

## SOCIAL INNOVATION AND SUSTAINABILITY: CASE STUDIES IN THE USE OF ELECTRIC POWER IN UNDERPRIVILEGED COMMUNITIES IN BRAZILIAN NORTHEAST

FERNANDA GABRIELA FELDMAN BORGER<sup>1</sup>; BELMIRO N. JOÃO<sup>2</sup>; ICARO A. CUNHA<sup>1</sup>

<sup>1</sup> CATHOLIC UNIVERSITY OF SANTOS; <sup>2</sup> PONTIFICAL CATHOLIC UNIVERSITY OF SÃO PAULO

**Abstract** About 1.8 billion worldwide do not have access to electric power and 2.4 billion still use wood to cook. This paper is about the use of electric energy universalization plans by underprivileged communities in Brazil. The main objective is the creation of a sustainable model. A study was made of the legal aspects (universal access to electric power and regulations) as a necessary, but not sufficient condition for any development project to present systemic effectiveness and for the integration of the participation of the State, as a whole, together with the power sector, so as to make actions part of public policies. So public policies and social exclusion is the subject of this paper. The methodological procedures began with a research of the bibliography and documents, a survey carried out through semi-structured interviews and the study of cases. We consider underprivileged communities those that are isolated, that is, are not served by electric power services. The concept of sustainability adds to the dimension of social equity that of environmental sustainability, which is based on the double ethical requirement of synchronic solidarity with current generation and diachronic solidarity with future generation, demanding the use of multiple time and space scales. The projects in small communities involve their life cycle, which consists of different stages: start, planning, execution, control and closing. The qualification and role of leaderships in community projects is important in the scope of this paper. These were carried out in low income communities where the price of public services is often prohibitive. Indicators of underprivileged communities and of sustainable power development were used. This paper shows a trend for making power sector legislation more socially inclusive, particularly through the electric energy universalization of services. The management of the power problems that afflict the bottom of the pyramid involves elements that are relevant for developing countries and issues like sustainable development; clean and distributed energies; local knowledge and global reach; private companies with support and investment policies (public and private) to achieve scale are part of this agenda.

**Key words** social innovation, Bottom of the Pyramid, Electric Power sector, sustainability

### Introduction

In the whole world about 1.8 billion individuals do not have access to electricity and 2.4 billion still use wood to cook. This paper is about the universalization of the use of electric power by underprivileged communities in Brazil. New trends and business models, such as the bottom of the pyramid (BOP - *Bottom of the Pyramid*) by Prahalad [1], are altering the offer of products and services in general as well as the issue of social inclusion [2] through public services like electric power and innovative solutions such as micro *franchising* [3, 4] for the BOP. This concept of a business model is a new approach proposed by Prahalad and Hart [5]. According to the authors, the BOP segment provides a new context for corporate innovation, company strategies and the development of community organizations. Bruggmann and Prahalad [6] shows with the liberalization of markets is forcing executives and social activists to work together. They are developing new business models that will transform organizations and the lives of poor people everywhere. Ricart et al. [7] and London and Hart [8] extend the BOP model to transnational companies. Christensen et al. [9] shows the catalytic innovation for social change. The authors present these guidelines in how to identify social innovations worthy of your investment: look for evidence of existing catalytic innovators; identify specific catalytic innovations and assess prospective recipient's ability to implement the desired innovation.

The objective of this article is to identify, describe and analyze cases of provision of electric power distribution services in Brazil that present an organizational model and management practices that can meet the needs of the low income population with high quality and efficiency, as well as innovations introduced in these cases. The consumers' of low-income definition in the extent of the Law 10,438 includes all the consumers with a monthly consumption of up 80

kWh/month, registered in social programs and below certain defined regional limit for ANEEL (National Agency of Electric Power). The objective, furthermore, was to provide an understanding of the organizational trends and of the new business models applied to the provision of electric power distribution services for the poor, the critical factors for success as well as failure, and the lessons that can be learned from these experiences. Thus it will be possible to generate hypothesis about the alternative approaches to the provision of electric power distribution services for the poor.

The article has been divided into four parts, plus this introduction: first some concepts related to the BOP strategy will be reviewed, the experiences in which the model was applied, a brief characterization of the power distribution system and the organizations that have adopted models to attend the low income population. Then we will present a brief description of the methodology and, followed by the cases selected for a more thorough study that embody the organizational strategies adopted by distribution organizations to attend the low income population, adjusted to the reality and the social, economic and institutional context, and, finally, the conclusions.

### **1. The Business Model in the Bottom of the Pyramid (BOP)**

Bottom of the social and economic pyramid is the definition of the four billion individuals, in emerging countries, whose *per capita* yearly income is below E\$1,500 or US\$ 3,000 in PPP (Purchase Power Parity), a segment of the population that has become the target of companies and organizations not only for the provision of their consumer needs, but also as a new business opportunity [10].

According to Sachs [11], poverty, defined as lack of income, can be divided into three different levels: extreme poverty, moderate poverty and relative poverty. The World Bank defines extreme poverty [12] as the situation in which the income is less than US\$ 1 a day, measured in terms of purchase power parity. This means that families cannot satisfy their basic survival needs, are chronically hungry, without access to health, drinking water and sanitation, lack of access to education for some or all their children, live in a rudimentary shelter and do not have access to basic articles like clothes and shoes. Moderate poverty, defined as the situation in which the income ranges from US\$1 to US\$2 a day, refers to conditions in which the basic needs are satisfied, but with extreme difficulty. Relative poverty is defined by a family income level below a certain percentage of the average national income, meaning lack of access to goods and services that the middle class enjoys. Recently, researchers and managers have preferred to use the term "low income sector" (LIS) to refer to segments of the BOP market [13]. The Low Income sector includes persons in the condition of extreme or moderate poverty, and the main argument to include them is that they are not inserted in the market economy and do not benefit from economic growth. What characterizes the market is not so much the lack of income, but the lack of conditions to access goods and services. The population in the three segments of poverty (extreme, moderate and relative) do not have their needs satisfied in a significant way, as, for example, access to water and sanitation services, electricity and basic health services, many live in informal dwellings, without any formal title of property, depend on the informal market to get jobs and live in conditions of subsistence, being penalized for the conditions in which they live, that is, pay higher prices for basic goods and services than wealthier consumers, and frequently receive lower quality goods and services, so that they are incapable of escaping poverty.

In Brazil, the low income market totals 114.5 million, accounting for 65% of the population, but holding just 22.6% of the total family income, US\$ 171,585.3 million in PPP. About 86% of this sector (LIS) lives in urban areas [10] and not in rural areas.

The Bottom of the Pyramid business model – BOP – is seen as a promising approach for the reduction of poverty, because it addresses three fundamental factors: scale, permanence, and efficiency and efficacy. A more effective answer to global poverty requires the capacity of scale, an intervention that will affect not thousands, but millions of individuals; initiatives that can be implemented for generations, so they have to be lasting and permanent; and cannot depend, in the last instance, of finite resources and the attention of managers, in its political and bureaucratic process. The rapid growth in emerging economies cannot be sustained in the face of mounting environmental deterioration, poverty, and resource depletion [14]. Given the dimension of the problem and the scarcity of resources, an effective answer must also include the most productive allocation of these means. Empirically, industries and markets have shown the capacity to operate massively, in a permanent and efficient way [13].

The traditional form of increasing the consumption capacity of low income populations has been to offer free products and services according to the welfare model, through charity and social assistance, or through the supply of public goods and services. These solutions are not very effective, as they are not sustainable, making the production of these goods and services economically unfeasible and, when offered as public goods and services, generating market distortions and deficiencies – in the case of free products – which compromise their availability in the long term and the quality of goods and services. Lovins, Lovins e Hawken [15] coined the “natural capitalism” concept. Successful businesses in the new era of natural capitalism will realize that solutions lie in understanding the interconnectedness of problems, not in confronting them in isolation. Tightly correlate sustainability solutions with existing strategic goals and help top executives use sustainability to find best solutions for existing problems. Natural capital refers to the resources and services provided by nature. They are of enormous economic value - more so than the gross world product. Natural capitalism is a system of four interlinking principles, where business and environmental interests overlap, and in which businesses can better satisfy their customers' needs, increase profits and help solve environmental problems all at the same time.

The core of the market model for the BOP is the recognition of the low income population as private economic agents – consumers and producers – who make decisions in market transactions as the other segments do, and this behavior allows the operation of markets in the search of more efficiency, competition and inclusive solutions. This benefits the low income population through the creation of consumer capacity (with the sale of services that are compatible with the families' budgetary constraints) and allowing their insertion in the market economy. Prahalad and Hart [5] call market development with an attitude of dignity.

The business model for the BOP is a strategy that aims at the development of goods and services, orienting investments and innovations to improve the quality of life of the low income population with profitability, changing the dominant logic of management oriented to the Top of the Pyramid. In order to create consumption capacity it is necessary for products or services to meet three conditions: to be compatible with the payment capacity of the Low Income segment, to be accessible – delivered and distributed taking into account the conditions in which the LIS live and to be available when and where the LIS need them.

The concept of innovation describes a solution for a market problem and a new combination of factors in the organizational context. An innovation is not necessarily a technological innovation; it may be a new service or a new form of organization [16]. For an organization to serve the BOP the current business model must be innovative in order to alter the costs, the quality and the delivery standard of products and services [1].

The World Resource Institute's report [10] stresses the need to create value, allowing the LIS families to find their own path to escape poverty. The solutions involve the development of market efforts incorporating innovative corporate strategies such as the education of consumers; micro credit and oriented financing; crossed subsidies between the different income brackets; franchises or retail agents' strategies which can create jobs and expand income as well as partnerships with the public sector and with non-governmental organizations (NGOs).

Economy e Liberthal [17], for countries in development, cites the pollution in China has reached such epic proportions and offer suggestions for mitigating environment-related risks in four forms: lack of usable water, rising energy needs, soil erosion and, air and water pollution. Differently from Economy e Liberthal [17] authors as Prahalad [1] mentions successful experiences in many countries, particularly in India, and in different sectors. The E-Choupal system implemented in rural areas (agricultural) in several states of India by the ITC, one of the leading companies in India, with interests in agribusiness, is aimed at solving inefficiencies in the acquisition of grain in the government's markets. The Voxixa initiative in Peru has created a system to monitor the patterns of diseases, particularly in remote and mountainous regions where access to Internet or to computers is precarious. In Brazil, the most frequently mentioned experience in corporate models oriented to the low income population is that of Casas Bahia [1], the largest white line retail chain in the country, in which the LIS represent a large, profitable and sustainable market with a financial approach oriented to this bracket, taking into account the needs and the cash flow of low income clients. Among telecom companies, the most successful example was the introduction of the pre-paid system for mobile phones, through which a large share of the consumers can use and pay for the services.

The BOP model and market oriented strategies work more successfully in certain regions, particularly in India, and in some specific sectors, such as housing, agriculture, consumer goods, financial services and mobile telephony. On the other hand, not all sectors have been

able to attend the BOP by developing the market. The low income sectors differ around the world, and the differences involve cultural, social, educational, and political aspects, as well as legal and institutional aspects that influence actors and agents, organizational forms and the environment for the development of market oriented strategies. No model fits all segments, and this is the reason why it is important to understand the basic dynamic factors that affect the success of strategies and *benchmarking* of experiences. This paper presents an analysis of the electric power distribution sector in Brazil and how innovative strategies were developed to attend the Low Income segment.

In the section that follows the methodological aspects, the current situation of electric power services in Brazil will be presented in order to establish the institutional aspects that led certain entities to provide power services for the low income population, so as to adjust the BOP model to the Brazilian reality.

## **2. Methodology**

The execution of the research has been divided into two separate stages: the first consists in a bibliographical review followed by a survey of potential experiences. The preliminary research was based on consultations of the *web sites* of the companies to identify the strategies and organizations that could be selected and of interviews with experts on the development of innovative actions from the companies selected. The professionals interviewed have worked for the private and public sectors, and are now occupying management positions in their organizations. We have interviewed experts in R&D (Research and Development), Social Responsibility and Environment and Quality.

In the first stage of the research, an inventory was made of organizations with innovative approaches in their management model to attend the low income population through the offer of effective and high quality services. It was possible to identify relevant experiences and changes electric power distributors are implementing to face the challenge of providing services to the low income bracket. Out of this inventory two relevant experiences were selected to prepare the case studies in this research.

The second stage consisted of the collection of primary and secondary data for the development of the case studies[18]. Primary data was gathered through interviews in depth, including videoconferences, with key personnel, managers and administrators, observation and visits to the organizations, while the secondary data was collected from documents of the organizations. The Northeast area presents about 30% of the population of the country and the lowest per capita domestic consumption (262 kWh/cap in 1999). The people without access to electricity are located, in largest part, in the areas of smaller of Human Development Index and the families of low income. About 90% of these families have income inferior to three minimum wage and 80% are in the rural way. There is a close relationship between poverty and energy access in Brazil.

## **3. Case studies**

### **3.1 . Electric Power distribution sector.**

The electric power sector has undergone significant changes in recent years, particularly through the process of privatization of state-owned companies, the development of an electric power market and the creation of an agency to regulate the services. In their relationship with the government and the public power, the electric power concessionaires follow the guidelines and norms passed by ANEEL, the National Electric Power Agency (*Agência Nacional de Energia Elétrica*), created in 1996. The regulatory agency has the function of monitor and promotes the rights of users, guaranteeing that the provision of electric power services is based on parameters of equity, ethics, and defense of competition and guarantee of individual and collective rights.

Among the issues that are relevant to the sector, universal access and use of electric power services stands out, and the companies in the sector are responsible for creating conditions for the benefits of electric power to be available to all those who do not make use of the services yet and guarantee access to consumers independently of their payment capacity.

In a country of continental dimensions like Brazil, the electric power distribution sector has to adjust to the extreme diversity of the regions served – from a luxury condominium in the Santa Catarina sea coast to the shacks of a village in the margins of a river in the Amazon forest. Electric power distributors are currently responsible for the supply of over 40 million households, 4.5 million commercial establishments, 500,000 industrial establishments and almost 3 million rural clients. Electricity, an essential service for the population and the development of

production sectors, is received today in about 5,500 municipalities. Out of all the basic services provided to the Brazilian population, electric power distribution is the one that reaches the largest share of the population. According to the most recent data available at ANEEL, the National Electric Power Agency, 95% of Brazilian households are served. Nevertheless, 6 million Brazilians do not have access to electricity. The service is not provided mainly to the population whose monthly family income amounts to up to one minimum salary. In this bracket, 10.7% do not receive electric power in their homes. When the offer of other basic services is examined, we can see that life conditions in this bracket are even more precarious: 36.5% do not have access to treated water, 74.7% do not have adequate sewer collection and 69.3% do not have access to fix or mobile phone services. To give these Brazilians access to electric power means to guarantee minimum conditions for them to become citizens and enjoy the same rights enjoyed by other Brazilians. The issue of universal access involves making the service available through the expansion of the network and mainly through the provision of the service to the population adjusted to their payment capacity. Further, it is necessary to promote and guarantee the continuity of the service provision.

Several programs were created by the government to integrate the low income population. Rules were established to subsidize the payment for the service with rate discounts and social rates were instituted; these problems, however, did not become effective solutions, and are seen as political and bureaucratic difficulties for the market strategies of the concessionaires and especially as a risk for the financial results of companies. To guarantee profitability, the companies restricted the access to the services with reduced rates, underprivileged communities were left without the service and consumers resorted to solutions such as clandestine connections, with losses and risks for all involved, creating a vicious circle that results in losses for the community, for the companies and for society.

In this context, some companies, particularly those whose concession areas are in the poorer regions of the country (the Northeast region) and in large urban centers, where most of the underprivileged population is concentrated, living in slums or informal dwellings, forming a significant share of their consumer markets, were forced to seek new solutions to attend the Low Income segment.

The companies' strategy was to turn a legal obligation into new business opportunities, implementing the integration of their operational management and commercial processes with social actions in the community, allocating resources from programs aimed at increasing power effectiveness and investing in new technologies to serve the low income population.

ANEEL established that companies in the sector must invest 0.5% of the net operational revenue in programs to enhance effectiveness (better use energy performance in use) and 1% in Research and Development, and the companies invested these resources in the development of communities, joining efforts and synergies.

Case studies that reflect social innovation in the use of electric power in underprivileged communities in two Brazilian states located in the Northeast (Ceará and Bahia) will be presented in the next section

### **3.2 COELBA: Companhia de Eletricidade do Estado da Bahia**

Coelba was founded in 1960, controlled by the state government and supplies electric power to all the seats of municipalities in the state of Bahia. It was privatized in 1997. The company is controlled by the Neoenergia group, which also controls Celpe (Pernambuco) and Cosern (Rio Grande do Norte). In Brazil, it is the third largest electric power distributor in number of clients, and the largest concessionaire in the North and Northeast regions. The company is responsible for the supply of 60% of the total power consumed in Bahia. The power of Coelba is present in 415 municipalities in Bahia and it supplies over 13.5 million in a concession area of 563 thousand km<sup>2</sup>.

#### **3.2.1 Agent Coelba -Coelba Donation of refrigerators**

The project was launched in 1999, with the aim of reducing the distance between the company and the community and of making things easier for the members of the community through the company's commercial demand Agents. The proximity with the community led the relationship to evolve beyond the request of services, as the agents began to act as facilitators in the negotiation of debts for defaulted payments and in the regularization of clandestine connections. Under the program to aimed at making the use of electric power in underprivileged households more efficient, the replacement of internal lines by new ones and of incandescent lamps by more economical fluorescent lamps is usually carried out.

The Coelba Agent Project promotes the generation of jobs and income, employing annually 99 underprivileged young persons in the 17 to 21 age bracket. In 2006, the project received

investments that totaled R\$ 9,089,660.57. It attends 62 low income communities in the Metropolitan Area of Salvador, benefiting about 204 thousand households a year. The social initiative of the company led to the realization that the replacement of lamps and small improvements in the houses would not be enough to reduce power consumption, as the bad conditions of refrigerators in the households would not allow these consumers to pay regularly their light bills and they would soon be back in the irregular situation they were before.

The project to replace the refrigerators in a precarious state of conservation by more efficient ones in low income communities in the city of Salvador was created with the objective of reducing electric power consumption adjusting the consumption to the payment capacity of these populations.

The project also allows the withdrawal of Freon gas - CFC-R12 – preventing its release in the atmosphere and an adequate disposal of the foam used in the heat insulation of the refrigerators, thus fulfilling the commitment made by Brazil in the Montreal Protocol. The steel plates of the refrigerators are recycled. The sale of the steel provides resources to manage income generation projects in underprivileged communities. The company has already recycled 355,97 tons of steel plates and collected R\$ 300 thousand that were invested in a biscuit plant and a community vegetable garden for two cooperatives in the Moradas da Lagoa neighborhood in Salvador.

Additionally, the project is being analyzed to be included in the Clean Development Mechanism (Mecanismo de Desenvolvimento Limpo, MDL) and quantification of carbon credits. The revenue obtained with the sale of carbon will be invested in the acquisition of more efficient refrigerators and their distribution for the underprivileged population.

### 3.2.2 Results

72 thousand incandescent lamps were replaced by Economical Fluorescent Lamps of 15W, 13 W and 20W, 13 thousand refrigerators with the seal of the Electric Energy Conservation National Program (PROCEL) were distributed and 2 thousand precarious internal electric installations were substituted. In this project, 7,675 refrigerators were donated to low income consumers who live in underprivileged communities up to April 2007.

The reduction in power consumption of the consumers who received efficient refrigerators and lamps amounted to 42.9%. Multiplying 39.72 kWh (average consumption reduction) by 16 thousand clients we obtain a saving of 516 MWh/month.

Default rose 9.4% in the communities that received refrigerators, multiplying this percentage difference by the estimated revenue of R\$ 40/month relative to the clients who received a refrigerator up to September/2006, we have the value of R\$ 48,880/month. Table 1 shows the comparison of Payment Level rates of the communities that received the refrigerators with those that did not receive them and with the general rate of the company.

**Table 1: Payment Rate (September - 2006)**

General payment rate in all communities	76.9%
Payment rate of clients who “Did Not Receive” refrigerators in the communities benefited by the donation of refrigerators project	77.7%
Payment rate of clients who “Received” a refrigerators in the communities benefited by the donation of refrigerators project	87.1%

**Source: Research Data (2008)**

The collection from clients disconnected increased by R\$ 920 thousand in the period of June 2006, the debt of these disconnected clients was of R\$ 4.2 million and in September 2006 of R\$ 3.3 million.

The investment in the project in the 2006 and 2007 period was of R\$ 20 million. The reduction in power consumption of the consumers who received the refrigerators and also efficient lamps was of 28%, on average, and the payment rate grew to 90% in the benefited communities. Up to December 2008, the project had led to power savings of 10143 MWh/year.

For the consumer, the benefit is the reduction in consumption which results in a reduction in the light bills, and, consequently, a reduction in defaulted payments.

For the concessionaire, the donation of efficient equipment in the state of Bahia allowed a reduction in power demand in peak hours, delaying the need to invest in the power system, in addition to a closer relationship with the community. It promoted an improvement in the services provided by the concessionaire, with a reduction in disconnections and overload of the network and the promotion of equipment with the PROCEL seal for residential use.

The project also involved environmental benefits such as the reduction of the emission of gases R-22 and CFC-12 that affect the ozone layer, as the old refrigerators were destroyed.

The project involved the development of strategic partnerships with third sector entities and public agencies. The NGO "Coordenação para o Desenvolvimento e Morada Humana" (CDM) is responsible for the selection of individuals from the community benefited who are trained by Coelba to provide attendance to the members of the community. The Environment ministry which allowed the withdrawal of gases R-22 and CFC-12, through specialized machines. The state government that exempted the payment of a state tax (ICMS) the refrigerators, allowing the savings to be reinvested in the acquisition of new refrigerators. The Caixa Econômica Federal and the State of Bahia government through SEDUR (Urban Development Secretariat), which also registers the beneficiaries of their programs to participate in the donation of refrigerators project. The MDS – Social Development and Fight Against Hunger ministry which makes available the single Register (*Cadastro Unico*) of those who receive the benefit of "Bolsa Família" for these families to have priority in the donation of refrigerators, as long as they fulfill other pre-established criteria.

In 2008 a new project was launched by the Neoenergia group in partnership with Banco do Brasil. Through the Banco Popular, the project integrates the Energy Efficiency Annual Plans (Planos Anuais de Eficiência Energética) of concessionaires Coelba, in Bahia, Celpe, in Pernambuco, and Cosern, in Rio Grande do Norte. The project can be seen as an improvement of the refrigerator donation project, as these will be subsidized by the company and its partners.

Coelba is offering to its clients 30 thousand 252-liter efficient refrigerators with their Procel power saving seal. In order to make this partnership feasible, Coelba subsidizes with the Energy Efficiency Annual Plan's resources 70% of the value of the equipment, or R\$ 420,00, and the State Government, 10%, or, R\$ 60,00. The consumer will pay the remainder, R\$ 120,00 in cash, in other words, just 20% of the total value of the refrigerator.

This new stage of the project shows that there was an evolution in the program in which the low income consumers are seen as economic agents who can exercise their buyer and consumer decisions choosing options that are more efficient, responsible and adjusted to their budgetary restraints.

### **3.1. COELCE: Companhia Energética do Ceará**

Founded in 1971 and privatized in 1998, the company is controlled by the group Endesa, which also controls Ampla (Rio de Janeiro). Coelce is today the third largest distributor in the Brazilian Northeast in volume of power commercialized and responsible for the power supply for more than 2.5 million clients, out of who 2.0 million are residential consumers, and operates in 180 municipalities in the state of Ceará. The Company operates over 95 thousand kilometers of distribution and transmission lines.

#### **3.1.1. Program Ecoelce –Social Development for Power Consumed**

A survey carried out in 184 low income communities located in the Greater Fortaleza showed a strong relation between the low acquisitive power of part of the population and the large volume of solid residues improperly dumped in the environment. The survey also revealed that the low income communities visited presented high default and energy theft rates, leading to an increase in power losses and an inefficient use of power.

Faced with this reality, COELCE developed, in partnership with the University of Fortaleza (UNIFOR), the company KNBS Telecomunicações e Informática Ltda., and the garbage collect company, Organizações Gonçalves. within the Power Sector Research and Development Program, regulated by ANEEL, the Ecoelce Social Development for Power Consumed Program (Programa Coelce de Desenvolvimento Social pela Energia Consumida, ECOELCE), which allows the exchange of recyclable residues for discounts in the light bills of consumers. The pilot project was launched in 2006 for low income communities in Fortaleza.

With a R\$ 212 thousand investment in 2008, the program created 63 points for selective collection, 35 of the fixed and 28 mobile, in the municipalities of Fortaleza, Maracanaú, Maranguape, Caucaia, Farias Brito, Reritaba, Milagres, Sobral, Morada Nova, Campos Sales, Quixadá, Iguatu and Juazeiro do Norte.

The program is not limited to low income consumers, and has already reached 112 thousand clients, and collected R\$622,770.42 in bonuses. the consumers that do not belong to the low income segment can donate the bonus in their bills to charities that will receive them in their light bills. The main objective of the project is to give the population an alternative income source, giving liquidity to light bills and a reduction in default rates and clandestine connections. In order to take part in the program the client receives the ECOELCE Card, containing the

identification of his/her Consumer Unit. With the recyclable residues, the client goes to an authorized Collection Post which, through the Collecting Machine developed for the reception and transmission of data, registers the value of the bonus. The credits are then sent through GPRS to the Processing Center that processes the data and sends it to the COELCE Billing System for processing and register the credit in the client's light bill.

### 3.1.2 Results

ECOELCE has yielded a number of benefits such as income generation, environmental education, stimulus for the safe supply of electric power, reduction of residue treatment costs for the municipalities and of the volume of residue carried to sanitary dumps and, especially, the preservation of the environment.

The impact of the ECOELCE Program on clients, particularly those in low income communities, was significant. The clients benefited could see an improvement in their quality of life, both due to the reduction in the volume of solid residues in the urban environment and to the savings obtained with the collection of residues for the payment of their light bills.

In the initial stage of the operation, the program recorded cases of a reduction of over 90% or even the total liquidity in light bills, revealing the level of commitment of the population in actions for the reduction of pollution and environmental preservation. Through this initiative, the population was encouraged to strive for sustainable consumption, the efficient use of electric power and contributed significantly for the reduction of the environmental impact caused by solid residues.

Until 2008, the program had collected 4.7 tons of residues, saving energy to extract from nature the raw materials that would be needed to turn them into products. According to Calderoni [18], for each type of material recycled it is possible to obtain significant energy savings due to reprocessing. For this author, it is possible to assess the energy gain through the accounting of the amount of residues destined to recycling.

**Table 2- Ecoelce Results**

Residue	Energy Saved (Mwh/T)	Tons Recycled	Total Energy Saved (Gwh/2008**)
Metal	5.3	201.30	1.06
Glass	0.64	215.41	0.13
Paper	3.51	595.02	2.08
Plastic	5.06	263.35	1.33
Totals	---	1,275.08	4.6

Table 3 presents the results of the residues recycled and accrued values collected for 2007 and 2008:

**Table 3 – Residues Recycled**

Residue	Volume Until 2007 (Kg)	Value Collected Until 2007 (R\$)	Volume Until 2007 (Kg)	Value Collected Until 2007 (R\$)
Paper	419,688	39,532	2,031,27	153,717
Glass	114,434	13,329	777,192	40,539
Metals	466,792	60,185	1,069,83	219,016
Plastics	164,262	45,701	872,174	230,109
Kitchen oil	981	290	10,527	3,061
Carton packaging			1969	82
<b>TOTAL</b>	<b>1,166,15</b>	<b>159,037</b>	<b>4,762,97</b>	<b>646,523</b>

The data in the table show the positive variation of the results in volume and values collected in 2007 and 2008.

The company obtained significant results because it guaranteed investments and the continuity of services for the population benefited without compromising its revenues, since the payment of the bill is guaranteed by the material sent to recycling and paid by the recycling companies. From the economic point of view, the project is feasible and promoted the inclusion of the low income population, giving them conditions to pay the bills and obtaining significant



environmental results. The program innovated and generated value for the parties involved and is based on the sustainability tripod.

#### 4. Conclusion

The cases studied showed that the inclusion of the social and environmental dimension to corporate management can generate value for the companies. The two programs changed the standard of attendance of the Low Income segment, and was copied by other electric power companies in different regions. They cannot be seen as isolated initiatives to attend a specific community, but an innovative approach to attend the low income segment that is effective, efficient and permanent. Both companies are recognized as references to innovation, social responsibility and sustainability for both the energy electricity and for other Brazilian companies. From cases studies, and as a contribution, draw up a proposal for the use sustainable electricity in poor communities in Brazil: build solutions that are economically sustainable and socially fair, both for the present generation and for the future.

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