Urban and Peri-Urban Energy Access in Brazil II

José Goldemberg[1], Suani Teixeira Coelho[1], Emilio Lèbre La Rovere[2], André Felipe Simões[2], Patricia Guardabassi[1], Regiane Gorren[1]

[1] CENBIO—The Brazilian Reference Center on Biomass, IEE—Institute of Eletrotechnics and Energy, USP—University of São Paulo, São Paulo, Brazil

[2] Centro Clima/COPPE/UFRJ – Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

Abstract

The types of fuel sources that are used currently in Peri-Urbans regions in Brazil cover a very wide range of sources. They can be categorized as Natural Gas, LPG, Kerosene, Fuelwood/Solid residues, Charcoal, Electricity and Diesel oil.

However, most of Brazilian Energy Matrix comes from renewable energy. In 2006, about 41.1% of the primary energy was supplied by renewable energy sources, from which 14.8% came from hydroelectricity. The hydroelectricity has a large contribution in the Brazilian electric matrix 74.1% (MME, 2007) and an annual growth rate of 5.7 % of the primary energy supply.

Data related to each energy source in the energy matrix in 2006, describes the energy consumption as follows: diesel 16.2%, LPG 3.5%, Natural Gas 7.2%, Kerosene 1,2%, fuelwood and charcoal 11.1%, electricity 16.5%.

Brazil does not have a database that aggregates specifically peri-urban population, which is not necessary low income population. The needier population usually is concentrated in slums. The slum formation process undergone in large Brazilian cities is related to social exclusion. The concept of exclusion involves issues that are hard to quantify and are more complex than poverty or inequality.

Due to the fact that data per energy source or income level is scattered makes it impossible to establish a more precise picture of energy consumption patterns in the country. Note that this problem is not only related to urban and peri-urban areas. Hence most of energy data is not specific for peri-urban population.

This paper shows the existing barriers and the variety of policies outlines and instruments promoting the use of those fuels. Further policies discussion and conclusions are presented in the topic “conclusion” in this document.

1 Introduction

In 1940 Brazilian rural areas had a population density up to 69%. At that time, the total country population was only 41 million and the overall domestic energy supply was 24.3 M toe (million tonnes of oil equivalent) / year. From 1940 to 1990 there was a trend of people moving to urban areas. This was caused by an accelerated economic growth of around 7% per year (GOLDEMBERG, 2003).

Brazil does not have data specifically for the poor populations concentrated in the peri-urban area. This difficulty stresses the need to carry out studies that include field research, i.e. direct contact with the target population. The slum formation process undergone in large Brazilian cities is related to social exclusion. The concept of exclusion involves issues that are hard to quantify and are more complex than poverty or inequality. Exclusion is more comprehensive than living on the fringe, and is not necessarily related with poverty (SPOSATI, 1997).

Regions inhabited by deprived populations in urban and peri-urban areas in Brazil inter *alia* have not been the main target of public policies (urban planning, for example). Housing, in those regions, has basically been a population's initiative, in low property value areas. Therefore, the lack of infrastructure and access to essential public services are the main factors that define the concept of energy exclusion in urban and peri-urban areas in Brazil.

The historic series of Domestic Energy Supply in Brazil is given in Table 1, which shows that the role of coal and derivates in the energy supply decreased in the last six years back to the level of the year 2000. On the other hand there were a significantly rise on energy production based on sugar cane (ethanol, and electric energy generation from bagasse of cane) and other renewable sources of energy.

Table 1: Domestic Energy Supply in Brazil – 1940/1970/1980/1990/2000 and 2006.

Source/Year	1940		1970		1990		2000		2006	
	Mtoe	%	Mtoe	%	Mtoe	%	Mtoe	%	Mtoe	%
Oil, NG and derivatives	1.522	6.4	25.420	38	62.085	43.7	96.999	50.9	107	47.3
Coal and derivatives	1.520	6.4	2.437	3.6	9.615	5.1	13.571	7.1	13.5	5.97
Hydro and Electricity	0.352	1.5	3.420	5.1	20.051	14.1	29.980	15.7	33.5	14.82
Firewood and Charcoal	19.795	83.3	31.852	47.6	28.537	20.1	23.060	12.1	28.6	12.65
Sugar cane products	0.563	2.4	3.593	5.4	18.988	13.4	20.761	10.9	33	14.60

Other*	0	0.0	0.223	0.3	2.724	1.9	6.245	3.3	10.5	4.64
Total	23.752	100	66.945	100	142.000	100	190.615	100	226.10	100

Notes: *Include other renewable sources and uranium.
To convert hydro electricity a factor of 0.086 toe/MWh was assumed, in the Brazilian Energy Balance
Source: MME, 2006.

There is hardly any data and information available in Brazil to distinguish urban and peri-urban areas. The concept of a peri-urban area[1] is defined more by its social aspects than by geographical boundaries leading to a mismatching. The peri-urban area is also considered a unique social area, due to the means of urban life i.e. high mobility of its population; social variety, with prevail of different social classes. It also refers to the distinct residential areas; the social behavior in the more intense social relations; and a greater contemplative value of nature, without however, integrating with the countryside. This area is also acknowledged by its contrast to the city, given its tranquility and the greater contact to the environment (ZARÁTE *apud* VALE, 1984).

According to (KAGEYAMA, 1998), peri-urbanization is a new concept related to workforce and it means reproduction, production and distribution activities. This concept does not have boundaries specified by law, like the concept of urban areas. Thus, under the concepts of urban areas and rural areas used by the Brazilian Geographical and Statistics Institute (IBGE), there are also regions defined as peri-urban. In order to enhance the understanding and for the sake of consistency, IBGE terminology will be limited to the concepts of urban and rural areas and metropolitan regions.

Most of the Brazilian population (83.01%) lives in urban areas. The North and Northeast regions have the highest number of people living in rural areas. In 2004, 26.48% of the population of the North Region lived in the countryside. For the Northeast Region, this figure was 28.5%.

Spatial distribution of the poor population is still occurring through a significant movement of population to the periphery of large and medium-sized cities. One of the reasons for this process is the hard access to urban land for low income families. This resulted in a fast growth of informal human settlements, like slums, shanty-towns and illegal land parceling, in the peri-urban areas of metropolitan regions. Often, problems are related to the two-way use of land and to poverty. The alternative of land parceling became a way to house population with low income. It is mostly found in areas where legislation forbids occupation (environment permanent protection areas, such as spring water areas) and buildings.

There is a large difference between family income in the North Region (US$232.10), which has the highest rate of people living in households without electricity (81.55%), and that of the Southeast Region (US$345.9), which has one of the highest rates of people in households with

[1] It is also known as the urban fringe or shadow (ZARÁTE *apud* VALE, 1984).

electricity (98.77%).

The lowest electricity access occurs in rural zones. These are the ones with the lowest monthly incomes, as well. Normally, the household average monthly income of urban areas is greater than the rural ones.

There is a rather high difference between urban rural income areas. In the urban ones the monthly average income of Brazilian households is US$321.70, while in the rural areas this income drops to US$152.90.

Brazil is a country of huge inequalities, shown by the income concentration. In recent years there was no substantial change in income concentration in Brazil, despite an increased share of total income by the poorest people. The income for the poorest people grew from 12.7%, in 1999, to 13.85%, in 2004, however the number of poor people also increased from 56.18 million to 59.43 million in the same period (IPEA, 2006).

Although income distribution indicators show favorable results over the last five years, in the urban area income concentration still drives poverty and influences the organization of the social space. The process of slum formation, experienced by most large Brazilian cities, has increased substantially over the past few years.

Most of the growth of large urban agglomerations is happening without any kind of planning. In 1991, there was a concentration of about 43 million people or 38% of the Brazilian urban population. Hence, in that year 70% of the slum households in Brazil were in this urban category. In terms of population, this means approximately 5 million people living in slums i.e. about 12% of the metropolitan population.

The 2000 Census[2], carried out by IBGE, registered 1,650,548 households in 3,905 sub-normal groupings (slums, shanty-towns or slum-tenements) throughout the country, representing 6,550,634 people. The Southeast Region concentrates more than 60% of its houses in slums, that is, 1,038,068 houses. The Census also registers that the number of slums in Brazil enhanced fivefold from 1991 to 2002, going from 717 to 3,905.

The scenario of poverty and social exclusion intertwined with intra-urban growth dynamics in Brazil.

This article reveals that approaches for urban planning are detached from the socio-economic framework. It will further reveal that these approaches are excessively static and restrictive to follow urban dynamics and that they are insufficient to meet essential urban demands. Currently the sources of energy in Brazil strongly rely on hydropower (electricity), biomass and oil.

[2] The last official census carried out in Brazil.

Regarding to fuels in the urban and rural areas we can mention that LPG and fuelwood are the main energy sources for cooking. LPG comes in bottles of 13kg. The infrastructure is well settled in all regions. The LPG usage had a positive trend from 1950 until 2001. However when the subsidy for LPG stopped in 2001, this trend reverted and the use of fuelwood took over.

2 Objectives, methodology and scope of study

At present, most information available to differentiate urban and peri-urban areas is hard to be found in Brazil. In order to enhance the understanding and for the sake of consistency, IBGE terminology will be used for this article. This terminology limits the concepts of urban and rural areas and metropolitan regions.

In some specific cases, it is possible to overcome this barrier – especially when peri-urban practically mean rural areas and when fuel wood is thoroughly used. In fact, Brazil needs a more consistent and organized database with information related to national wood energy. In this way the database would identify the “hot spots” that deserves more attention. In recent doctor theses the author Oliveira, 2008, reports the demand and supply balance of charcoal and fuelwood in Brazil.

Considering the methodology adopted in the present UPEA II Brazilian Report, it is relevant to mention that the present work will rely mainly on secondary data. This decision was based on two aspects: (1) the absence of appropriate data that focuses the energy sources used in urban and peri-urban areas; and (2) the time for report elaboration. The selected sources of data include national energy statistics annual reports, census and socio-economic survey in sources like IBGE (Brazilian Statistics Bureau), BEN (Brazilian Energy Balance), ANEEL (Brazilian Energy Agency), ANP (National Petroleum Agency), MME (Ministry of Mines and Energy), MCT (Ministry of Science and Technology), Eletrobrás (the federal holding company in the power sector) and Petrobras (the national oil and gas company).

3 Main analysis and findings

3.1 Detailed analysis of the status of usage of various fuels

Fuelwood

The practice of cooking using solid fuel derived from biomass in traditional cook stoves is the most important issue in health-energy access field in Brazil. Poor urban and peri-urban continue to depend on solid fuel derived from biomass like wood fuel, charcoal and many types of waste materials, such as construction debris, (JANNUZZI *apud* LUCON, COELHO, GOLDEMBERG, 2004).

Fuelwood and solid residues represent 37.8% of energy consumption in the overall residential sector. In Brazil it is used mostly by low income peri-urban, rural and isolated areas populations for cooking and heating purposes. Even though their high availability, these fuels exploration by low income population is economically unsustainable.

According to MME, in 2006, wood fuel percentage in the residential sector accounted for about 37.8% of its production. Wood fuel and charcoal represent 12.65% (MME, 2006) of Brazilian Energy Matrix.

Although forest resources are important for national energy matrix, there is not a coordinated system that regulates and updates the information.

The Brazilian doctor theses prepared by Oliveira (2007) reports a new methodology, which points out the personal consumption for wood fuel in domestic sector.

Concerning to health, air pollutant emissions from those types of fuel cause indoor pollution that can affect human health specially children and women. Biomass combustion releases high levels of known indoor air pollution, which can be increased if the fuel burned, comes from waste materials. Carbon monoxide is just one part of this pollution. It also presents particulate material and volatile organic compounds (VOCs), when the fuel that is burned comes from waste materials. These materials composition may have been affected by: paints, wood stains, sealants, adhesives, and sealers. In this way indoors pollution from cooking in urban Brazilian areas can represent even more health risks.

Charcoal

Residential cooking and hot water in rural areas of Brazil are supplied primarily by direct combustion of biomass in the form of wood, crop wastes and charcoal. In recent decades, the decline in forest resources in many countries directed attention to more efficient household use of biomass, as well as solar cookers, but not in Brazil. Regarding to domestic use by peri-urban population it has bad practices issues like indoor pollution deforestation and risk of unsustainable exploration.

Brazil produces large amounts of charcoal that was initially from forests residues. It represents 2.4% of energy consumption in residential sector, used mainly for cooking purposes in peri-urban area, most commonly in North and Northeast regions. About 25.4 million m^3 of charcoal were used in steel, metallurgy and cement production in 2001 (ROSILLO AND MOREIRA, 2006).

LPG – Liquefied Petroleum Gas

Among usual ways of energy consumption for cooking, poor urban or peri-urban population in

Brazil rely upon bottled LPG and solid fuel firewood. The 13kg bottles of LPG available in several specialized stores or distributed by trucks. LPG delivery infrastructure is highly developed in all regions, including rural zones, contributing to reduce deforestation.

In 2004, 98.48% of urban population owned cooking stoves and 7.61% of rural one did not owned any stove (PNAD, 2004). Even though this high rate for poor population urban or rural LPG cooking stove is not the only means of cooking. They keep wood fueled stove as a back up in case they can not afford LPG (LUCON, COELHO, GOLDEMBERG 2004). So that the biggest energy access problem faced by poor urban is still related to biomass burning most of the time for cooking activities.

According to Costa (2006), the Brazilian Government have intervened on LPG for domestic use prices based on price controls and cross-subsidies through an additional tax on other fuels such as gasoline.

LPG usage increased from the fifties until 2002 when the subsidy “Gas Allowance” was removed. From this point its consumption decreased and simultaneously woodfuel consumption increased. For the same period, for traditional the consumption of woodfuel went in the way around. The residential use of traditional biomass has declined significantly over the last decades because it was substituted by more efficient fuels and end-use technologies.

This inversion occurred because the residential use of firewood for cooking in traditional wood stoves has dwindled over the years. With the growing of the urbanization (currently less than 20 per cent of the Brazilian population lives in rural areas), the increase of people’s income, the large level of deforestation in some regions of the country and a larger availability of LPG gas the population started to use it. Now it turned out that residential consumption of firewood has declined from 53.5 percent of total biomass consumption in 1970 to just 13.8 per cent in 2002. In Industrial sector the use of firewood is stable due to the sustainable use of wood. The main policy recommendations is to expand even more the distribution network.

Natural gas

Natural gas is an expanding marketing but with low availability. So far, it is concentrated on the Centre South part of the country. It is used as fuel for vehicles (compressed Natural Gas) and as source for thermo electricity generation, industries and urban domestic use. The domestic use is characterized by pipeline distribution in some distribution areas. Peri-urban population normally does not use natural gas as fuel due to the installation costs and the low income of peri-urban population (Table 3).

It must be mentioned the current domestic use of the natural gas as fuel cooking and heating practices. However, the availability is restricted to big cities like São Paulo and Rio de Janeiro where the pipelines for natural gas distribution have already been installed in new residential.

A strong barrier to the enhancement of natural gas contribution in the energy matrix is the price, which is highly dependent on international market. Once it is imported from Bolivia[3] (LEITE, 2007) that leads Brazil into the energy security field, unless the recently natural gas reserves discover announced by Petrobras (419 billion m^3 in Santos basin 2003) starts its production in order to cover the growing demand (COSTA *et al*, 2006). Other barrier is the lack of more pipeline distribution for the final consumers.

On the other hand, natural gas represents a good practice replacing electricity for water heater purposes using efficient applications (good option especially in peak hours).

Regarding policy recommendations aiming at an increase of natural gas usage, enlargement of the existing distribution network could be a solution.

Electricity

The majority of Brazilian population lives in urban areas where the higher rates of electricity coverage are found for the residential sector, representing 31.6% of energy consumption. Urban areas have electricity access nearly to 100%. In the rural areas the access is distinct, being the availability in the rural areas in general medium, except for the South/Southeast regions where the access level is high.

Due to the low affordability, peri-urban and urban population's electricity consumption have many times irregularities such as unauthorized consumption (informal connection to the grid), which is unmetered and can lead to losses, as well as security issues e.g. risk of fires incidents. This situation is a result of the lack of infrastructure and urban planning.

In principle, an increase in the electricity generating capacity should have been easy to achieve. Brazil has enormous hydroelectric potential, and investments in the sector were forthcoming, although with an initial delay. However, until 1995 nationalistic considerations excluded foreign capital from the electric energy sector, and regulatory obstacles prevented domestic private investment. After 1995, this situation underwent changes with regard to the privatization program.

The lower electricity coverage normally occurs in isolated areas in Amazon and urban area outskirts. It is clearly necessary to give attention to these communities' needs and renewable energy can collaborate to achieve this goal (GOLDEMBERG *et al*, 2003).

Another issue that represents a barrier for major accessibility is the need for valid address evidence from consumers and in some regions the distance is a strong barrier to grid

[3] The pipeline built to transport natural gas from Bolívia to Bazil is 3150 km long. In May, 2006, the Bolivian President Ivo Morales, nationalized the oil and gas reserves via decree, through with Petrobras and others oil companies were affected (Costa et al, 2006).

connection.

In the seventies, Brazil started with subsidies to benefit low income population to afford energy power with law No.10.438 from April 2002. All residential consumers with single phase connections and an average monthly consumption less than 80 kWh automatically benefit from the subsidies. Consumers in the 80 to 220 kWh per month range must be registered at the utility and in the Federal Government's Single Social Programs Register. The low income tariff was financed by resources from the Energy Development Account (CDE)[4]. There are currently some 18 million households that benefit from the low income tariff, 14 million of which have a monthly consumption of less than 80 kWh, and 4 million in the range of 80 - 220 kWh/month (ANEEL, 2006).

Policy recommendation includes the expansion of the connection network for poor urban in general, more incentives to energy efficiency, energy conservation and renewable energy increase.

Kerosene and diesel

For low income population the use of kerosene and diesel is restricted to isolated areas like in Amazon Region to produce electricity via diesel motors receiving CCC (explained on topic 3.3.1.1) help to afford the fuel costs). Kerosene is mostly used by deprived population to provide lightning in this region.

Diesel oil consumption (37 million cubic meter in 2007) in Brazil is mainly in the transportation sector (buses and trucks), but there is also a high consumption (up to 809 thousand cubic meter per year) in diesel generators for isolated communities mainly in the Amazon Region. Aiming to keep inflation rates at low levels, special subsidies for diesel were introduced in the past and still exist. These subsidies are based on price structure of gasoline for final consumers (ANP, 2002). Because of this price structure, light vehicles using diesel oil are forbidden in the country.

3.2 Policy recommendations

Natural Gas

- Expanding distribution network.
- To increase reliability.

Fuelwood / solid residues

[4] The CDE is a sectoral tax and is part of the cost of the electricity tariffs. It is paid by all Brazilian consumers.

- Enforcement of illegal fuelwood uses.

LPG

- To expanding distribution network.

Kerosene

- Expanding access to clean energy services.

Electricity

- Expanding the connection for poor urban in general.

Charcoal

- Enforcement of illegal production.

Diesel

- Stimulating the use of renewable energy sources (Biomass, Photovoltaic Systems and Solar Water Heater).

3.3 Policy pointers

The Brazilian Constitution (1988) considers the distribution of energy to be an essential public service for which the Federal Government assumes full responsibility, either directly or through designated concessionaires or "permissionaires". The Constitution further states that these public services can only be granted through public bidding.

The next topics give an overview of existing legal instruments and laws that support peri-urban population in achieving electrical energy.

3.3.1 Instruments

The instruments that make possible funds for policies implementation are: CCC, Fuel Consumption Account; RGR, Reversion Global Reserve; and CDE, Energy Development Account. They are further explained in the chapters bellow.

3.3.1.1 CCC, Fuel Consumption Account

As mentioned before, diesel fuel is not a fuel used by peri-urbans by themselves, except if they are located in isolated areas where the electricity generation is based in this type of fuel. The price of diesel in Brazil is lower than the others petroleum derivates (special taxes). In order to support the electricity generation in isolated areas of Brazil, especially in *the* North region (basically Amazon region) where the generation is pretty much based on diesel oil, the CCC instrument is used. CCC is an instrument that subsidizes diesel oil consumed for this support through a fund called Fuel Consumption Account (Conta de Consumo de Combustíveis – CCC) with resources collected from electricity consumers.

This account is funded by energy utilities, from special taxes on electricity bills for households all over the interconnected system. ANEEL Resolution 245/99 determined conditions and timeframes for sharing of projects in isolated electric systems that substitute totally or partially oil fired thermoelectric generation (diesel generators). This scheme is applicable by May 2013.

The bases for the creation of CCC is article 13, item III of Law Nº 5899/73, of July 5 that says: "The onus and advantages resulting of fossil fuel consumption, for interconnected system or due national imposition interests, will be shared by all companies of the system…"

The Decree Nº 73102/73, of November 7, regulated the article 13 of law Nº 5899, establishing in its article 29 that "CCC will be a financial reserve for fossil fuels costs coverage, working as a compensation account, through the share of onus and advantages of fuel consumption in thermo electric generators that belong to companies being connected total or partially to the interlinked system, South / South-East.

"Portaria" MME (Ministry of Mines and Energy Brazil) No. 360/77, of March 17, article 4 determined the extension of CCC to North-East.

Decree No. 774/96, of March 18, article 22 extended to all concessionaries and Distributors. CCC was divided in 3 sub-accounts.

- CCC South/South-East/Centre-East
- CCC North/North-East
- CCC Isolated Systems (CCC – ISOL)

At this time the tariff for the whole country was the same.

After tariffs equality being extinguished due the restructuring of the power sector it was necessary to create strict rules and a CCC extinguish chronogram.

The latest news about CCC is that there will be a tariff raise for all the consumers in the

interconnected system in order to enlarge CCC funds

3.3.1.2 RGR, Reversion Global Reserve

Law 8631/93 and subsequently Decree 774, assure financing for grid expansion and rural electrification programs through the RGR[5], a fund managed by Eletrobras (Holding of the Brazilian Power System), with compulsory contributions by all concessionaires. These contributions are included in the tariffs imposed by concessionaires. Law 9427 from 1996, which institutionalized ANEEL, decreased 50% of the resources of RGR should be directed to the North, Northeast, and Mid-West regions and that 50% of such resources should be allocated to programs for rural electrification, energy efficiency, and electrical power for low-income users. Such an initiative reflected the concern with the supply of electricity to the rural and **low-income populations**, plus the concentration of investments to provide funds to minimize potential future problems.

An extension of RGR until the end of 2010 will insure resources for the continuation of the "Luz no Campo" Program. State and Municipal Governments, concessionaires and "permissionaires", rural electrification cooperatives and infrastructure cooperatives for land reform projects and inter-municipal consortia are now allowed to borrow resources from RGR. These resources can be used for the expansion of distribution services, particularly on **low-income urban** and rural areas, and specific promotion program to the individual or collective use of solar energy conversion to electricity.

3.3.1.3 CDE (Energy Development Account), Law 10438, of April

Law 10438/02 institutionalized a national fund CDE (Energy Development Account) to promote universal access to electricity and the use of innovative sources of energy. It stipulates that resources from RGR can be used for the expansion of distribution services, particularly on low-income urban and rural areas. It further enfolds a specific promotion program to the individual or collective use of solar energy conversion to electricity.

3.3.1.4 Subsidies

Electricity

In Brazil, the use of subsidies as a mechanism for price discrimination in order to allow the inclusion of the poorer segment of the consumer market, goes back to the seventies. Law No. 10.438 changed the parameters for inclusion in the low income tariff. All residential consumers with single phase connections and an average monthly consumption less than 80 kWh

[5] Reversion Global Reserve is a yearly reversion quota (up to 2.5%, limited to 3% of annual income) to be levied on concessionaires and "permissionaires" investments, and transferred to electricity tariffs.

automatically benefit from these subsidies. Consumers in the 80 to 220 kWh range must be registered at the utility and in the Federal Government's Single Social Programs Register. The low income tariff is financed by resources from the Energy Development Account (CDE)[6]. It is about 18 million households that benefit from the low income tariff, where 14 million have a monthly consumption of less than 80 kWh, and 4 million in the range of 80 - 220 kWh/month (ANEEL, 2006);

Governmental subsidies to reforesting have benefited 5.5 millions hectares in 2001 (compared to 3.3 million hectares in the 1965-1980 period), to produce charcoal; wood fuel, pulp, and paper. Charcoal and firewood were the predominant fuels in Brazil until 1954. About 40% of Brazil's steel production made use of charcoal (now from sustainable forests) instead of imported coke.

LPG

Despite the subsidy for LPG called "Gas Allowance" from the fifties, there is a Government intervention process via price control and cross-subsides. The deregulation process started in the nineties and lasted until the subsides were removed in 2002. Anther decree (4102) about the regulation/legal[7] structure was made to minimize distortions by income transfers from the Brazilian Government help for LPG purchase (COSTA *et al* 2006).

Gas Allowance, regulated through Decree No. 4.102, dated January 24, 2002,[8] was a cash transfer program created by the government in 2001. The aim was to compensate poor families for the elimination of LPG subsidies in 2000. The program transferred US$ 6.97 every two months to 8.5 million people. Beneficiaries were those families whose monthly per capita income was below half a minimum wage, (U$ 81.40). To benefit from the subsidy, the family had to be registered for another cash transfer program, such as the Food Allowance[9] or Schooling Assistance[10];

Because of the difficulties in administering the programs and the low impact they had on the poor population, the Federal Government launched the Family Allowance program through Law No. 10,836 from 2004 This Law united all the cash transfer programs (gas allowance, schooling assistance and food allowance).

---

[6] The CDE is a sectoral tax and is part of the cost of the electricity tariffs. It is paid by all Brazilian consumers.
[7] Removal of subsidies (end-2002), followed by the creation of a Federal "gas assistance" program, in order to transfer to low-income families subsidies for residential LPG.
[8] The resources for financing the program came from taxes gathered from imports and commercialization of oil and derivatives, natural gas and its derivatives and ethyl alcohol fuel.
9 The Food Allowance program ensures a monthly aid of US$ 6.97 to US$ 20.93 per family. It benefited at most 3 family members (children up to 6 years of age at nutritional risk, pregnant and nursing women) and the family per capita income had to be less than half the minimum wage. The Food Allowance program lasted for six months and was renewable for equal periods if the family continued to remain in poverty and if they met a set of commitments related to health.
[10] Schooling Assistance ensured a monthly aid of US$ 6.97 for children from 6 to 15 years of age who went to school. The program benefited at most 3 children per family and the family per capita income could not be higher than US$ 41.86.

Uniting the programs initially reduced the number of beneficiaries of government cash transfer programs because, according to the new rules, families with a per capita income from US$ 23.25 to US$ 46.51 and without children were excluded from the benefit. The idea was to give the benefit to poor families with children and also to the very poor families without children;

In 2004, the government expanded the benefit, which increased the inclusion of the needier population. The Family Allowance Program and PETI transfers[11] went from less than US$ 930.23 million to more than US$ 1 billion a year. In the same year, the Gini[12] index dropped about 4%. Furthermore, according to the simulations done by Rocha (2004), the percentage of poor people in Brazil dropped from 34% to 32% after the implementation of the Family Allowance Program;

Criticisms related to cash transfer programs, like the Family Allowance, have to do with the concept of citizenship. Critics believed that implementation of the Family Allowance were disguising a situation of structural unemployment. They also stated that only growth together with sustainable development can provide needy populations with true alternatives for social transformation (JUSTO, 2004).

3.3.2 Laws and decrees

The Brazilian policies supporting low income population are:

3.3.2.1 Light for Everyone Program ("Luz Para Todos")

This program means access to everyone so that, peri-urban ones are included.

It was conducted by the Federal Government and intends to provide energy access to **all households in Brazil** up to 2008. This program will have priority alternative energy sources, particularly in the North region where most of the remote villages in the country are located that do not have energy access to the grid.

3.3.2.2 Law 10438/02

In April 2002, Brazilian Congress passed Law 10438. The law provisions the reduction of tariffs to **low-income consumers,** the establishment of targets for concessionaires and 'permissionaires' to provide full energy coverage, and the creation of a national fund CDE (Energy Development Account) to promote universal access to electricity and the use of

[11] Program to Eradicate Child Labor
[12] The Gini Index measures income inequality. The closer to zero, the better the distribution.

innovative sources of energy. Among the innovations specify that RGR resources can be used for the expansion of distribution services, particularly on **low-income urban** and rural areas. They further specify specific promotion program to the individual or collective use of solar energy conversion to electricity. The Law institutionalizes an Incentive Program for Alternative Electric Generation Sources (PROINFA - Programa de Incentivo as Fontes Alternativas de Energia).

ANEEL (Federal Electricity Regulatory Agency) regulates this Law, whereby utilities must provide full coverage under a target timetable plan. On parallel lines, MME (Ministry of Mines and Energy Brazil) is preparing a program to accelerate universal access to electricity by ensuring additional resources, and particularly by creating rules for the use of CDE resources.

3.4.2.3 Cide - Contribution of Intervention in the Economical Domain

Law N 10.336, of December 19, 2001, institutionalized Cide (Contribution of Intervention in the Economical Domain) on the import and the commercialization of gasoline its alike products, *diesel* its alike products, aviation *kerosene* and other kerosene oils, fuel oils (fuel-oil), *liquefied gas of petroleum* (GLP), besides derived him/it of natural gas and of naphtha, and combustible ethyl alcohol. There are different Brazilian taxes for fuels, related to diesel or kerosene.

The Cide is paid by the producer, blender, or importer of fuels. The taxpayer is allowed to deduct the Cide from the Program for Social Integration (PIS) and Contribution for the Financing of Social Security (COFINS).

The tax rates[13] vary from product to product:

- Gasoline: R$ 501.10 per m^3;
- Diesel: R$ 157.80 per m^3;
- Kerosene: R$ 25.90 per m^3;
- Aviation Kerosene: R$ 21.40 per m^3;
- Fuel oil: R$ 11.40 per t;
- Liquefied Petroleum Gas (LPG): R$ 104.60 per t;
- Liquid Fuel Ethanol: R$ 22.54 per m^3.

4 Further areas for research and way forward

Brazil has a paradox at the forest sector. It has one of the biggest native forests of the planet

[13] The average rate is 1.8 per Reais per Dollar.

(416 millions of hectares, corresponding to 31% of the native forest covertures of the planet) and has the fifth biggest reforested area of the world. However, there is scarcity sustainable of wood in Brazil, for all uses – including energy. In order to change this panorama it is important to develop researches focusing mainly in the following issues:

- Implementing of some policy guidelines;
- Expanding sustainable woodfuel production;
- Increasing efficiency in the process of conversion and final use of the wood. Considering the growing importance of the issue "reduction of the deforestation of tropical forests, especially, the Amazonian forest" in the context of mitigation of the global climate change, this issue is absolutely fundamental.

The analysis of primary data (and also secondary data) related to the Brazilian forest sector tends to be a key point for the used methodology. This kind of data is not so easy to obtain in Brazil, especially considering forest regions. To succeed it is important that the Brazilian Team of researchers working for GNESD and scientists that are now working in research centers or universities located close to forest work closely together.

Once again it is important to stress that energy exclusion does not just mean that no energy is supplied by the utility company. It involves social and economic issues that prevent access to energy (not just electricity), which in turn, deny the individual the possibility to education, health and leisure, in other words denying the right to citizenship. In the city of Rio de Janeiro, for example, energy exclusion is seen particularly in the hills and slums, places where access to electricity is mostly through illegal connections.

To provide modern clean energy sources supplying rural communities with their own effective means to achieve sustainable development is a great challenge in Brazil. The expansion of the use of some technologies (like solar or win energy or efficient stoves) could help.

However, to overcome this challenge it's necessary to implement strategies really focused in the effective income distribution and in the job generation. Probably, there are good practices related with the expansion of the energy access occurring in small Brazilian cities that we can learn from. This kind of initiatives must be known in order to a possible replication.

The Federal Government has a fundamental role to reduce the historical inequalities in Brazil. Also NGOs (local civil associations), municipal and state government can help a lot. To detect, map and analyze good practices focused on income distribution and on job generation through energy access implemented in small Brazilian cities. They could help all these actors to promote replication of the best practices. This is a possible area for deeper research for a next GNESD study.

References

ANHALT, J. Institute for Sustainable Development and Renewable Energies – IDER. Tecnologias Renováveis para o semi-árido (*Renewable Technologies for the Semi-Arid*). 2006. Available at http://www.ider.org.br. Accessed in December 2006.

BACHA, C.J.C. et alii., 2006, Estudo da dimensão territorial do PPA: setor silvicultura, manejo florestal, madeira e celulose, preliminary version, Brasília

BRASIL, 2006, Balanço Energético Nacional 2005, Ministério de Minas e Energia, Brasília

Brazilian Electricity Regulatory Agency, ANEEL, Boletim Energia (Energy Bulletin) 251/2006. Available at http://www.aneel.gov.br. Acessed in November 2006.

BRITO, J.O, 1990, "Carvão vegetal no Brasil: gestões econômicas e ambientais", Estudos Avançados, 4 (9): 221-7, Instituto de Estudos Avançados da Universidade de São Paulo, São Paulo

Census 2000. Available at http://www.ibge.gov.br/censo. Accessed in August 2006.

CEPEL – Centro de Pesquisas de Energia Elétrica [Electric Energy Research Center], 2004. Estudo de avaliação da eletrificação promovida em Mato Grosso do Sul.

COSTA, M.M., Schaeffer,R., Cohen, C., 2006 Energy and Social Issue *in* Brazil: A Country Profile on Sustainable Energy Development. ISBN 92-0-104906-4

CPFL – Companhia Paulista de Força e Luz (São Paulo Power and Light Company), 2006. Personal communication, Campinas, São Paulo.

GOLDEMBERG *at al*, 2003 '' Expanding the access to electricity in brazil", GNESD report.

GOLDEMBERG, J., COELHO, S.T., 2003. "Renewable Energy – Traditional Biomass vs Modern Biomass", *Energy Policy*.

IBGE, 2004, Pesquisa de orçamentos familiares 2002 - 2003, microdados,

IBGE, 2005, Pesquisa nacional pro amostragem de domicílios 2004, microdados Brasil, Instituto Brasileiro de Geografia e Estatística, Rio de Janeiro, CD-ROM

IBGE, 2005, Produção da extração vegetal e da silvicultura 2004, Instituto Brasileiro de Geografia e Estatística, Coordenação de Agropecuária, Rio de Janeiro

IBGE, 2006, Produção da extração vegetal e da silvicultura 2005, Instituto Brasileiro de Geografia e Estatística, Coordenação de Agropecuária, Rio de Janeiro

Instituto Brasileiro de Geografia e Estatística (Brazilian Geography and Statistics Institute) – IBGE. Social, demographic and economic information. 2006. Available at http://www.ibge.gov.br. Accessed in August 2006.

Instituto de Pesquisa Econômica Aplicada (Applied Economics Research Institute), IPEA. Sobre o IPEA (About IPEA) 2006. Available at http://www.ipea.gov.br. Accessed in August 2006.

Instituto de Pesquisa Econômica Aplicada (Applied Economics Research Institute), IPEA. IPEADATA, 2006. Available at http://.www.ipeadata.gov.br

Instituto Pereira Passo, IPP. Armazém de Dados (Data Warehouse). 2006. Available at http://www.rio.rj.gov.br/ipp. Accessed in August 2006.

Health Ministry /SVS - Sistema de Informações de Mortalidade (SIM)
http://tabnet.datasus.gov.br/tabdata/cadernos/BR/Brasil_GeralBR.xls

JUSTO, C. R. Experiências de Renda Mínima no Brasil: Um Mapeamento dos Programas e Modelos Paulistas (Experiences of Cash Transfer Programs in Brazil: A Map of Programs and Models in São Paulo). São Paulo, 2004. UNICAMP. IV Encontro Nacional das Associações Brasileira de Ciência Política (IV National Meeting of Brazilian Political Science Associations).

KAGEYAMA, A. Pluriatividade e ruralidade: alguns aspectos metodológicos (*Pluriactivity and rurality: some methodological aspects*). In: CONGRESSO BRASILEIRO DE ECONOMIA E SOCIOLOGIA RURAL, SOBER, 36. São Paulo. Unicamp. Electronic Annals. 1998. Available at: http://www.eco.unicamp.br. Accessed in July 2006.

LEITE, A.D.; 2007, Partida para o novo século, *in* "A Energia do Brasil", 2° ed., page 417, ISBN 978-85-352-26881.

LIGHT. Instalação de Aquecimento Solar em Comunidade de Baixo Poder Aquisitivo Aquecimento Solar II (Installation of Solar Heating in Low Purchasing Power Communities – Solar Heating II). Rio de Janeiro 2004. (Final Report).

LUCON. O., Goldemberg, J., and Coelho, S.T., 2004 ''LPG in Brazil: lessons and challenges", *Energy for Sustainable Development,* VIII/3, pp. 82-90.

LUCON, O. et alii., 2004, "LPG in Brazil: lessons and challenges", Energy for Sustainable Development, VIII (3), Paris.

MME, 2004, MME, Ministry of Mining and Energy, 2004. Brazil; “National Energy Balance” Available at www.mme.gov.br.

MME, 2005, MME, Ministry of Mining and Energy, 2005. Brazil; “National Energy Balance”, Available at www.mme.gov.br.

MME, 2006, MME, Ministry of Mining and Energy, 2006. Brazil; “National Energy Balance” Available at www.mme.gov.br.

MME, 2007, MME, Ministry of Mining and Energy, 2007. Brazil; “National Energy Balance” (the latest data from 2006, available at www.mme.gov.br). Available at www.mme.gov.br.

NERI, M. Lampião, “Gatos” & Robin Hood (Illegal connections and Robin Hood). Centro de Políticas Sociais (Social Policies Center). IBRE/FGV. Rio de Janeiro. 2001. Available at http://www.fgv.org.br. Accessed in August 2006.

OLIVEIRA A. U.;”Lenha e Carvão Vegetal no Brasil: Balanço Oferta-Demanda e Métodos para a Estimação do Consumo”.

OLIVEIRA, M. G; LAURIA, T; DIAS, C. et al. Avaliação dos impactos socioeconômicos de projetos energéticos – eletrificação rural: área de concessão da ENERSUL – MS (Evaluation of the socioeconomic impacts of energy projects - rural electrification: area of the ENERSUL - MS utility company). Perspectiva Econômica (Economic Perspective), Rio Grande do Sul, year 1, 2005, No. 2. Available at: http://www.perspectivaeconomica.unisinos.br. Accessed in July 2006.

PNAD - Pesquisa Nacional por Amostra de Domicílio (*National Household Sample Survey*), 2004. Available at http://www.ibge.gov.br/censo. Accessed in August 2006.

REIS, E. P; SCHUARTZMAN, S. Pobreza e exclusão social: aspectos sócio políticos (Poverty and social exclusion: sociopolitical aspects). Rio de Janeiro: IETS (mimeo). Available at http://www.schwartzman.org.br. Accessed in July 2006.

RIBEIRO, C. M. Eletrificação Rural com Sistemas Fotovoltaicos Distribuídos no Contexto da Universalização do Serviço de Energia Elétrica (Rural electrification with distributed photovoltaic systems in the context of universal access to electricity services). 2002. 176 p. Dissertation (Master's Degree in Energy Planning), Federal University of Rio de Janeiro, Rio de Janeiro.

ROCHA, S. Impacto sobre a Pobreza dos Novos Programas Federais de Transferência de Renda (Impact on Poverty of the New Federal Cash Transfer Programs). Rio de Janeiro: FGV 2004. JEL - I3 Welfare and Poverty - I38 - Government Policy; Provision and Effects of Welfare Programs. Available at www.anpec.gov.br. Accessed in November 2006.

ROCHA, S. Tendência Evolutiva e Características da Pobreza no Rio de Janeiro (Evolutionary Trend and Characteristics of Poverty in Rio de Janeiro). Rio de Janeiro: IPEA 1997. pp 10-22.Text for Discussion n. 536. Available at http://www.ipea.gov.br. Accessed in July 2006.

RODRIGUES, F A., Análise da viabilidade de alternativas de suprimento descentralizado de energia elétrica a comunidades rurais de baixa renda com base em seu perfil de demanda (Analysis of the feasibility of alternatives for decentralized supply of electricity to low income rural communities based on their demand profile). Rio de Janeiro, 2006 – 146 p. Dissertation (Master's Degree in Energy Planning), Federal University of Rio de Janeiro, Rio de Janeiro.

Rosillo F.; Moreira J. R., 2006 Domestic Energy Resources *in* Brazil: A Country Profile on Sustainable Energy Development, pag. 58. ISBN 92-0-104906-4

SILVA, T. L.V. Estimativa de padrão de consumo energético de comunidades carentes, estudo de caso: Complexo da Maré (Estimate of energy consumption pattern of needy communities, case study, Complexo da Maré). Rio de Janeiro, 2003 – 129 p. Dissertation (Master's Degree in Energy Planning), Federal University of Rio de Janeiro, Rio de Janeiro.

SIM/SINASC http://tabnet.datasus.gov.br/tabdata/cadernos/BR/Brasil_GeralBR.xls

SOARES, P., 2006 ,"Lenha ganha espaço de gás de cozinha". Folha de São Paulo (Caderno Dinheiro), São Paulo, 4 jan. 2006

SPOSATI, A. Mínimos sociais e seguridade social: uma revolução da consciência da cidadania (Social minima and social security: a revolution of the awareness of citizenship). Brasília: SASMPAS/ FUNDAP (mimeo). 1997.

VALE, A.R. Definindo o conceito e descobrindo a plurifuncionalidade (*Defining the concept and discovering plurifunctionality*). São Paulo, 1984. *Apud* ZÁRATE, A. El mosaico urbano - organizacion interna y vida en las ciudades (*The urban mosaic - internal organization and life in cities*). Madrid: Cincel. Cuadernos de Estúdios, v.13. 1984. Available at http://www.igeo.uerj.br. Accessed in August 2006.

WHO Preventing disease through healthy environments. Towards an estimate of the environmental burden of disease. / Prüss-Üstün A, Corvalán C.World Health Organization. ISBN 92 4 159382 2. France, 2006.