolvimento Econômico e Social - BNDES

The National Bank of Social and Economic Development - BNDES has been the main funder of infrastructure developments that Brazil needs for its development.

The electric power sector comprises three segments: electricity generation, transmission and distribution. BNDES has making an important role in supporting the expansion and modernization of the electricity sector, which has enabled the implementation of projects that require long-term maturity and high levels of investment. The objective of the Bank's actions is to ensure the supply of electric power quality, safety and low prices, meeting the needs of the economy and society as a whole.

The conditions are defined according to the product used in the financing. The products available are:

- a) BNDES FINEM - financing investment projects worth at least R\$ 10 million;

- b) b) Automatic BNDES - financing investment project worth up to R\$ 10 million;
- c) c) BNDES Credit Limit - revolving credit facility to support companies or economic groups already BNDES clients with low credit risk;
- d) d) BNDES Bridge Loan - to finance a project, granted in specific cases, to increase investments by allocating resources in structuring of long-term operation;
- e) e) Finance Project - financial engineering contract supported by the cash flow of a project, serving as collateral assets and receivables of the same development.

The first step is to send query letter to BNDES. The bank, in possession of all data, does a pre-assessment of the adequacy of the application.

The conditions of financing plans SHP, Wind Power and biomass are:

- a) Interest Rate: Long Term Interest Rate (TJLP) or 80% Interest Rate and 20% Currency Basket;
- b) BNDES Remuneration: from 0.9% to 1.3%;
- c) Maximum Deadline: 14 years;
- d) Funded Percent: 60% to 80%.

There is no pre-established amount for SHP, Wind Power and Biomass projects. Financings are handled on a case by case determinations, but there is no lack of sources for good projects.

Banco da Amazônia S. A. – BASA

Banco da Amazônia S. A. - BASA is responsible for managing the Constitutional Financing Fund of North (FNO). This fund established by Law 7827/89 can offer resources to legal persons under private law, including

individual companies, associations and cooperatives, organized in accordance with law that aims to invest in infrastructure.

Plants financing conditions for SHP, Wind and biomass Power are:

- a) Interest rate: 10% per year.
- b) Maximum Deadline: 12 years
- c) Funded Percent: Up to 90%.

Banco do Brasil S. A.

Brazil Bank is responsible for managing the Constitutional Financing Fund of the Midwest (FCO). This fund has also been established by Law 7827/89 in order to develop the Midwest Region of Brazil. Funding may be granted to legal persons under private law, including individual companies, associations and cooperatives, organized in accordance with law that aims to invest in infrastructure.

The conditions are similar to those of Financing Fund of North (FNO)

Banco do Nordeste do Brasil S. A. - BNB

Northeast Constitutional financing fund (FNE) is under Northeast Brazil Bank – (BNB) responsibility, similar to two other funds presented earlier, the FNE aims the development of northeastern Brazil and provides financing for infrastructure projects, as developments of SHP, wind and biomass power.

The conditions are similar to those of Financing Fund of North (FNO) and Financing Fund of the Midwest (FCO).

Banco Regional de Desenvolvimento do Extremo Sul - BRDE

Far South Regional development Bank (BRDE) has credit lines to infrastructure enterprises, among them, power generation developments from alternative energy sources.

Funding may be granted to companies of legal persons of private law: Limited, Corporation, and Civil Societies with the purpose of generating products or services

The conditions of project financing from alternative sources are:

- a) Interest Rate: Interest Rate Term²⁰;
- b) Remuneration BRDE: to be defined for each case;
- c) Maximum deadline: 116 months
- d) Funded Percent: from 50% to 90%.

Caixa Economica Federal - CEF

Besides the agents listed above CEF, as an arm of federal government that operates in the sanitation and infrastructure, has some credit lines to finance business for small and medium companies.

The conditions are negotiated on each case, but always with a view to support socio-economic environment in Brazil.

Pension Funds

In Brazil, pension funds have been strengthened over the past decades. According to estimates Pension Funds Department (SPC), Brazil's assets are around US\$ 250 billion.

²⁰ In Portuguese: Taxa de Juros de Longo Prazo - TJLP

With the Brazilian macroeconomic stabilization and the consequent possibility of reducing interest rates, it becomes a need for these funds seek investment alternatives that are compatible with their actuarial targets, since the financial market is becoming increasingly restrictive.

In this context, investments in enterprises of a certain return and long maturation fit perfectly in the portfolio of pension funds.

If we imagine that 5% of the assets of pension funds were intended for projects of power generation based on alternative sources, it would be possible to finance US\$ 12.5 billion. Taking as a basis of a capital structure of 70% debt capital and 30% equity, this volume could leverage developments of \$ 42 billion, which is more than sufficient to support the projected investments in this segment by 2017 (US\$ 32 billion), as mentioned in the previous chapter.

The mechanism to be used would be the formation of Special Purpose Entities – SPEs, in which funds would participate as partners in development. The funds would keep throughout the project development stage, or withdraw before, in case of joining to other members who would have an obligation to purchase of the shares if the decision is to leave.

Several pension funds in Brazil have already realized this opportunity and are already talking to the formation of an Investment Fund Equity – FIPs, to analyze projects and partners, such as ELETROBRÁS foundations, whose wealth is approximately US\$ 10 billion.

External Financing

Interamerican Development Bank - IDB

IDB is an important source of multilateral financing for Latin America, the main objective is to support the process of economic and social development of the region.

The Bank grants loans and makes technical cooperation non-refundable. With a triple A credit rating, the Bank raises funds in the international market with

favorable market rates, enabling the bank to lend funds at competitive costs. Therefore, the Bank can structure loans with competitive interest rates to their customers in borrowing countries.

In Brazil, IDB has financed numerous projects to generate electricity. In the last 5 years the Bank financed US\$ 3.2 billion only for the energy sector in the country.

Alternative energy projects when well structured may receive funding from IDB due socio-environmental benefits that are tied to these developments. Particularly if structured in special purpose companies (SPCs).

World Bank

The World Bank is one of the largest sources of funding and knowledge of the world that offers support to member governments in their efforts to invest in schools and health centers, water and energy supply, fighting disease, and protecting the environment.

The funding of alternative sources projects is entirely consistent with the objectives of the Bank, by energy or by protecting the environment. In Brazil, IRDB has funded many projects in electricity generation and more recently financed the similar ventures to those described in this paper, for example, The Lages Wood Waste Cogeneration Plant Project²¹ and Usina Alta Mogiana S.A.²²

²¹ Lages Wood Waste Cogeneration Project for Brazil aims to reduce emissions by generating energy from renewable sources. It also supports the development of an international market mechanism for emissions reduction under the framework of Kyoto Protocol. The project produces reduction of carbon dioxide emissions by substituting electricity by thermal plants with electricity from renewable sources, using wood waste from existing wood processing units and other wood residues from legal sources and avoiding methane emissions from wood waste piles, currently landfill in most cases in an environmentally harmful manner.

²² The objective of Prototype Carbon Fund - PCF - Sugar Bagasse Cogeneration Project is to reduce emissions by generating energy from renewable resources. It is designed to facilitate the implementation of several subprojects in Brazil, of which two sugar bagasse cogeneration projects are presented for approval. Alta Mogiana Bagasse Cogeneration Project is hosted by Usina Alta Mogiana S.A., and focuses on increasing efficiency in the cogeneration process to produce more steam, and increase electricity output to supply the national grid. The Guarani Cruz Alta Bagasse Cogeneration project is hosted by Azucar Guarani S.A. and focuses on installing new facilities to increase the electricity output from its generation plant. Under Phase I,

Thus, it is possible to point out that the World Bank can be a source of funds to finance projects related to renewable energy, mainly through International Finance Corporation – IFC.

Funding Agencies

There are also government agents interested in funding projects in self-supporting developing, as alternative sources of electricity that we have been dealing in this research. Among them, German KfW Bankengruppe and French Agence Française de Développement - AFD.

KfW, for instance, has been funding projects of Small Hydroelectric Power Plants ELETROSUL S. A.²³

They have profound interest in financing projects of small hydroelectric plants, wind power and biomass thermoelectric, due to the important ecological appeal that these developments represent today and for the future.

About Germany, for example, it is also worth highlighting the vanguard of studies on wind power reached there, which greatly helps that mode without closing the door to others.

Carbon Credits

Carbon credit is a kind of certificate that is issued when there is a reduction of gases emission that cause the greenhouse effect and planet global warming. A unit of carbon credit equals one ton of CO₂ (carbon dioxide) that is no longer produced. Other gases are reduced by credits issued, using an equivalent carbon chart.

a 21.8 MW. The project will receive carbon finance, and project preparation and processing from the Prototype Carbon Fund (PCF).

²³ The KfW funded projects SHPS Barra do Rio Chapéu, Itararé, Pinheiro and João Borges, all in the State of Santa Catarina, which account for a total of 53 MW

The idea of creating the system of carbon credits has been to compensate gases emissions that produce global warming through a program that wakes up countries for a political willing in reviewing its industrial processes and thereby reducing pollution in the atmosphere and its impact on global warming.

Companies that can reduce greenhouse gas emissions get these credits being able to sell them in national and international financial markets. These carbon credits are considered commodities (goods traded with prices set by the international market).

The permitted amount of greenhouse gas emissions and laws governing the system of carbon credits have been established during the negotiations of Kyoto Protocol (discussed and negotiated in Japan in 1997).

In practice, the carbon credits are certificates that are issued by environmental protection regulators agencies, stating that there had been a reduction of greenhouse gases emission. The amount of carbon credits received varies by the amount of reduced carbon emissions.

This certificate is traded in the international market, where the reduction of greenhouse gases is replaced by a monetary value to contain the pollution. There are several ways to achieve this, some examples are reforestation, reduction of emissions from burning fossil fuels, replacing fossil fuels by clean renewable energy such as wind, solar, biomass, SHP (Small Hydro), among others ; use of emissions that would otherwise discharged into the atmosphere (methane from landfills) for energy production.

In international agreements, developed countries have been given to maximum quotas issue these greenhouse gases. These countries had to create laws to restrict greenhouse gas emissions in their territories.

Countries and their industries that exceed the targets must purchase certificates of carbon credits in the same way that company can reduce its emissions can sell the surplus of greenhouse reduction gases in goods and stock markets to other countries or industries that need these credits.

Therefore, the use of such credits has dual benefit. On the other hand, it contributes to improving the environment and a cleaner planet and helps to

enable alternative energy developments as SHP, wind energy and thermal biomass, reported in this study.

There are many consultants in Brazil that can assist companies in obtaining carbon credits, since it is a bureaucratic process that requires specific knowledge of the subject.

Conclusion

The modern world requires awareness of the human species about which we look to the future of the planet. This discussion hinges on the definition of renewable energy we will use for years to come, because there comes most of the pollution that affects the planet.

We are aware that Brazil needs to develop but do not have the right to commit future generations. For this reason, we have been discussing the possibilities of investment in power generation, which in our opinion is the future energy mix from renewable sources.

The Brazilian Electricity Sector has constituted a pillar of the country's development over the past 120 years. Despite the drawbacks faced along the way, the sector managed to support the growth of Brazil. Now we face a new reality: we need to develop, but at what price? The alternative energy sources are part of the answer.

Thus, the estimates from this study, Brazil will need to invest U\$ 32 billion over the next 10 years in Small Hydro – (SHP) small hydro, wind farms and Thermal Biomass, to reduce the level of degradation of the planet. There is a physical possibility because we have watercourses, wind and waste for generating clean energy.

Experience has shown that investment in electricity has excellent financial returns for those investors who have an expectation of long-term, such as pension funds.

On the other hand, there are financial resources to support this niche business, as demonstrated, being these resources from national or international bodies.

There is also in the country a whole regulatory framework able to support the implementation of these projects, either to provide security to investors, with the elimination of the hydrological risk, or to encourage the financial development through incentives to generate energy from alternative sources, e.g. reduction of transmission charges.

So the challenge is issued to those entrepreneurs who seek modern capitalism that does not aim to earn higher profits, but the best profit and profit commensurate with risk.

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