

**WINDOWS**  
**ON**  
**RURAL ELECTRIFICATION**  
**IN BRAZIL**

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## 1 - INTRODUCTION

As of the world population, 1.6 billion do not have access to electric power. According to the International Energy Outlook data, if the current trend of the electrification rate remains, by the year of 2030, we will still have had 1.4 billion people without access to electric power, and in order to universalize the access in the south area of Asia and Africa Sub-Saharan, it would be necessary more than 40 and 80 years, respectively.

Public efforts toward promoting the rural electrification have been legitimated

In addition to state efforts, multilateral organizations such as World Bank, has made efforts towards the implementation of rural electrification programs, since it means that electrification brings a plethora of social benefits and is a key component in poverty reduction. World Bank have succeeded in bringing electrical infrastructure to many rural areas over the past three decades. More than one hundred (120) Bank-supported projects with rural electrification activities since 1980. A number of trends emerged. Support for off-grid electrification, usually as a subcomponent of a larger project has grown. Most off-grid projects rely upon renewable energy technologies (RETs) which have also been more prominent in the Bank's lending in the last 15 years. Another trend is the growing number of projects in Sub-Saharan Africa and Latin America, in the case of the latter rural electrification being common in multisectoral community-driven development projects.

The rural electrification is frequently considered as a strategy of rural development, regardless of the technology used. However, it has not been always easy to identify its

effective contribution to the improvement of the recipients' life, particularly in the developing countries where countless economic and social restrictions are verified.

In all developed countries, the rural population has already acquired the right of taking advantage of the benefits from electricity. Motivated by the efficiency levels enhanced by the introduction of the market competition, many of these countries have decided to implement institutional reforms, and expanded the electric network to the limits of the national borders, accomplished with strong support of the Government.

## **2 - RURAL ELECTRIFICATION IN BRAZIL – PUBLIC POLICY**

In Brazil, the darkness is still a reality to about 25% of the rural population. The electrification rates are quite differentiated upon the geopolitical areas of the country, being lower in the poorest areas - North and Northeast.

In the last few decades, there has been a constant migration of rural population to urban areas looking for employment and better quality of life. During the same period, the industrial sector grew significantly and became economically more important than the rural sector. Consequently, the industrial sector became government's first development priority. In addition, the energy system was focused on large power plants energy production and high potentials of long distance transmissions to large energy consumers, urban centers and industries. Limited efforts, by Government, were made to provide energy to small and dispersed rural consumers as it seemed to be economically less attractive.

This meaningful number of people without access to electric power yet is prevailing in the countryside. According to the Brazilian Institute of Geography and Statistics (IBGE) data, out of the 5.8 million rural properties in Brazil, only 1.6 million (27.5%) are connected to electric network. After almost 120 years, from the inauguration, in Campos city in 1883, the first electric lighting utility in Brazil and South America, bringing electricity into the rural reality has been a challenge not met as yet.

During the century XX, Brazil was one of the countries which most prospered, presented an actual average growth rate of 4.85% per annum in the period 1901-1999,

while its population grew at quite moderate rate, around 2.32% per annum (1901-1996). Before that spectacular economic performance, the earnings of per capita income were also extraordinary neighboring 2.5% per annum on average. However, those elevated increments of income were not distributed evenly among the population, resulting in an awful social disparity. As a consequence of a development policy centered on the urban-industrial sector, the difference between the urban areas and the rural ones became clearly evident.

The economic growth was not enough to historically reduce the social inequality in Brazil. In view of such scenario, it was necessary to adopt public policies, directly and indirectly, toward the reduction of the social inequalities. One of the combatting mechanisms to poverty refers to the expansion of the capacity of generation as of the poor's income, increasing their productivity, making it possible better access to credit benefits, land, machines and equipment, and electric power, for instance. Another mechanism traditionally used refers to compensatory policies based on direct transfers which relieve poverty. However, they do not change the capacity of improving the source of income.

A glaring social inequality impacts on poverty adversely to the stability and growth, so that the high poverty rate in Brazil is partly consequence of the critical income distribution.

The inequality of income distribution is intrinsically related to our economic structure which historically perpetuates the means and processes – an income-concentrating factor. It is unquestionable that economic growth is a must. However, considering the relative stability of poverty, even in periods of economic growth, it is crucial to carry out a planned strategy of reduction of poverty, combining economic growth with public policies focused on the reduction of social inequality.

In spite of the recent reduction of poverty, income imbalance in Brazil remains rather high, being the income for 1% of the rich close to the income for 50% of the poor. Even maintaining such steady rate as the inequality has been reduced recently, it would take a long time so that Brazil would start to present a compatible income distribution in relation to the countries which have development level comparable to the Brazilian one.

That lingering negligence to the needs of the Brazilian rural setting has provoked a series of side effects, being reflected in the swelling of the urban centers, to which urban violence is linked, the reduction of the quality of life of population and the increase of the costs of administration of the big metropolises.

Nonetheless the dimension of the potential benefits associated with the rural electrification, the history has demonstrated that only now the Brazilian nation was capable of holding to their actions toward the universalization of the rural service. In spite of that, on the threshold of the century XXI, there are still at least 12 million Brazilians who have never had the opportunity to take advantage of the invention which Thomas Edison came up with to the world in 1880.

The rural electrification in Brazil is, above all, a matter of social nature. If electric power is a raw material capable of raising productivity and quality rates of agricultural properties, it is also indubitable its need for the improvement of the quality of life of those who are just rural residents or depend on agriculture for their own living. Such condition leads to the thought that, to be accessible, electricity has to have compatible cost with the capacity of payment of the low-income population.

However, the lack of attractiveness to the rural market for the electric power companies, and also the development of programs of rural electrification based on merely technical and financial criteria resulted, until then, in high average costs of network connection,

making it unfeasible the access of the low-purchasing-power residents to electricity. Even the *Light for Everyone Program (PLPT)*, the most recent and ambitious program of rural electrification in the world by the Federal Government which intends to bring electricity to 12 million peasants over the national territory until 2010, with investments amounting to US\$ 6.0 billion, does not seem to solve the problem definitely.

### **3- SOCIAL APPROACH**

In Brazil, in spite of recent efforts, the electric service is still deficient, be it either for the lack of access or for the precarious service itself. Today, about 5 million Brazilians do not have access to electric power. Most of them are in the rural area, usually spread and not integrated with the most dynamic centers in the country.

The bibliography regarding the rural electrification points out that, among the expected positive consequences, it can be stated that the expansion of the electricity utility by means of rural electrification will bring out immediate benefits to the rural activities in the country, both tangible and intangible, highlighting : improvement of the quality of life for peasants with longer time for leisure, reduction of the energy costs, citizenship, reduction of the social vulnerability, social integration, reduction of the emission of pollutants, the settlement of peasants in the countryside, increase of agricultural productivity and improvement of quality of the agriculture-industrial products, improvement of job rate, increase of the consumption market for "new" products and services in the rural regions, increase of tax collection, and enlargement of the consuming market of electric power.

We should observe that the described points possess differentiated impacts according to the conditions and socioeconomic characteristics found in the country in question, as

well as their results are influenced by matters of transverse public policies, besides the electrification itself, as for instance: access to credit, cooperative work, access to the consuming market, policies of income transfer, and improvement of education.

The elimination of poverty represents one of the great world challenges today, and it is one of the pivotal requirements for the sustainable development, namely, reaching a development to embrace social, economic, and environmental measures equal to either for the current or future population, mainly in the developing countries.

In Brazil, there are 50 million people living in poverty and 20 million living in abject poverty. It is observed that the percentage of Brazilians below the poverty line is larger in the rural regions (22.92%) than in the urban regions (17.67%). That significant portion of the population does not have access to the most basic utilities. In some states, there is not even infrastructure which makes it possible to reach public policies, as of the access to electric power. It is one of the necessary inputs for the permanence of those services.

The diffusion of modernity in the rural regions also generates new sociocultural reference which stimulates in peasants the fascination for the urban residents' lifestyle, consuming a great amount of energy: cooking gas, electric light, cuisine simplified by the use of the cooling system for food storage, radio and television, motor vehicles, for instance.

The relationship between energy and poverty is clearly noticed when it is verified that several social indicators are related to the access to sources of power, among them: illiteracy rate, infant mortality rate, life expectancy, and birth rate. Naturally, it is the lack of the access to electricity that is linked to a number of poverty indicators, not making it feasible to build hospitals, schools, and cooperatives, for instance. And for providing the appropriate access to the essential utilities, electric power is classified as

basic welfare for integration of the human being with social development. Also, the lack of the access to electricity is intrinsically related to poverty. The larger the number of the poor, the smaller the consumption of energy sources. (CEPEL 2004 [12]).

The countries whose population is less than 5% below the poverty line, the per capita consumption of energy is four times larger than in countries where 75% of the population lives below the poverty line. In general, the consumption of electricity is correlated with wealth. In the world, 27% of the population is on the margin of the basic principles of citizenship; still considering that more than 99% of such population lives in developing countries, being 4/5 in the rural areas

There are good perspectives as on what refers to the decrease of poverty, at least in Brazil. Based on the national follow-up report of the execution of the Objectives of Development of the Millennium of the United Nations, Brazil has already reached the goal of reducing by half the proportion of the population that lives under 1-dollar (Buying-Power-Parity) income a day. In 1990, 8.8% of Brazilians lived in grinding poverty, and in 2005 this percentage dropped as low as 4.2%, reaching an absolute reduction of 47 million people in the referred period, what represents the reach of a superior goal to the established one by the United Nations. However, the same report emphasizes that about 7.5 million people still remain in severe poverty, being necessary continuing with actions in favor of the invigoration of the social policies toward the reduction of the social inequality, as adopted by the Government starting in 2004, with the promotion of policies of real increase of the minimum wage, and programs of social inclusion.

In this sense, any strategy for the reduction of poverty depends basically on the economic growth and a better income distribution, as well as on the democratization of

the access to electricity. Specifically focusing on the rural area, public policies oriented to the rural electrification can minimize inequalities in several aspects as to facilitating the access to health care, education, and employment, for instance. It could be constituted in an important fomentation tool for the adoption of more social inclusion policies.

Considering the high correlation between poverty and the lack of access to electric power, it is decisive the evaluation of programs, projects and/or electrification plans, be it for the shortage of public resources which demand an expense rationality, or for the enormous proportion of the population number to be covered.

The limited evaluation to just register the percentage of executions of physical or financial goals does not mean to assess the program itself. An effective evaluation occurs exactly when it reviews such results and the processes by which they were produced.

Evaluating social impacts is a very ambitious task if we consider the inherent complexity to the so-called social phenomena. The evaluation is a powerful tool to know the studied social reality, with all of the imperfections and inherent risks upon working on a reality in constant mutation and influenced by several agents.

#### **4 – PURPOSE**

Based on the survey carried out by Electricity Research Center – CEPEL, it intended to know and evaluate the reality at the end of the implement of the resources and actions foreseen by the Government. For the accomplishment of the survey, it was necessary to define the result of the interventions, whether initial objective was reached, and their unfoldments.

In this work, as a general objective, it is supposed that electric power makes it possible an improvement in the quality of peasants' life. In relation to the specific goals, they can be introduced for by a set of factors, such as: increase of income, better access to information; valorization of rural properties, improvement of nourishment, reduction in the emission of CO<sub>2</sub>, improvement of education level, increase of agricultural production, for example. These results bear impacts differentiated over time, considering the interval of time among the field surveys, before and after the interventions - the access to electric power in a regular and safe way.

Countless methodological approaches exist for the evaluation of social interventions, and in this case quantitative and qualitative assessment were adopted, making it possible more assertive investigation in the interpretation of the studied reality, inserted in the private social context.

Being such, the methodology developed by the surveyors and collaborators of the Center of Researches of Electric Power (CEPEL), with support of the Brazilian Electric Headquarters S.A. (Eletrobrás), tried to capture the rural area resident's local characteristics before and after the regular and safe supply of electric power. The survey comprised the whole cycle of project of evaluation of the effects arising out of the rural

electrification, and it included the structuring of the data-collecting stage in the field, and the descriptive analysis of the respective information. All those stages were fundamental, in the sense of understanding mainly the current socioeconomic variations from the rural electrification as about the peasant's pertinent reality.

The evaluation was made over time, in two moments: the former-previous phase - the conditions of the properties before the beginning of the rural electrification - and the former -post phase, regards to the period of at least 2 years after the ruralelectrification.

The analyses proposed in the survey contemplate the following samples:

**Electrified properties of theformer-previous phase**

The sample of data composed of information on properties that in the moment of the interview, has not enjoyed the use of electric power in a regular and safe way as yet, but they would have such access within two years' time. This sample contemplated 8,888 properties distributed among 26 electric power dealerships in 21 states .

**Electrified properties of theformerpost phase**

The sample of data composed of information on properties which were provided with the access to electric power in a regular and safe way in the minimum period of two years' time after the initial phase. This sample contemplated 8,214 properties distributed among 25 electric power utility dealerships in 21 States.

All of the results shown in this work were based on these two types of samples of data. Such samples were compared, aiming to make a general analysis of the obtained information intended to find out the effects of the rural electrification.

In relation to the descriptive analyses, they are: education grade , nourishment condition, income , evaluation of properties, ownership of home appliance,

and rural equipment.

There are other items not included in this work.

All of the collected information and the analyses carried out had as main objective to capture the surveyed universe, delineate the investigated scenario, and principally monitor the socioeconomic conditions.

## **5 – VERIFIED RESULTS**

### **5.1 - EDUCATION LEVEL**

Education is one of the basic references to the study of the quality of life, being related with rural development for being linked to the improvement of the economic, social, politic , and cultural conditions of population.

Brazil has 32 million people living in the rural area , and the number of schools to assist the children comes up to 107,000. Half of those schools possess one classroom only and they offer, exclusively, the primary schooling.

Of the population from 15 to 17 years old, which totals 2,2 million people, 34% do not go to school.

The differences in terms of student enrollments contribute to worsening such inequality even more, since the urban areas account for 86,6% of the enrollments, and the rural ones, only 13,4%.

A comparison of the school situation in the rural and urban areas displays that in the rural area 29,8% of the adults are illiterate while in the city that rate falls by half. Of the students from 10 to 14 years old, 23% are in the suitable grades to their ages. Such rate in the urban area is of 47%.

In this sense, *Chart 2* presents the percentage distribution of the education level of the members of the interviewed families, including: illiteracy, elementary schooling, high school , these three last ones, being considered either the graduate and non graduate ones.

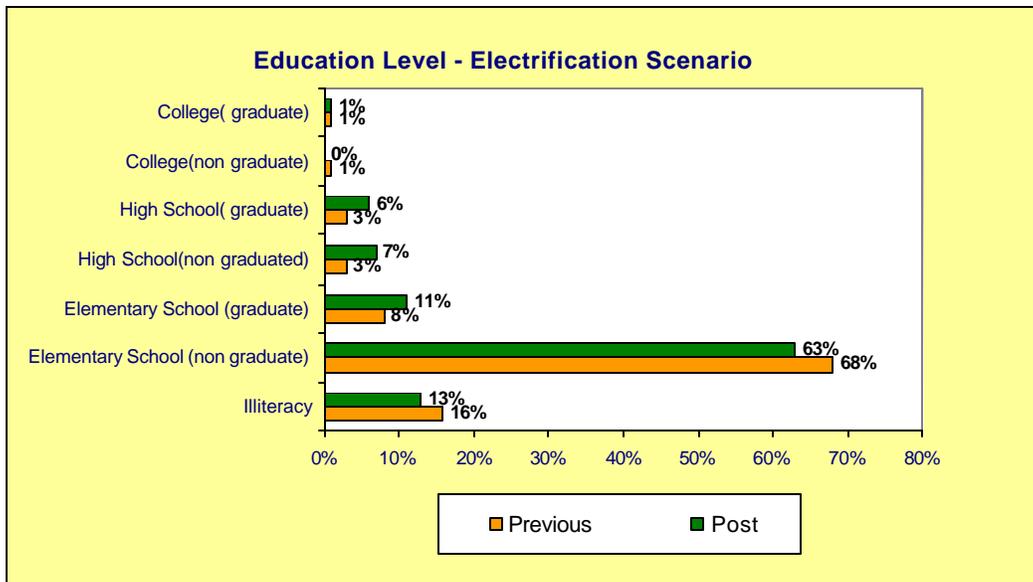


Chart 2 - Percentage Distribution Education Level

It is observed in *Chart 2* that most of the sample concentrates on the Non-Graduate Elementary school, presenting 68% in the previous phase, and 63% in the post phase. The data show that there was a slight decrease in the percentage of the illiterate, which came from 16% in the previous phase to 13% in the post phase, and an increase in the percentage of graduate primary school people, non-graduate high school people and graduate high school people from the previous phase to the post one, coming from 8% to 11%, from 3% to 7%, and from 3% to 6%, respectively. The total sample included 25,119 data in the previous phase and 25,207 in the post phase .

Basically, this analysis suggests that there was a relative improvement in education level of the sample surveyed over the phases. It is worth observing that it is necessary a longer time for the perception of the changes in this study.

## 5.2 NOURISHMENT CONDITION

A variety of safe and good-quality foods, and enough food guarantees a healthy living and appropriate nutrition, without which children and the youth cannot develop their potential fully, and the adult experience difficulties to maintain or improve their work and life conditions. This way, foods provide the necessary energy for the growth process, physical activities, and the basic body functions. The excess, lack or an inadequate balance of the different foods (unbalanced feeding) can contribute to a weakened health and increasing the risk of chronic illnesses. Good nutrition also depends on the appropriate conservation of foods we consume, and the preservation of their nutritional qualities.

About 790 million people (one out of five in the developing countries) are not provided with enough food yet to satisfy their daily nutritional needs. The world development has not benefited its population in general because, while some countries have made notable progress, in others hunger has increased, especially in those which already faced the severe difficulties to feed their population.

The Food and Agriculture Organization of the United Nations - FAO esteems that 840 million people in the world suffer extreme hunger.

In Brazil, malnutrition reaches 5% to 19% of the population – between 8,5 million and 32,3 million people. Similar situation takes place in countries such as Colombia, Ecuador, China, and Pakistan, where in proportion, the portion of the population which consume less than 2 thousand calories a day is similar to the Brazilian.

Therefore, the development model which reproduces and sustains the economic and social inequalities takes advantage of the predatory exploration of the natural and

human resources, influencing social and physical lifetime, leading to hunger and poverty.

In the evaluation of nourishment condition, in the survey, it was made the conversion of the foods consumed by the rural residents into calories and proteins. The average intake per capita of calories and proteins in each property on daily basis is compared with the average consumption per capita of calories and proteins on daily basis in the state as well as with the consumption recommended by FAO. This Organization determines that the average consumption per capita recommended of proteins is 53 grams/day as well as the minimum consumption recommended of calories is 1,900 cal/day.

*Charts 5 and 6* exhibit the average amounts of the daily consumption of calories and proteins - per capita and family – for the phases of the survey. In relation to the average consumption of calories, it is noticed that the amounts decreases from one phase to the other. In a similar way, the analysis of the average consumption per capita of proteins displays that the amounts decrease between the phases, being, however, above the value recommended by FAO, that is, 53 grams of proteins/day. The average consumption per family a day accompanied the variation of the per capita consumption, also presenting a reduction between the phases as to the calories and proteins amounts.

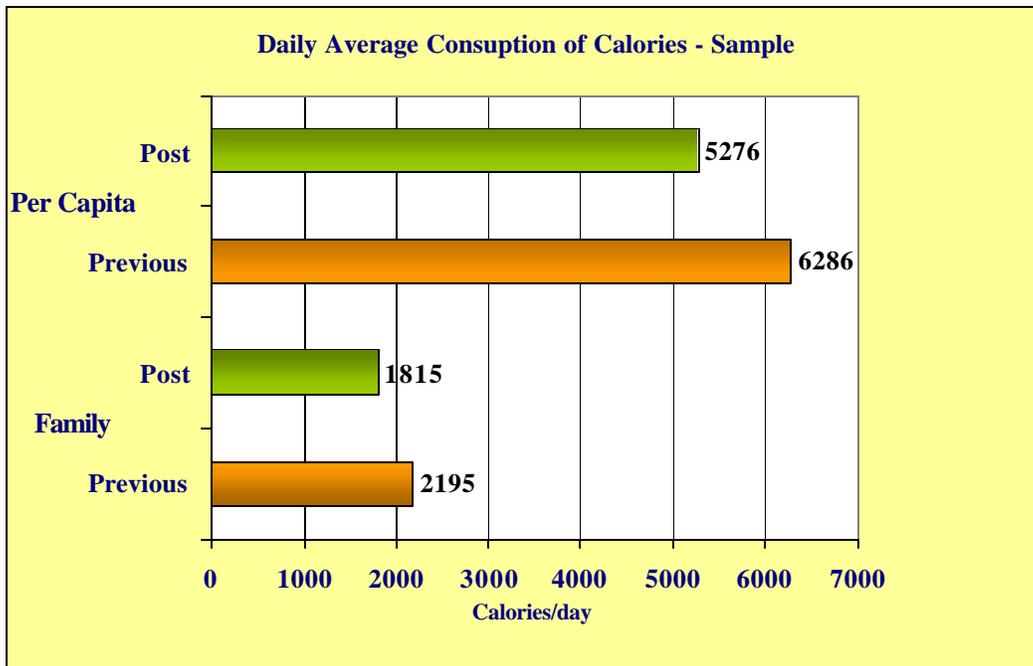


Chart 5 - Average Consumption of Calories Per Capita and Family Between The Phases - Sample

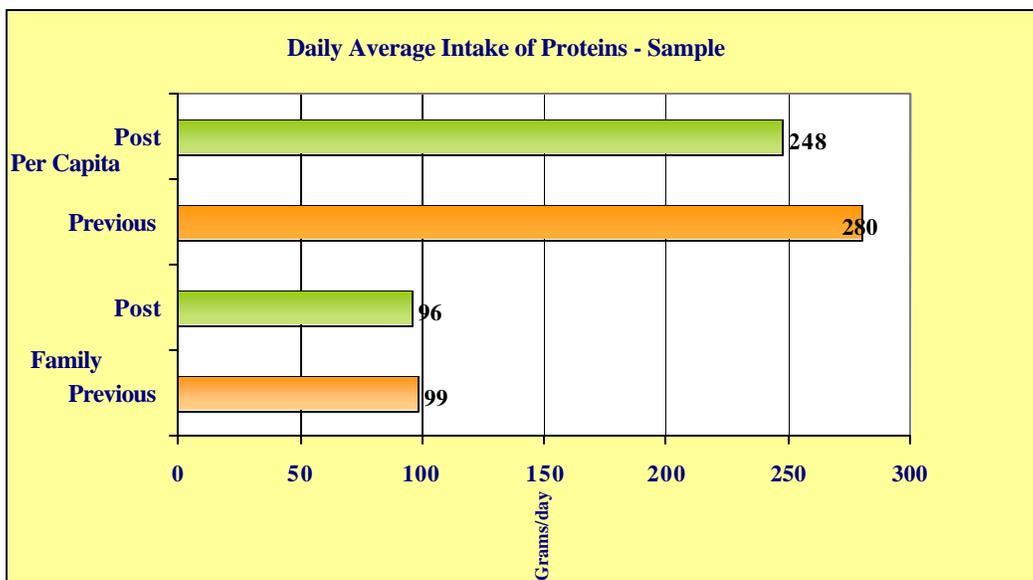


Chart 6 - Average Consumption of Proteins Per Capita and Family Between The Phases - Sample

In the light of the information presented on feeding for the sample, it is worth observing that in quantitative terms it is verified a drop of the average amounts between the

phases. Conversely, on qualitative terms, the continuous cooling, provided by the access to regular and safe energy, contributes directly to the reduction of health-related problems such as hypertension, considering that previously the meat foods were conditioned in salt or fat.

### **5.3 ECONOMIC APPROACH**

According to the rural electrification background, such project is not financially feasible. However, it is economically necessary to foster the development of the rural area, besides being socially desired. This sub-item bears as an objective evaluating the changes in the electrified rural properties regarding the economic variables of these properties. The outstanding variables in the field survey were: the family and per capita incomes, the percentage of people above the poverty line, the percentage of income expense on energy, and the valorization of land. Income is a traditional indicator of well-being of population. It is believed that, with the rural electrification, families can increase their productivity, generating an increment in terms of monetary earnings and, consequently, quality of life. Also, it is expected the benefit of electrification for the valorization of land to be direct, because the fact of being linked to the electricity net adds value to land, besides the modifications in the infrastructure of the area by means of the access to electric power.

### 5.3.1 INCOME

The generation of income is one of the main inductors of the balance in the rural areas, making it possible to maintain the indigenous population and to attract new people. This process results in the increase of the well-being level. It is expected that the access to energy serves as a development vector in the rural area, creating new opportunities and allowing for the permanence of the population in the countryside.

However, the income in the rural areas does not measure up to what is produced. The understanding of income varies from region to region and also in relation to the production form in the rural area.

As to *Table 1*, it can be observed that there was a slight reduction of the average family income in Brazil as in the regarded period, from US\$ 280 in the previous phase to US\$ 274 in the post phase. On the other hand, it was verified that the difference of the averages between the phases is not deemed statistically significant.

<b>Regions</b>	<b>Monthly Average Family Income</b>	
	<b>Previous</b>	<b>Post</b>
<b>Middle-west</b>	<b>\$404</b>	<b>\$368</b>
<b>Northeast</b>	<b>\$151</b>	<b>\$196</b>
<b>North</b>	<b>\$313</b>	<b>\$253</b>
<b>Southeast</b>	<b>\$340</b>	<b>\$295</b>
<b>South</b>	<b>\$296</b>	<b>\$328</b>
<b>BRAZIL</b>	<b>\$280</b>	<b>\$274</b>

*Table 1 - Monthly Average Family Income Between the Phases*

This result suggests that, in fact, the historical socioeconomic inequality in Brazil, in addition to being noticed between the rural and urban contexts, it is thoroughly

portrayed among their areas, being the North and the Northeast the areas which present the municipal districts with the worst Human Development Index - HDI.

As seen in *Table 1*, the average family income in the Northeast, in both phases, is much smaller than the average income in other areas.

This way, in spite of the analysis reflecting the Brazilian rural reality, it is important to highlight that there are regional differences which should be considered in the evaluation of the results. Areas differently developed respond in a different way to the benefit of the access to electric power.

Surveys indicate (Yang - 2003), that, if the goal is the economic development, the government should invest in communities with a good level of rural development. However, if the purpose is the reduction of poverty, the investments should prioritize the areas with a level of medium development so that it comes out with more effective results.

Drawing a parallel to the data previously presented, it shows that rural electrification denotes positive or negative modifications in the average family income in the states depending on other local characteristics.

Regarding the average per capita income in Brazil (*Table 2*), it is verified that it remains unaffected between the survey phases, at about US\$ 113. As for the information per areas, the only difference among the significant averages which is the variation of the average per capita income in the Northeast, that surpasses US\$ 59, in the previous phase, up to US\$ 75 in the post phase.

<b>Regions</b>	<b>Monthly Average Per capita Income</b>	
	<b>Previous</b>	<b>Post</b>
<b>Middle-west</b>	<b>\$194</b>	<b>\$165</b>
<b>Northeast</b>	<b>\$59</b>	<b>\$75</b>
<b>North</b>	<b>\$119</b>	<b>\$107</b>
<b>Southeast</b>	<b>\$133</b>	<b>\$124</b>
<b>South</b>	<b>\$101</b>	<b>\$124</b>
<b>BRAZIL</b>	<b>\$113</b>	<b>\$113</b>

*Table 2 - Monthly Per Capita Income Between the Phases*

With respect to the economic aspect in Brazil, it could be observed that there was not improvement regarding the average income. The average family income suffered a slight reduction, from US\$ 280 in the previous phase down to US\$ 274 in the post phase. The per capita income remained around US\$ 113 in both phases, and these differences are not significant. Despite this fact, it is observed that either the average family income or the average per capita income, in both phases, is above the minimum wage (US\$ 155) and the poverty line (US\$ 39), respectively.

Nevertheless, it is worth underscoring that the low income level observed, when compared with the necessary income to meet the basic vital needs (US\$ 770), suggests that the electric power was not enough until then to upgrade the local potentialities.

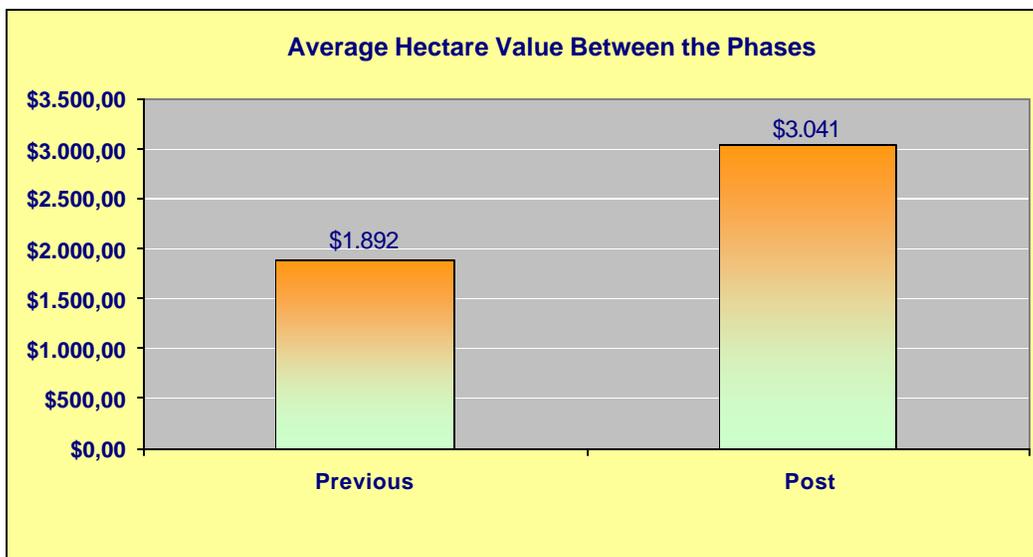
### **5.3.2 VALORIZATION OF LAND**

The great sociocultural and economic diversity in Brazil, as well as its immense proportions are reflected in the rural issue. On one hand, a rural Brazil exists where the capitalism is advanced, the agriculture is modern, and the agricultural production is run by rural companies which incorporate mechanization and technology. On the other

hand, a small-and-micro-properties Brazil is turned to the subsistence production. These differences are quite clear either among regions or inside the same State.

The rural electrification affects the technical and economic development directly in the rural area, making it possible to add value to land. The adoption of credit policies can allow for and facilitate the acquisition of lands on the part of the rural population of low income, thus contributing to reduce the social inequality.

The data analysis of the survey revealed a significant increase in the average value of the rural hectare between the previous and post phases, from US\$ 1,892 to US\$3,041.



*Chart 7 – Average Hectare Value Between the Phases*

As to *Chart 7*, the increase trend of the average value of the rural hectare is observed.

Starting with the presented analysis, it is verified that there was a valorization of the rural hectare, in real terms, of the electrified properties.

## **5.4 ELECTRICITY**

### **5.4.1 OWNERSHIP OF EQUIPMENT**

As mentioned, the arrival of electric power makes some means accessible and it accelerates the process of adoption of the urban habits, not meaning, however, that the urban pattern is better or worse than the rural one. Upon the information of the acquired equipment after the electrification, it can be foreseen the consumption practices adopted by the rural proprietors in case. This information can suggest a reasonable notion of the dynamics of the demand impelled by electrification.

The ownership of equipment is a very important indicator related to the level of economic development of the rural areas. However, the possible variations should be held as to the regions of the country. It is worth mentioning, for instance, the use of heater or air conditioner, which is relative to the climatic factor.

Some factors determine the predisposition to certain behaviors. The low level of income, for instance, limits the market penetration of electric rural equipment, which, in general, bears higher acquisition values than home appliances. Besides the income factor, others are necessary: credit readiness, technical know-how, consuming market, for example. So, taking into consideration the level of income, the rural families will acquire goods to improve their well-being, taking into account their respective order of priorities.

*Table 4* displays, on percentage basis, the rate of home appliances in the electrified rural properties, that is, the percentage of properties which possessed at least a certain home appliance in relation to the total of the properties of the sample in each phase of the survey.

Equipment	Percentage of Properties	
	Previous	Post
Television Set	29,6%	80,1%
Refrigerator	19,2%	73,5%
Stereo System	22,5%	52,7%
Blender	13,3%	51,9%
Satellite Dish	6%	47,8%
Electric Iron	15,0%	46%
Washing Machine	5,9%	34,3%
Computer	0%	0,1%

*Table 4 - Home Appliances - Market Penetration Rate*

According to the results of the previous phase, the home appliances mostly mentioned are television set, refrigerator, stereo system, electric iron, and blender. In the post phase most of the properties claimed to possess, after the electrification, television set, refrigerator, stereo system, and blender. It is worth citing an important participation of satellite dish in more than 40% of the properties interviewed.

One of the possible explanations for the participation of some home appliances in the previous phase, refers to the borrowed energy from electrified properties to the properties not electrified. As a result, it is possible that the rural families advance their acquisitions partially, considering the realistic chance of having access to electric power in a regular and safe way. Other possibilities refer to the use of a power generator run by diesel or even a battery-run generator as electric sources of energy, besides the fact that some of these pieces of equipment could directly use other sources such as the gas-run refrigerators.

It is worth alluding the transforming effect of the digital inclusion in a near future. In spite of the low market penetration of computers in the post phase, it is observed that it is not necessary to possess them. Computers can be used in schools, associations, and so forth.

Home appliances are related directly to comfort needs and consumers' well-being. Refrigerators can also be associated with the preservation of production goods, as well as vaccines. In the same way, some home appliances as electric iron and washing machine can be used for services rendered to third parties.

Table 5 allows for assessment, on the percentage basis, of electrified properties, the rate of market penetration of the electric rural equipment in the previous and post phases. Among the data, water pump is the equipment of the highest representativeness, with market penetration rate of 68% in the previous phase and 27,1% in the post phase. It is verified that the other electric rural pieces of equipment hold a low market penetration rate.

Equipment	Percentag of Properties	
	Previous	Post
Water Pump	6,8%	27,1%
Grain-Grinding Equipment	1,8%	4%
Cow-Milking Equipment	0,1%	0,3%
Industry Freezer	0,1%	0,2%

Table 5 - Electric Rural Equipment - Market Penetration Rate

According to the data of the field survey, it is clear to see a substantial increase in the demand for home appliances after the access to electric power. However, aside from the water pump, this behavior was not verified for the electric rural equipment. Such fact is due to the reduced time of electrification of the analyzed properties. The trend is that consumers first prefer to meet their comfort needs over the production ones.

It is still worth highlighting that, despite the rise of the market penetration rate of water pump, from the previous phase to the post phase, this equipment, most of the time, is of small size, being used to improve the household's water supply.

## 6. CONCLUSION

The discussion about the effectiveness of the social inclusion projects questions the high investments made in Brazil in this area and the achieved results in the last decades.

The effectiveness refers to the real impact of the action on the target population, and the criterion adopted in objective terms is before the measure of the quantitative change inbetween before and after the government intervention, and in subjective terms they are the behavior changes, the faiths and values of the rural population. In this sense, it is fundamental that the government institutions promote the evaluation of the effectiveness of their social investments so that the development of the country can reach a broader scope than the one of the purely economic questions.

The search of the sustainable development goes beyond the protection to environment. It includes the improvement of the quality of human being's life through the promotion of the rational use of natural resources, arriving at a timing should have their basic needs met and that they have opportunities to fulfill their aspirations to a better life.

This work approach tries to evaluate in a superficial way the changes in socioeconomic and energy conditions of the rural population benefited from the access to electric power, through rural electrification, in recent years.

The result allowed for the visualization and comparison of some aspects such as the access to education, health care, housing, and income. Undoubtedly there are many other perspectives which were not approached due to the overlooking nature of the present work.

In a wide and general way, it is possible to infer that there was a reasonable drop in the percentage of the illiteracy rate between the phases, as well as a slight increase in education level. Even showing a relative improvement, these pieces of information let

us observe how precarious it is the educational reality in the rural area in Brazil. And, considering that there is a narrow relationship between education level and socioeconomic development, it highlights the importance of government efforts aiming at better offer and improvement of the quality of teaching in the rural area.

In relation to the nourishment condition, a reduction was verified in the average consumption of calories and proteins between the former-previous and former-post phases. The average per capita consumption of calories for the former-previous phase was above the minimum established by FAO, but in the former-post phase, the consumption shown was below the limit determined by FAO.

With respect to the economic approach, a relative stability of family income could be observed. Also, it was observed that the per capita income remained practically unaffected in both periods. On the other hand, the percentage of properties with incomes above the poverty line presented a rise between the phases, indicating preliminarily that there was an improvement of socioeconomic conditions particularly for the poorest population.

Another result refers to the valorization of hectare, in real terms, of the electrified properties. It was verified an increase average value of hectare in the electrified sample. That result calls for caution because it shows that market quickly incorporates the benefit of electrification. However, such behavior can lead to a higher concentration of land possession. On the other hand, it values one of the few assets of rural population, if not, at least, the only asset they have.

As for the energy aspect, it was verified that was a high increase in the market penetration rate of home appliances. However, as to electric rural equipment, the water pump was the only asset which showed a significant increase in use. The home

appliances with higher market penetration rate were: television set, refrigerator, stereo system, blender, satellite dish, and electric iron.

It is interesting to emphasize that the electrified properties started to use energy in a more intensive way, suggesting that the electrification contributes directly to the improvement of the quality of life, especially when it is considered that it is necessary a minimum contribution of energy so that those families can make use of the benefits of a regular, reliable and clean source.

In spite of the rural electrification hardly being profitable from an entrepreneurial point of view, it produces strong positive consequences, that is, social benefits.

Several sectors of the rural and urban societies, the government sector, and the country's economic system have great advantages along with the universalization of the electric utility, mainly when connected with other components of the rural environment.

Finally, this work shows the importance of rural electrification over human, economic and social development including its impact across the rural communities' boundaries.

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