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MAKING COMPETITION WITH RENEWABLE POWER PLANTS IN BRAZILIAN ELECTRIC ENERGY MARKET

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INDEX

I – INTRODUCTION	**3**
II – BRAZILIAN ENERGY SECTOR OVERVIEW	**5**
II.1 - Policy and Regulation	**8**
II.2 - The Brazilian Electricity Sector Reform	**10**
II.3 – Economic Indexes for Brazilian Electricity Sector	**13**
III - ELECTRICITY AND THE ENVIRONMENT	**14**
IV –BRAZILIAN INCENTIVES FOR RENEWABLE ENERGY GENERATION	**20**
IV.1 - Renewable Energy Incentives Ended	**20**
IV.2 – Current Renewable Energy Incentives	**20**
V – ADJUST PROPOSAL IN BRAZILIAN REGULATION FOR RENEWABLE ELECTRIC GENERATION	**25**
VI – CONCLUSION	**27**
BIBLIOGRAFY	**29**

I - INTRODUCTION

Fourteen years after the Brazilian legislation began the process of the electrical sector deregulation in 1995, with federal Law number 9,074/95, this country had results in last energy auctions that must be reviewed. The major part of auction winners signed contracts which permit the building of oil fuel and others fossil fuel power plants. It means, in 2008 almost 3,000 MW of no clean generation was added in Brazilian energetic matrix. The expectation of the government and the regulator was not that but economic indexes brought this result.

This work analyses the Brazilian current model of benefits for the electric energy generation with renewable power plants and suggests adjusts in this model to create conditions to increase renewable energy participation in Brazil or others countries in development or even already developed. The aim of the thesis defends here is that good deregulated market don't need so much rules to work (HAYEK, FRIEDRICH AUGUST VON - Law, Legislation and Liberty, Vol. I, II and III – 1973, 1976, 1979) but some market imperfections must be regulated. In this case, to increase participation of renewable energy, rules and changes have to adjust the price to make competition between those different types of energy production. This adjusts consists in a group of topics that is followed:

1) For old power plants, taxes are not a solution: new charges for old power plants won't resolve the issue, only will increase the final price of energy. For the old ones, the compromise is with emissions reduction and pollution control;

2) For new power plants that wants to sell energy to Distcos – Distribution Companies, specific auctions for each kind of renewable power plant technology can be one solution: in structure of regulated market for small consumers (the Brazilian case), auctions is a good tool to obtain energy for Distcos, so this solution could input a determinate parcel of renewable energy in electric matrix;

3) For new power plants that wants to sell energy direct to consumers, discount in tariff for consumers that chooses a renewable power plant to buy energy: if the consumer chooses your renewable power plant to hire, he will get a discount in his wire tariff. Of course, in this case the mechanism of tariff calculation has to be modifying by regulator to not affect the economic equilibrium of Distcos.

With those points, we can create conditions to input competition in electric sector with renewable power plants. The traditional structure must be changed due the fact that the recent energetic matrix grow up aren't satisfactory in aspect of clean generation and these changes might take first place in reform agendas. Why competition? The major difference between regulation and competition has to do with who takes responsibility for various risks. Of course, a mix with regulation and competition may be a good idea.

II – BRAZILIAN ENERGY SECTOR OVERVIEW

Generation capacity in Brazil is dominated by hydroelectric plants, which account for 77 % of total installed capacity, with 24 plants above 1,000 MW. About 88 percent of the electricity fed into the national grid is estimated to come from hydroelectric generation, with over 25 % coming from a single hydropower plant, the massive 14 GW Itaipu facility, located between Brazil and Paraguay on the Paraná River. Natural gas generation is second in importance, representing about 10 % of total capacity.

This reliance on abundant hydroelectric resources is beneficial for Brazil as this reduces the overall generation costs. However, this large dependence on hydropower makes the country especially vulnerable to supply shortages in low-rainfall years as happened in the 2001-2002 Brazilian energy crises.

Brazil is still a net importer of electricity (mostly from Argentina), but import reliance is falling. In January 2007, the break-down of generation by source was:

Source	Number of plants	Installed capacity (MW)	% Total
Hydroelectricity	633	73,678	72.1%
Gas	101	10,798	10.6%
Oil	568	4,446	4.4%
Biomass	269	3,693	3.6%
Nuclear	2	2,007	2%
Coal	7	1,415	1.4%
Wind	15	237	0.2%
Total installed capacity	**1,595**	**96,294**	**94.3%**
Contracted imports		5,850	5.7%
Available power		102,144	100%

Source: Ministry of Energy and Mines, 2007

As summarized in the table above, Brazil has two nuclear power plants, Angra 1 (630 MW) and Angra 2 (1,350 MW), both of them owned by Eletronuclear, a subsidiary of the state-owned Eletrobrás.

The National Agency for Electric Energy (ANEEL) has commissioned feasibility studies for several hydroelectric plants (small, medium and large) in the period 2006-2009. These studies correspond to a total potential capacity of 31,000 MW. The three largest projects studied, Jirau, Santo Antônio and Belo Monte, are already beyond the feasibility phase: In 2007 and 2008, ANEEL made the auctions for the construction of two new dams, Santo Antônio (3,150 MW) and Jirau (3,300 MW), on the Madeira River in the state of Rondônia. The bid for the Santo Antônio plant was awarded in December 2007 to Madeira Energy, with 39 % participation from state-owned Furnas, while the bid for the Jirau plant will be launched in May 2008. The agency is also pursuing development of the 11,000 MW Belo Monte Dam in the state of Pará, on the Xingu River.

Also in 2007, Electronuclear was granted permission to resume construction of Angra 3, a 1,350 MW plant, and is currently in the process of selecting a site for a fourth nuclear power plant.

Currently, the development of gas-fired thermoelectric power is somewhat jeopardized by the lack of secure gas supplies. In fact, having a secure gas contract is a prerequisite to build a new thermoelectric plant and to participate in a new energy auction. In order to counter the risk of unavailability of gas supplies, Brazil is in the initial stages of planning to build two Liquid Natural Gas terminals that would likely come on-stream around 2010. However, in the meantime, several thermoelectric plants are converting their machinery to dual-fuel capacity (oil and gas).

Total electricity consumed in 2007 was 410 TWh, while annual consumption per capita for the same year averaged 2,166 kWh (compare with 12,300 kWh per capita for the United States of America). The share of consumption by sector was as follows:

- Residential: 40% (including 6% for the rural sector)
- Industrial: 25%
- Commercial: 22%
- Rural: 6%
- Public: 13%

Electricity demand is expected to grow an average of 3.6% in the next few years, leading to total estimated consumption of 504 TWh and average per capita consumption of 2,527 kWh (around 18% of that of the United States and 45% of that in the United Kingdom).

In Brazil, capacity addition traditionally lagged behind demand growth. Between 1980 and 2000, electricity demand increased on average by 5.4 per cent per year while generation grew by 2.4 per cent on average per year. Investment is therefore needed to boost generation and transmission capacity because there is limited excess supply, despite the reduction in demand following the energy rationing program implemented in 2001 in response to the energy crisis. But with last actions, electricity capacity will be in order to follow expected demand.

II.1 - Policy and Regulation

The Ministry of Energy and Mines (MME) has the overall responsibility for policy setting in the electricity sector while ANEEL, which is linked to the MME, is the responsible for Brazilian electricity regulatory and was created in 1996 by Law 9427. ANEEL's function is to regulate and control the generation, transmission and distribution of power in compliance with the existing legislation and with the directives and policies dictated by the Central Government. The National Council for Energy Policies (CNPE) is an advisory body to the MME in charge of approving supply criteria and "structural" projects while the Electricity Industry Monitoring Committee (CMSE) monitors supply continuity and security.

The Independent System Operator of the national transmission grid (ONS) is a non-profit private entity created in August 1998 that is responsible for the coordination and control of the generation and transmission installations in the National Interconnected System (SIN). The ONS is under ANEEL's control and regulation.

The Power Commercialization Chamber (CCEE), successor of MAE (*Mercado Atacadista de Energia Electrica*), is the operator of the commercial market. The initial role of the operator was to create a single, integrated commercial electricity market, to be regulated under published rules. This role has become more active since now CCEE

is in charge of the auction system. The rules and commercialization procedures that regulate CCEE's activities are audited and approved by ANEEL.

Finally, the Power Research Company (EPE) was created in 2004 with the specific mission of developing an integrated long-term planning for the power sector in Brazil. Its mission is to carry out studies and research services in the planning of the energy sector in areas such as power, oil and natural gas and its derivates, coal, renewable energy resources and energy efficiency, among others. Its work serves as input for the planning and implementation of actions by the Ministry of Energy and Mines in the formulation of the national energy policy.

The Brazilian electricity model is almost fully deregulated, which allows generators to sell all of their "assured energy" via freely negotiated contracts with consumers above 3 MW or via energy auctions to Distcos, in general way. Under this model, distributors are required to contract 100% of their expected demand. Currently, Brazilian generation supply can be sold under five types of markets:

- "Old energy"* auction contracts (long term): approximately 40% of the 2007 market;
- "New energy"* auction contracts (long term):delivery started in 2008;
- Free-market contracts (long and short term): approximately 25% of 2007 market;
- Spot Market Sales: at CCEE without contracts;
- Distributed Generation: to Distcos for small ones with limited price.

(*The government identifies two types of generation capacity, "old energy" and "new energy". Old energy represents existing plants that were already contracted in the 1990s, while new energy refers to that energy produced by plants that have not yet been built, or by existing plants that meet certain criteria.)

II.2 - The Brazilian Electricity Sector Reform

The power sector in Brazil was essentially in government's hands until the early 1990s. The sector had seen remarkable development in the 1970s. However, by the late 1980s, the state-ownership model was on the verge of collapse. This delicate situation was the result of heavily subsidized tariffs and a revenue shortfall in the sector of about US$ 35 billion, which led to the delay in the construction of about 15 large hydro plants due to lack of funds for investment. Efforts to address the deterioration of the sector were not successful, a situation that further intensified the need for deep reforms. A major commitment was made by President Cardoso to carry out a substantial reform of the Brazilian electricity sector. The first reforms introduced in the power sector were aimed to allow the participation of private capital and also to improve its economic situation.

The Project for Restructuring the Brazilian Electric Sector, RESEB, which laid down the first steps for the implementation of the power sector reform, was initiated in 1996 during the administration of President Cardoso. The objective of the reform was to build a more competitive power sector with the creation of a level playing field for private sector participation. In addition, state-owned utilities and assets were privatized. Although transmission assets were not privatized, most of the expansion of the transmission network has been carried out by private capital. This reform also led to the creation, in 1996, of ANEEL, a quasi-independent regulatory body in charge of overseeing the electricity sector. However, the main restructuring steps were taken with the enactment of the 1998 Law (Law 9,648/98). Those steps included the creation of an independent system operator of the national transmission grid (ONS) and a market operator of the energy trade (CCEE), which did not become operational until 2001.

As a result of the reforms of the power sector, new capital was attracted, both in terms of privatization and greenfield projects. Some of the state-owned generation capacity was acquired by foreign investors such as Tractebel, AES, Prisma Energy, El Paso and Duke, which became significant producers. In addition, local investors such as industrial groups, large customers, utilities and pension funds also invested heavily in the national generation sector. Other companies such as EdF (Électricité de France), Endesa and Chilectra focused on the distribution segment, a segment in which

privatization brought improved quality of service and a reduction of theft, non-payments and technical losses.

However, the reforms were not successful in preventing the energy crisis that was to unfold in 2001. Installed capacity expanded by only 28 percent during 1990-99, whereas electricity demand increased by 45 percent. In 1999, as the power shortage was already foreseen, the President Cardoso Administration made efforts to increase private investment in the electricity sector through a Priority Thermal Power Program (PPT) that aimed at the expeditious construction of more than 40 gas-fired thermal plants. Unfortunately, the needed investment did not materialize and the crisis became unavoidable.

Brazil was faced with one of the most serious energy crises in its history in 2001-2002. The crisis was the direct result of a sequence of a few years drier than average in a country with over 80% of hydroelectric generation capacity. Additionally, several delays in the commissioning of new generation plants and transmission problems in the third circuit from the Itaipu hydropower plant accounted for a third of the energy deficit. Reservoir levels reached such low levels that supply could not be ensured for more than four months.

It was soon clear that strict demand reduction programs would be needed in order to avoid widespread blackouts. In June 2001, the government created the Crisis Management Board (CGE), chaired by President Fernando Henrique Cardoso himself. The CGE received special powers among which was the authority to set up special tariffs, implement compulsory rationing and blackouts, and bypass normal bidding procedures of the purchase of new plant equipment. Instead of resorting to rolling blackouts, the government chose to apply a quota system. Quotas were established for all the consumers based on historical and target consumption level, applying bonuses for consumption well below the prescribed level, penalties for over-consumption and some freedom for the large users to trade their quotas in a secondary market.

The government's goal of reducing historical consumption levels by at least 20 % for an eight-month period was successfully achieved, with the government having to pay over US$200 million in bonuses to residential, industrial, and commercial

customers. This achievement allowed the system to overcome that long period without blackouts and brownouts and proved the potential of demand-side management and energy efficiency efforts, which were able to create a virtual capacity of 4,000 MW, helping the country to bridge the supply demand gap in a very economic way. In addition, the government launched a program for contracting emergency generation capacity, with bids for a total of 2,100 MW of new thermal capacity accepted.

However, the crisis affected numerous actors. Generators and distributors experienced a 20 % reduction in their revenues due to the contraction in consumption. This situation was eventually addressed by an increase of tariffs approved by the government. The financial situation of distributors was also damaged, with customers also suffering from the increase in electricity prices (140% in nominal terms between 1995 and 2002).

In January 2003, the new administration led by President Luiz Inácio Lula da Silva took over among criticism of the reforms introduced in the electricity sector by the administration of President Fernando Henrique Cardoso, supporting a model in which the system should be fully regulated. The pending privatizations of three generation subsidiaries of the large state-owned utility, Electrobrás, were stopped. However, despite initial expectations, the new administration opted for a model that clearly aims to attract long-term private investment to the sector and that heavily relies on competition. In addition, the existing institutions were preserved and in some cases strengthened, with a new company, EPE, created with the specific mission of developing an integrated long-term planning for the power sector in Brazil.

The new legislative framework was defined by Law 10,848/2004, which established clear, stable and transparent rules aimed at ensuring supply and the continuous expansions of the intrinsic sector activities (generation, transmission and distribution). The expansion was linked to a fair return on investments and to universal service access, together with tariff adjustments. Decree 5,081/2004 approved the regulatory framework for the power sector, specifying specific provisions to achieve the objectives of the reform. One of the defining elements of the model adopted by the new administration is the establishment of energy auctions as the main procurement mechanism for Distcos to acquire energy to serve their captive consumers. This

initiative assisted in the introduction of competition in the power sector and also helped to address some of the existing market imperfections.

Under this system, auctions of capacity from new generation projects will be held three to five years in advance of delivery dates. The Ministry of Mines and Energy wants to ensure that the totality of future expansion needs is met and that plants are only built once they have won bids in energy auctions and are guaranteed long-term contracts. The first auction was held in December 2004, with contracts for a total of about 40 GW traded.

II.3 – Economic Indexes for Brazilian Electricity Sector

Average electricity tariffs for the different sectors in 2007 were as follows:

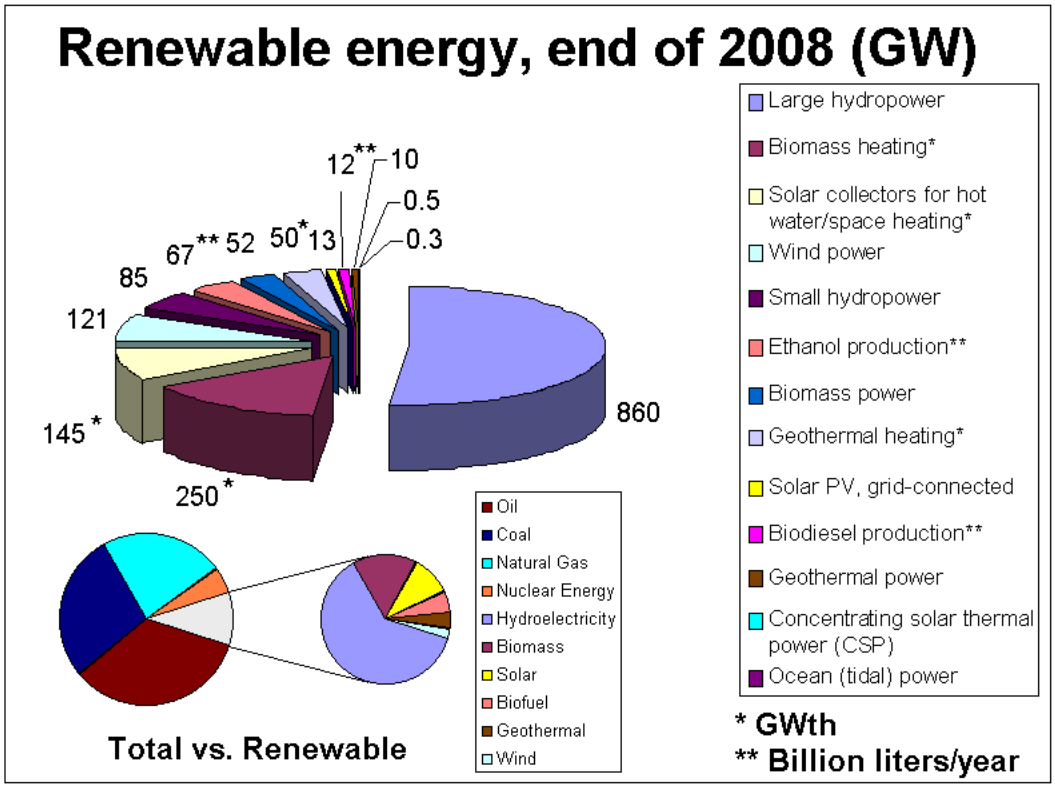
- Residential: 15.3 US¢/kWh
- Industrial: 11.3 US¢/kWh
- Commercial: 14.2 US¢/kWh
- Rural: 9.1 US¢/kWh

In the last 20 years, Brazil has been one of the main recipients of private capital investment in its power sector. Total investment by private actors in the power sector between 1994 and 2006 amounted to US$ 56,586 million in 124 projects. However, despite Brazil's deregulation and higher tariffs in the "new energy" auction system, investment, particularly in generation, has slowed significantly. This situation is not considered to be the result of concerns about the regulatory model or auction pricing caps, but it reflects the lack of available projects. The existing delays in granting environmental licenses and the uncertainties on the Bolivian gas supply, explain to a great extent the lack of hydroelectric and gas-fired thermoelectric projects respectively.

The investment required in power generation over the next 10 years is R$ 40 billion or around US$ 24.2 billion (April 29th, 2008). This high investment will only be realized if the government succeeds in attracting greater private-sector investment.

III - ELECTRICITY AND THE ENVIRONMENT

In world, the renewable generation is distributed as follow graph shows.



Source: http://www.ren21.net/globalstatusreport/g2009.asp

The Ministry of the Environment holds the environmental responsibilities in Brazil. One of its associated institutions is Ibama, the Brazilian Institute for the Environment and Renewable Natural Resources, which is in charge of executing the environmental policies dictated by the Ministry regarding environmental licensing; environmental quality control; authorization of the use of natural resources; and environmental monitoring and control among others.

OLADE (Latin American Energy Association) estimated that CO2 emissions from electricity production in 2003 were 20 million tons of CO2, which corresponds to less than 7% of total emissions from the energy sector. This low contribution to emissions

from electricity production in comparison with other countries in the region is due to the high share of hydroelectric generation.

Brazil is host to the largest number of clean development mechanism (CDM) projects in the Latin America region. Registered projects represent 40% of the total in the region and account for 45% of Certified Emission Reductions (CERs) (up to 2012).

As for the power sector, there were 91 projects registered in March 2008, adding up to an estimated total of 9 million tons of CO2 per year. The distribution of projects by category is as follows:

Project type	Number of projects	ktonCO2/year
Biomass energy	38	1,860
Energy efficiency industry	1	49
Energy efficiency own generation	1	90
Energy distribution	1	54
Fossil fuel switch	6	139
Hydroelectricity	23	1,013
Landfill gas	17	5,660
Wind	4	170
TOTAL	91	9,034

Source: UNFCCC

Other issue is that all thermal cycle plants (nuclear, coal, NG, solar thermal) require a great deal of water for condensing, and the amount of water needed will be reduced

with increasing boiler temperatures. Coal, being able to burn at high temperatures is thus more efficient and uses less water, while nuclear is more limited by material constraints and solar is more limited by potency of the energy source.

Thermal cycle plants, however, also have the option of using seawater if located on the seacoast. Such a site will not have cooling towers and will be much less limited by environmental concerns of the discharge temperature due to the fact that dumping heat will have very little effect on something with such a comparatively large thermal mass. This will also not deplete the water available for other uses. Nuclear power in Japan for instance, uses no cooling towers at all because all plants are located on the coast. Also, if dry cooling systems are used, significant water from the water table will not be used. Other, more novel, cooling solutions exist, such as sewage cooling at the Palo Verde Nuclear Generating Station.

Hydroelectricity's main cause of water usage is both evaporation and seepage into the water table. The following table show some number of water consumption by type of generation.

Feedstock / Fuel / Resource	Raw Material Production L/MW·h [L/GJ]	Fermentation/ Processing/Refining L/MW·h [L/GJ]	Electricity generation with Closed-loop Cooling	Total Water Consumption L/MW·h [1]	CO_2-eq kg/MW·h_e	SO_2 kg/MW·h	NO_x kg/MW·h	H_2S kg/MW·h	Particulate kg/MW·h	Cd mg/MW·h	Hg mg/MW·h	On-Site Accidents deaths/TW·yr	Average Capacity Factor %
Traditional Oil	10.8-25.2 [3-7]	90-234 [25-65]	1,200~	1,300.8-1,459.2	893[2]			814[3]		43.3[4]	9[5]		60~[6]
Enhanced oil recovery	180-32,400 [50-9,000]	90-234 [25-65]	1,200~	1,470-33,834	893[2]			814[3]		43.3[4]	9[5]		60~[6]
Oil sands	252-6,480* [70-1,800*]	90-234 [25-65]	1,200~	1,542-7,914	893[2]			814[3]		43.3[4]	9[5]		60~[6]
Biofuels: Corn	32,400-360,000 [9,000-100,000]	169.2-180 Ethanol:[47-50]	1,200~	33,769.2-361,380	893~[2]			814~[3]		43.3~[4]	9~[5]		52~[2]
Biofuels: Soybean	180,000-972,000 [50,000-270,000]	50.4 Biodiesel:[14]	1,200~	181,250.4-973,250.4	893~[2]			814~[3]		43.3~[4]	9~[5]		52~[2]
Coal	20-270 [5-70]	504-792 -to-liquids:[140-220]	1,200-2,000	Coal-to-liquids:N.C. 1,220-2,270	B:863-941 Br:1175[7]	4.71[3]	1.95[3]	0[3]	1.01[3]	H:3.1-L:6.2[4]	14-61[5][8]	342[9]	70-90[6]
Traditional Gas	Minimal	25.2 [7]	700	725.2	577:cc[7] (491-655)			550[3]		0.2[4]	0.1-0.6[8]	85[9]	60~[6]
Natural gas: Shale gas	129.6-194.4 [36-54]	25.2 [7]	700	854.8-919.6	751:oc[7] (627-891)			550[3]		0.2[4]	0.1-0.6[8]	85[9]	60~[6]
U Nuclear	170-570	See:Raw Material	2,700	2,870-3,270	60-65[7]					0.5[4]		8[9]	86.8[10]-92[6]
Hydroelectric			17,000:Evap.Avg	17,000	15[7]					0.03[4]		883[9]	42[2]
Geothermal power			Fresh:0-20[3] 5,300	Fresh:0-20[3] 5,300	T_L0-1[2] T_H91-122	0.16[3]	0[3]	0.08[3]	0[3]				73-90+[2]
Conc. Solar			2,800-3,500	2,800-3,500	40±15#								56.2-72.9[11]
Photovoltaics			Minimal	Minimal	106[7]					0.3-0.9[4]			14[2]-19 [12]
Wind power			Minimal	Minimal	21[7]								21[2]-40 [12][13]

Source(s): Adapted from US Department Of Energy, Energy Demand on Water Resources. Report to Congress on the Interdependence of Energy and Water, December 2006 (except where noted). *Cambridge Energy Research Associates (CERA) estimate. #Educated estimate. Water Requirements for Existing and Emerging Thermoelectric Plant Technologies. US Department Of Energy, National Energy Technology Laboratory, August 2008.

Note(s): 3.6 GJ = gigajoule(s) == 1 MW·h = megawatt-hour(s), thus 1 L/GJ = 3.6 L/MW·h. B = Black coal (supercritical)-(new subcritical), Br = Brown coal (new subcritical), H = Hard coal, L = Lignite, cc = combined cycle, oc = open cycle, T_L = low-temperature/closed-circuit (geothermal doublet), T_H = high-temperature/open-circuit.

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IV –BRAZILIAN INCENTIVES FOR RENEWABLE ENERGY GENERATION

In Brazil, hydroelectricity supplies about 77 % of total electricity demand. It is estimated that about 70 % of the overall hydroelectricity potential of the country, is still unexploited.

Apart from biomass, which accounts for about 3.5 % of total generation capacity, no other renewable energy source besides hydroelectricity plays a relevant role in the energy mix. However, the potential for wind energy, which is concentrated in the Northeast, is very large (about 140 GW, which exceeds current installed capacity), second only to Argentina. There are projects for the development of biomass, solar and wind energy, but these are still on a relatively small scale.

IV.1 - Renewable Energy Incentives Ended

In 2002, the government of Brazil created a Program to Foster Alternative Sources of Electric Power (PROINFA). The program aims to increase the participation of wind power sources, biomass sources and small hydropower systems in the supply of the Brazilian grid system through Autonomous Independent Producers (PIE). The medium to long-term objective (i.e. 20 years) of the program is that the defined sources supply demand consumption with 3,300 MW with renewable installed power plants. This program is already ended to new power plants and the second stage isn't in discussion at this moment.

IV.2 – Current Renewable Energy Incentives

In the case of one renewable power plant, currently the possibilities for trade energy or return the cost of investment are as follow:

A) <u>Without Participation at CCEE</u>

i) Renewable Power Plant in site without sales to Distco:

For consumers that install renewable power plants in yours site, in this case they don't need to sing contracts with Distcos or other entities of the Brazilian electric sector. Just notify Distco who have the responsibility to attempt the consumer and respect their electric install rules. Sometimes, with a new charge curve, the consumer needs to adjust your tariff class.

ii) Renewable Power Plant in site with sales to Distco

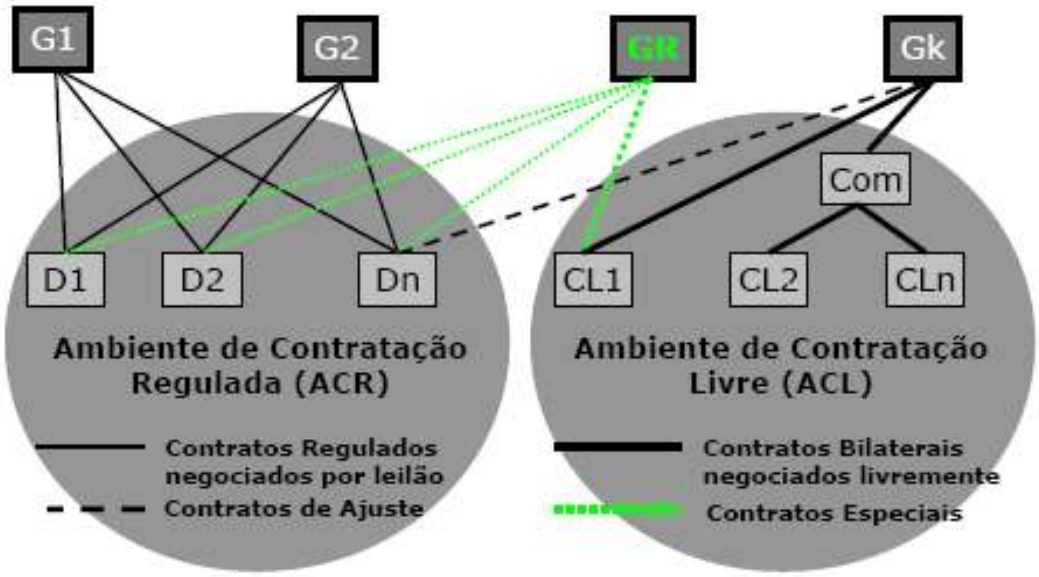
In this case, besides the respect of Distco electric install rules, the consumer only needs to change your energy measure equipment to especial one with sensibility to flux inversions. The energy inputted in Distco grid can be evaluated as "Distributed Generation" (GD), which the value cannot exceed the "Reference Value"(VR) for the Distco – average value that the Distcos bought in latter auctions, or as energy compensation respecting the tariff hour that was injected in the grid.

iii) Renewable Power Plant out site:

If the generation site is different of consumption site, the consumer can pay the Distcos uses grid and transmit active energy by wire from the generator to consumer. In this case, must pay attention with the difference between tariff hour of energy inputs by the generator in Distco grid and energy outputs by consumer in the same Distco grid or other one depending on who have the responsibility to attempt.

B) <u>With Participation at CCEE</u>

Before everything, we have to understand the two ambient that the Brazilian sector has. The ACR – *Ambiente de Contratação Regulada* and the ACL – *Ambiente de Contratação Livre*. The first one, the ACR, has all the Distcos Energy Auction winners and, of course, the Distcos. The second one, the ACL, has all others CCEE participants that trade energy with yourselves. They are big consumers (or small consumers if the trade is with renewable power plant), energy generators, energy importers, and energy traders [21, 26, 27, 28].



i) *Trading with Distco with Energy Auctions in ACR*

Every year, ANEEL makes some Energy Auctions to supply Distcos energy demand. In general cases, the contracts are long term: 30 year for hydro power plants, 15 years for others power plants, for "New Energy" (power plant not built in the year of auction); or short term: 5 year or less for "Old Energy" (power plant already built in the year of auction).

Important remember that in this option, it is must to install the CCEE energy measure equipment (called SMF – *Sistema de Medição para Faturamento*). This equipment has more compounds than normal one. Besides basic items, it has back-up measure equipment, memory mass and direct communication with CCEE. The SMF cost and the CCEE participation cost raises this option cost. So, to make economical viability, the agent who chose this case needs to trade more energy.

ii) *Trading with other CCEE participant in ACL*

As commented before, in ACL, CCEE participant can trade energy with each other. Here, there is a biggest point that all renewable energy generator must know. In December 2006 was published an ANEEL Resolution nº 247 that regulate energy trade

between renewable power plants and small consumers called “Special Consumer”. This retail trade with renewable energy is the only way to choose your energy seller by small consumer (under 3 MW of charge and more than 500 kW).

Other important point that Resolution nº 247 regulate is the possibility to trade renewable energy by traders. With that, energy trader can buy and sell renewable energy with energy portfolios to warranty a flat curve of production due the fact the renewable power plants production are very instable. And with more players, we believe that the market will be more perfect and clear and with less gaming.

The Resolution nº 247/2006 establishes the wire tariff discount for who trade renewable energy too. While the right to trade with small consumer is an energy advantage, this discount is a wire advantage. But rules and procedures of trade energy in CCEE care of final discount calculation to final consumer when energy trader sells your portfolio with different discounts to a buyer.

RESOLUTION Nº 247, DECEMBER 21th, 2006 Establishes the right of Renewable Power Plants trade energy with Especial Consumer (retail energy trade) and gives benefits as wire tariff discounts and others.	
Defines Renewable Power Plant	- Very small hydro power plant called MCH – *Micro/Mini Central Hidroelétrica* (under 1 MW); - Small hydro power plant called PCH – *Pequena Central Hidroelétrica* (over 1 MW and under 30 MW*); - Biomass power plant under 30 MW*; - Wind power plant under 30 MW*; - Solar power plant under 30 MW*. (* Power injected in grid)
Defines Especial Consumer	One consumer unit or group of consumer units that has 500 kW of charge*. (* Demand signed with Distco)

Gives wire tariff discount	Especial consumer will get 50 percent or more if trade with Renewable Power Plant.
Establishes the conditions and the contracts for energy trade and wire uses.	Renewable Power Plant and Especial Consumer have to sign a energy contract called CCEI – *Contrato de Compra de Energia Incentivada* and Especial Consumer and Distco have to sign a wire contract called CUST – *Contrato de Uso do Sistema de Transmissão* and CCD – *Contrato de Conexao ao Sistema de Distribuição*.
Forces the agents to participate at CCEE	The Renewable Power Plant, Especial Consumer or Trader, when trade renewable energy, they have to participate at CCEE and to install especial measure equipment called SMF – *Sistema de Medição para Faturamento*.
Gives the right to traders negotiate renewable energy	Energy trader can buy and sell renewable energy with energy portfolios to warranty a flat curve of production due the fact the renewable power plants production are very instable. And with more players, more perfect and clear will e the trade and with less gaming.

V – ADJUST PROPOSAL IN BRAZILIAN REGULATION FOR RENEWABLE ELECTRIC GENERATION

In recent years, electricity markets have developed important economic and operational tools looking for efficiency in terms of determining prices that represent the costs of production of energy and environmental impact measure to create competition between renewable power plants and conventional power plants.

From the structural point of view, there are many forms of markets auctions for trading energy [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,19] but because of different cost of production, it is necessary to separate conventional and alternative markets. The possible advantage of this auction structure is that the voluntary participation of traders in markets could provide efficiency, like in a pool, avoiding the use of complex optimization tools.

In the market auctions, electricity market products (conventional and alternative energy) are procured simultaneously through central auctions. The advantage of this integrated market is that the resulting prices better reflect the cost of resources due to the inherent relationship between conventional and alternative energy.

But in free market, with the small consumers that don't have structure to participate in these auctions, we have a regulatory gap that must be reviewed. The main idea is to allow the consumer to choose your energy generations source if this generations is previous approved by the regulator as a clean generation. The increasing conscientious of global warm and environment pollution is the best tool to hire renewable power energy in market.

To resume the adjustment, the following points can be implemented:

- ✓ The renewable energy market is composed of several types of generators. The characterization and requirements of these services are previously defined by the regulator and are based on the quality of their generation. The

prices of each generator is published and program tools allow consumer forecast your spent with energy;

- ✓ The consumer is free to buy energy from every approved as clean generation that he wants. He can estimate your energy spent analyzing the previous historic of you charge curve, given by the Distco who have the responsibility to attempt your consumer unit;

- ✓ The Distcos have an obligation to allow the consumer to buy energy from everyone he wants. And the consumer has only to respect the previous advice formally address to Distco to permit the operational change is his account and the payment of Distco grid uses.

With those points, the simple economic analyses can predict that with a fixed supply curve and a rising demand, the price will increase for those clean types of generation and sometime will be competitive with conventional power plants. Of course, the real market is not so simple but the role of regulator is care of these imperfections and creates conditions to competition in benefit of society.

VI – CONCLUSION

Nowadays, the care of environment is becoming higher each time that press shows news informing human impact. The points presented in this paper show that even considering subsides for alternative energy, independent of charging conventional energy, in a joint market, the resulting energy prices depend on the committed capacity allocated to supply the long term bilateral contracts and pool demand and associated prices. This regulated market does not bring the benefits of competition and efficiency that free markets can allow.

In this paper adjusts points is presented with the following characteristics: i) the renewable energy market is composed of several types of generators. The characterization and requirements of these services are previously defined by the regulator and are based on the quality of their generation. The prices of each generator is published and program tools allow consumer forecast your spent with energy; ii) the consumer is free to buy energy from every approved as clean generation that he wants. He can estimate your energy spent analyzing the previous historic of you charge curve, given by the Distco who have the responsibility to attempt your consumer unit; iii) the Distcos have an obligation to allow the consumer to buy energy from everyone he wants. And the consumer has only to respect the previous advice formally address to Distco to permit the operational change is his account and the payment of Distco grid uses.

With those points presented we can create conditions to input competition in electric sector with renewable power plants. The traditional structure must be changed due the fact that the recent energetic matrix grow up aren't satisfactory in aspect of clean generation and these changes might take first place in reform agendas. Why competition? The major difference between regulation and competition has to do with who takes responsibility for various risks. Of course, a mix with regulation and competition may be a good idea.

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