

Comparing effects and impacts of rural electrification on development in two South American Afro descendent communities

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Abstract

The effects and the impacts of electrification on the development of rural communities is analyzed in two Maroon Afro descendant communities in Brazil and in Suriname. The Saramaca maroon community of Brownsberg in Suriname was provided with grid electricity owing to a compensatory initiative, as this community had been displaced in order to build the Afobaka hydropower plant in central Suriname. The Kalunga Quilombo of Engenho II was provided with grid electricity as it was chosen to host the launch of the Light for All rural electrification program of the Brazilian Federal Government. There are several researches on the improvements that rural electrification has on the social development of communities. However, there is no research that analyses the effects and the impacts that electrification has on the social, economic, environmental, cultural and spatial dimensions of the development of Afro descendent communities

The research analyses these effects and impacts from the approach of sustainable development according to the vision of Ignacy Sachs and the vision of development as freedom from Amartya Sen. Methodological approaches have been developed and adapted from the visions of sustainable development of Sachs and development as freedom of Sen. The scientific relevance is in the multidimensional analyses and the method used in each community, adapted to its own characteristics and specific context.

The research was implemented with a quantitative and qualitative methodology and included the application of interviews, questionnaires, adaptation of the Battelle matrix and statistical software tools. The results show that in the Suriname communities with electrical energy there was an increase in income and infrastructure. The traditional authorities endorsed the positive side of the availability of electricity that is reflected in the development initiatives of the community of Brownsberg. In the Brazilian community youths returned to work in their community motivated by the presence of educational, health and communication services and income generation activities.

Keywords: Afro descendent communities, rural electrification, rural development, sustainability, Brazil, Suriname.

Introduction

Rural electrification for rural communities living in very remote areas is a challenge in South America. These rural communities are characterized by low electricity demands, wide dispersed households and difficulty in accessibility. This makes it difficult to implement rural electrification projects as it is not economically attractive.

Among these isolated communities, a special group is represented by the Maroon Afro

descendant in the hinterland of South America. They are descendants of enslaved Africans that were brought to South America in the colonial period in the 16th-19th century and managed to escape from slavery and oppression, seeking the most remote and isolated areas to re-create in freedom their ways of living and preserve their original culture.

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In this article, the cases of two Maroon Afro descendent communities are compared. The first case is a community of Saramacan Maroons in the hinterland of Suriname. The Saramacan Maroon community in the hinterland of Suriname were formed by runaway slaves in the 18th century and maintained themselves in a relatively isolated society until the second half of the 20th century. This relative isolation was broken when they had to be displaced because of the construction of a large hydropower plant that was to supply electricity for Suriname's national economy. The displaced maroon community was transferred to transmigration villages in 1964 where they lived for more than 30 years before they finally had access to reliable electricity service owing to a special rural electrification project in 1999 (Burnett, 2014).

The second case is a community of Kalunga Quilombolas in the hinterland of Brazil. The Kalunga are descendants of former slaves who worked in the mineral extraction phase of central Brazil in the 18th century ~~who run~~ and had run away and had taken refuge in this very remote and isolated area. The Kalunga formed an isolated society and is considered one of the major Quilombo areas in Brazil and only in the last 50 years they began interacting with the surrounding society. With the implementation of special public policies that would recognize and support the Brazilian Quilombos, a special rural electrification project was implemented in Kalunga territory in 2004 to mark the implementation of Brazil Rural Electrification Program "Light for All" (Echeverry, 2014).

This paper presents a comparative study of these two special communities. The two communities have been living for centuries in a relative isolation and were connected to the electricity grid owing to special public policies for rural electrification. It can be stated that they are an exception compared to other Maroon Afro-descendent communities in Brazil and Suriname, as most of them do not have access to electricity services.

The research has a specific scientific relevance and not generally because every process of development is unique.

Each development process has its own specific characteristics, although they are studied in two African descendent communities. The effects/impacts of the electrification process have to be evaluated by taking into consideration the sustainable development dimensions, especially its cultural dimension, and not as a standardized procedure that does not links technology to the context in which it is implemented.

The aim of the research is to determine the effects and impacts of electrification in the two communities-as well as to analyse to what extent the rural electrification has contributed to sustainable development of these communities in Suriname and Brazil.

Suriname and Brazil Afro-Descendent Community

In Brazil there are approximately 214,000 Quilombo families distributed in 1,948 Quilombo communities which are officially recognized by the Brazilian State. More than 75% of these families live in extreme poverty and their illiteracy rate is over 23%. The main productive activities developed by these descendants of slaves are agriculture, hunting and fishing (Seppir, 2012). The community studied is the Kalunga Engenho II village in the municipality of Cavalcante in the state of Goiás, located 27 km from the municipal town, and situated 311 km from the capital Brasilia in Brazil (Echeverry, 2014). Figure 1 shows the location of Cavalcante on the South American map.

The Republic of Suriname is situated on the North-eastern coast of South America, and has approximately 534,000 inhabitants. The population consists of a mixture of different ethnic groups, which is the result of colonial domination, and the Maroon community, which consists of 61,000 inhabitants live scattered in villages in the rural hinterland (Burnett, 2014). The second community is the Maroon Brownsveg village, a transmigrated conglomerate of 8 sub-villages, located in the district of Brokopondo and situated 96 km to the South of the capital of Paramaribo in Suriname. The location of Brownsveg village is shown on the map in Figure 1.



Figure 1. Map of Suriname and Brazil indicating the research area.

The Maroons in Brownsweg

The Saramaca Maroon is one of the major Maroon groups in Suriname with a population of around 35,000 people who live in several villages in the centre of Suriname. The village of Brownsweg, which is located in the Brokopondo district, was formed in 1964 when approximately 1,000 Maroons were displaced. They were directly affected by the construction of the Afobaka Hydropower dam and the associated lake of 156,000 ha., which is also in the Brokopondo district. The generated electricity was intended for the bauxite industry, whereas a smaller part is delivered to the government to meet the demand of urban coastal areas. The transmigrated Maroons did not only lose forestland as their only source of food and shelter, but also access to the river for their food, access to communications and transport, as since the sub villages of Brownsweg were no longer located along a river. They were not properly consulted in the formulation, implementation and evaluation of measures which affected them directly (Scholtens, 1994). Moreover, there were no facilities, nor was there any development in the transmigrated village.

The villages were provided with a diesel-based power supply system which generated electricity only some hours per day.

Only in 1977 an initiative was started to provide the villages with the electricity generated by the Afobaka Hydropower plant. The Brokopondo Rural Power Transmission and Distribution Project (BREP) was initiated in 1977, but was actually implemented in 1997 and delivered in 1999. The aim of the Brokopondo rural electrification project was to provide 7,000 estimated connections with a demand estimated in 1305 kVA, including 955 kVA for domestic use and 350 kVA for industrial use through a 35 km 33kV/12kV transmission line from the Afobaka Hydropower Station (Muntslag, 2006); (Burnett, 2014). The BREP connected the village of Brownsweg and other fifteen maroon villages to the central grid.

The fact that the transmigrated village of Brownsweg had waited for more than 35 years to get electricity services meant that the service was granted without a fee for the consumers in this village. Even without a legal status of the displaced people affected by the hydropower

plant, they are receiving this "de facto" special treatment by the government.

The Quilombolas in Engenho II

The Kalunga site is one of the largest Quilombo sites in Brazil and is situated in the state of Goiás and covers an area of 2,532,000 ha (BAIOCCHI, 1999). The Kalunga community has more than 6,000 inhabitants and the village of Engenho II has 371 inhabitants. Engenho II is the biggest village in the Kalunga site with 119 households, a community centre, a primary school for basic education and health centre (Echevery, 2014).

The universalization of access to electricity services in Brazil was introduced on the agenda of the electric sector in 2003 with the creation of the national rural electrification program "Light for All" (LFA).

This program was different than all the former rural electrification initiatives because it

introduced a mechanism to prioritize the provision of municipalities with a low Human Development Index (HDI) and populations that historically had been excluded from the process of rural electrification, such as people affected by dams, of rural settlements, extractivist communities, Amerindian and Quilombo communities.

In this context the Amerindian and Quilombo communities are the most difficult ones to be provided, due to the distance and isolation that they historically maintained with the urban centres. The official launch of the Light for All program was given in the villages of Engenho II in 2004 by the Brazilian President and 72 families were connected to the grid through the installation of a 15km 34.5kV transmission line, along with a corresponding low voltage distribution network.

The principal characteristics of the two villages are compared in Table 1.

Table 1. Comparison of Engenho II and Brownsweg

	Brownsweg (conglomerate)	Engenho II
Inhabitants	Approximately 3,100	371
Households	Approximately 693	119
Economics	Small-scale gold mining, and large-scale commercial forestry, shifting Cultivation/gardening, hunting, fishing, handicrafts, herbals and government transfer income.	Family farming, agro-extractivism, eco-tourism, craft production, government transfer income. Family income per capita less than half minimum wage (US\$112.54).
Social structure	The population of Brownsweg mainly consists of Saramacca Maroons with its traditional authorities. The traditional authority is recognized by the government but they are still without legal title to the (communal) land	Communal ownership of land and relations of solidarity. Community made up of descendants from Africans, Amerindians and Mestizos. They maintain cultural, subsistence and religious syncretism traditions. The Brazilian government recognizes the traditional community but they do not have the legal title to the land.
Basic services and infrastructure	Primary education, primary healthcare centre, access to television and radio channels and mobile cellular phone service. The village is located alongside an asphalt road. Water distribution.	Primary education, primary healthcare centre, mobile cellular phone service, internet access through communal LAN house, access to television and radio channels. Road without asphalt. Water distribution.

Source: (Muntslag, 2006); (ABS, 2012); (Echevery, 2014).

The two Maroon communities were provided by special rural electrification projects in the two countries within a special political trend. Literature shows that there is a tradition of supporting rural electrification programs both by international organizations and national governments depending on the trend in the political thinking of a given time. The state-led initiatives in the 1960's were succeeded by the liberalization policies in the 1990's when it was stated that market mechanism should be the driving force behind electrification expansion (Bhattacharyya, 2012; Cook, 2011).

Nowadays, the return of state intervention is gaining support to correct the market failure of the neoliberal model of the 1990's. The principle of universalization entered within the electrical sector legal framework as electricity service was considered a public service (Els et al., 2014).

There are several studies that analyse rural electrification initiatives within the broader context of rural development and sustainability. Bhattacharyya presents a methodology to assess different energy access technologies such as grid extension, off-grid solar home systems, off-grid electrification through local mini grids and other energy options considering five sustainability dimensions - technical, economic, social/ethical, environmental and institutional sustainability (Bhattacharyya, 2012). Van Els extends this discussion on decentralized generation with mini grids and states that in order to obtain sustainability of the projects it is necessary to change the paradigm from electrification to development (Els et al., 2012). This same approach will be applied in the next sections linking electrification with sustainable development.

Sustainable Development

The concept on sustainable development dates from 1980 when the World Commission on Environment and Development (WCED) created by the General Assembly of the United Nations in 1983 released a report named *Our Common Future* or the Brundtland Report in 1987 on common concerns, problems and efforts.

Before the Brundtland Report, the concept of development constitutes a progressive transformation of economy and society. At the time, development was usually related to

economic development with GNP growth as an indicator. In order to create a conciliating perspective between development and environment the notion of sustainable development was introduced (Bursztyn and Bursztyn, 2012).

Sustainable development is not only a strategy for social change but also a process of change in which the exploitation of resources, the directions of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations (WCED, 1987).

A crucial point within the development is the functioning of the institutions that are a significant part of the social capital (Loomis, 2000). Opportunities and prospects of societies depend on what institutions exist and how they function (Sen, 2000). Not only do institutions contribute to freedom, their roles can be evaluated considering their contributions to freedom.

The approach of Sen regarding development is interesting and applicable, because the provision of electricity significantly represents a social opportunity. Other social opportunities are healthcare, education, social security.

Sustainable Development then is a step beyond and involves guarantees for further generations or sustaining the freedoms of future generations. There are several definitions and visions/views but it is clear that striving for sustainable development is a major challenge (Rotmans, 2006).

The two approaches of sustainable development used in this paper respectively represent an ethical and a holistic view with its starting point in ecology. Both approaches connect with the principles of Brundtland but have their own regimes when it comes to the description of development. According to Sachs (Sach, 2004), one of the first authors to consider the synergy of development, the term Eco-development, for a given country or region, is endogenous development and depend on their possibilities and potentialities, in order to address the problem of the harmonization of social and economic objectives with ecologically prudent management of resources and the environment.

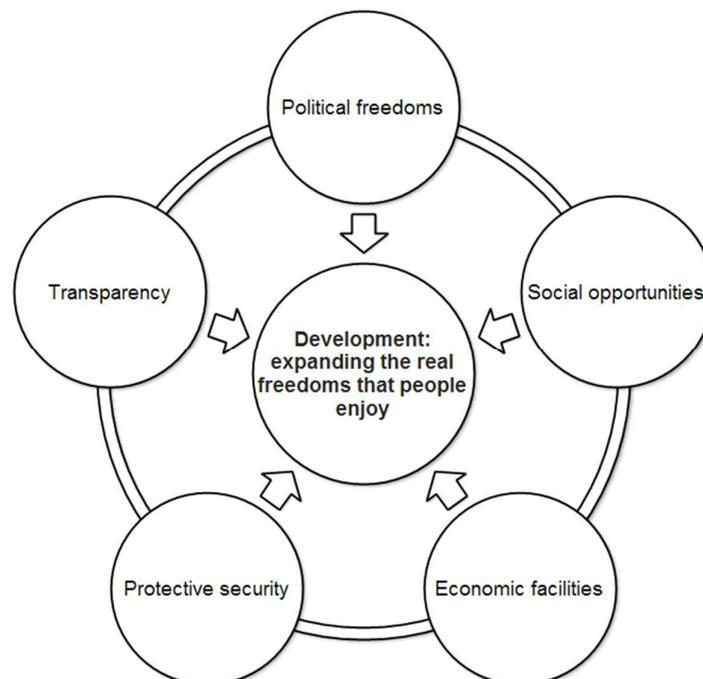
This concept considers five dimensions, which are:

- a) Social sustainability: significant reduction of social differences, including all material and non-material needs.
- b) Economic sustainability: economic efficiency, especially in terms of macro-social criteria.
- c) Ecological sustainability: Potential use of eco-systems, for their minimal deterioration.
- d) Spatial sustainability: balance between urban and rural.
- e) Cultural sustainability: Respect the specificities of each eco-system, culture and location.

On the other hand, Amartya Sen proposes an ethical concept of development with a freedom-oriented view. It is an integrated and interdependent view, where freedom is essential in the process of development. The first reason for considering this concept has an evaluative

character where progress is assessed in terms of whether human freedoms and capabilities are enhanced. The second reason deals with the effectiveness and relates to the fact that achievement of development is totally dependent on the free agency of people. Sen distinguishes between substantive freedoms and instrumental freedoms. The first set of freedoms involves both the processes of allowing freedom of actions and decision, as well as the actual opportunities that people have, given their personal and social circumstances. The second set of freedoms is linked to and contributes directly or indirectly to the overall freedom people have to live the way they would like to live. They include political freedoms (in the form of free speech and elections), economic facilities (in the form of opportunities for participation in trade and production), social opportunities (in the form of education and health facilities), transparency, and protective security (Sen, 2000).

The instrumental freedoms are illustrated in Figure 2.



Source: adapted from Sen (2000).

Figure 2. Instrumental freedoms for development according to Sen.

With this freedom-oriented modification, his concept of 'sustainable development' is transformed to development that prompts the capabilities of present people without compromising capabilities of future generations (Sen, 2013). It is about aiming at sustaining human freedoms rather than only aiming at the abilities of humans to fulfil their needs. The role of human beings as agents of change is far more significant than the role of consumers or people with needs

However, the freedom-oriented view comes with a social choice problem. It includes not only the determination of priorities between the different kinds of freedoms but also in the identification of different types of needs and the priorities between them (Sen, 2013).

Goals which society seeks to achieve or maximize are increases in real income per capita, improvements in health, educational achievements, access to resources, a fairer distribution of income, and increases in basic freedoms. Not only do institutions contribute to freedoms, their roles can be evaluated considering their contributions to freedom.

The approach of Sen regarding development is interesting and applicable, because the provision of electricity significantly represents a social opportunity. Other social opportunities are healthcare, education, social security. Sustainable Development then is a step beyond and involves guarantees for further generations or sustaining the freedoms of future generations. In this paper we will use this concept on sustainable development to compare the effects and impacts of the implementation of rural electrification on the selected communities.

Methodology

There are diverse methods to assess the effects or impacts of electrification projects which use qualitative, quantitative or mixed surveys. Some of these methods are ethnographic studies, comparison of socio-economic variables, activities and time allocation with relation to the presence of electricity, poverty aspects and perception of chances in the sustainable development dimensions and indicators system of socio environmental changes (Winter, 2008; Bernard, 2010; Brass et al, 2012; Burnett, 2014;

Echevery, 2014; Souza e Anjos, 2007; Souza e Brasil Junior, 2006).

The Battelle matrix is a technique (method) that permits the quantification of the impacts of an activity or project in a specific system, prioritizing the components according to its importance within the system. It is a method flexible to adaptation in a particular context and permits the assessment of diverse components (Dee et al, 1973).

In the present study, we choose to use the comparison of two villages, with the expectation of similarities in outcomes of effects or impact, no matter what method of evaluation is used. A mixed method of quantitative and qualitative research was done to assess the extent to which electrification contributed to sustainable development in the Afro descendent communities.

The research in Suriname is based on the comparison of periods before and after the 24-hour electricity service and consisted firstly of a survey with semi structured questions. It was done in two of the eight sub villages of Brownsweg to examine the effects of electricity. All eight sub-villages have homogenous characteristics regarding ethnicity and socio-economic circumstances. Since there was no sample frame available for the research area, a quota sample was chosen with a sample size of 40 respondents. The respondents had specific characteristics, namely that their house should be connected to the grid and that they were above 25 years of age. The themes to be examined were of social and economic nature namely social benefits, attitude towards electrification, basic knowledge of electricity, and reliability of electricity service. The questionnaires were processed by the statistical software SPSS 20.0. Secondly, four open interviews including one group interview with the traditional authorities and key informants of the Brownsweg village were done with the objective to get deeper insights into development issues of the Brownsweg village, its view on electrification and development as well as issues concerning consultation and involvement. There was also an open question submitted to the 40 respondents which aimed at assessing the overall effect of electricity on development.

The answers of the qualitative research were processed according to the methodology of Baarda and de Goede, which uses themes and labels (Baarda and de Goede, 2005). The theory of Sen served as the guideline for the themes of development to be examined while the guidelines set out in the International Labour Organization Convention No. 169 (ILO, 1989) were used for the themes of consultation and involvement. Finally, the themes examined were social opportunity, economic facility, institutional functioning, involvement in decision-making, own initiatives, appropriate procedures by government, representative institutions and opportunity of the local people to participate in the formulation, implementation and evaluation of measures and programmes which affect them directly.

In Brazil the research methodology was the combination of Battelle Matrix and specialist consultation. The Battelle Matrix is a technique originally designed for environmental impact assessments and was adapted for this research. The theory of sustainable development Sachs and development as freedom of Sen determined the five categories (dimensions), eight components and questions for interviews with experts, which in turn led to the proposal of 38 parameters or indicators.

The five categories or dimensions were: social, economic, environmental, cultural, and space. The eight components selected were: education, social organization and participation, public health, income, sanitation, culture, and land use and mobility and communication. The specialists were three professors from universities with knowledge of Afro-descendants' communities and rural electrification (academy); two leaders of the community (stakeholders); an employee of the municipality of Cavalcante (government); and teachers from the community school (local education). The data obtained from the content analysis defined 38 parameters used later in the form of questions of perception. The questionnaires were applied to a sample of 14 households in Engenho II. The perception was given on a scale of importance from 0 to 10 showing the importance of the changes associated with the presence of electricity. Moreover, the answers of the experts were used

to define the Weighted Importance Unit (WIU) of each parameter. This WIU is the relevance of each indicator in relation to the Kalunga development and the presence of electricity. Then, 1,000 points were distributed in categories from highest to lowest, distributed in social (500 WIU), economic (150 WIU), cultural (150 WIU), environmental (125 WIU) and spatial (75 WIU). The information obtained from the questionnaires was processed by the R statistical and Sphinx software. These results led to the average of responses in each five categories/dimensions and eight components and were processed in the adapted Battelle matrix to calculate the impacts (Echevery, Burnett, Diniz, & Els, 2014).

The impacts are calculated based on equation 1 (Delgado, 2000); (Kling, 2005):

$$EIU = \sum_{i=1}^N (EQ)_{ij} (PIU) \quad (1)$$

EUI = environmental unit impact for the alternative *j*

EQ = value of the environmental quality scale for the factor *i* and the alternative *j*

PIU = *WIU* = importance of the parameter unit for the factor *i*

Methodological approaches have been developed and adapted from the visions of sustainable development of Sachs and development as freedom of Sen.

Results and Discussion

The results of each community are given the continuation individually, and subsequently jointly.

Brownsveg

The quantitative research revealed that the respondents have a high rate of adoption of the electricity. All of the houses have electrical appliances that are mainly used for lighting (lamps), TV watching (television), the charging of mobile phones (charges), cooking (rice cookers), cooling (fans) and preserving (refrigerators and freezers). As in urban areas yearly consumption of electricity of Brownsveg is increasing, which could be related to the consumption pattern, most likely resulting from

increased incomes and improved infrastructure, and leading to the connection of the isolated areas with the urban areas. The productive uses at night and daytime suggest that electricity (radio and television) contributes to the personal development of the respondents. Positive attitudes towards the service also contributed to the rate of adoption. Both results assume that, within the social context of sustainable development, there is a continuous positive reflection with their own situation. When it comes to knowledge of electricity the respondents show no or limited knowledge, which may suggest that they have no interest in knowing or were not informed and educated about the service before receiving it. Within the context of sustainable development this could be a significant actor as well as the reliability of electricity. The latter proved to be a problem as the majority of respondents experienced regular power failure because of an overloaded electrical network. However, a solution for the power problems lies in the political context where there is a need for resolving the legal status of the consumers of Brownsveg as displaced people, and granting them special subsidised service (Burnett, 2014).

As Table 2 shows, the qualitative research exposed that the respondents prefer the freedom

from electricity as a social opportunity over the economic facility. The use and availability of electrical appliances provide better planning and management because of the 24-hour service. As a result, they have quality time and opportunities to study. The benefits of electricity for household management are appreciated more than the benefits in an economic sense. And as everything has its price, consequently expenses of household increase. The traditional authorities endorse the positive contribution of electricity to development, but emphasize increased institutional support as a means to maximize the effects. Likewise, the local development initiatives in the community need institutional support. These initiatives reflect a process of change, which is essential for sustainable development.

Reliability of electricity service is highly prioritized as well as the issue of consultation and involvement. As a representative institution the traditional authorities were not properly consulted in the Brokopondo Rural Power Transmission and Distribution Project and the local people, once again, just like during the transmigration period, could not participate in the formulation, implementation and evaluation of measures that affect them directly.

Table 2. Effects in Brownsveg

Category	Components	Parameters
Social	Education	Studying in the evening of young people and adults
		Literacy of young people and adults
	Public Health	Health Center
		Extension of medical services
		Conservation of food
	Personal well being	Alleviation of domestic chores
		Household planning
Quality time		
Economic	Income Expenditures	Knowledge of and attitude towards electricity
		Business opportunities and initiatives
		Reliability electricity service
		Institutional support
		Household expenditures
		Extended use of electrical equipment
Culture	Culture	Interests of young people
		Influence media on young people
		Leisure Activities
		Access of media (internet, radio, television)

Source: Burnett (2014).

Engenho II

According to the results of Battelle Matrix, in consultation with experts, not all dimensions of development have the same importance in an Afro descendent community. Thus, the social dimension has had greater relevance, followed by economic, cultural, environmental and spatial. Also, the results of the analysis indicate that with the Engenho II the impact was 539 IU. The perceptions of people who participated in the research on the impact caused by electric power service in the development in the community are presented in Table 3. In this table only the three main categories are shown, with their respective components and positive parameters more scored. It was observed that the biggest change was the first component of education, followed by health and income. It is possible to observe, for each of these three components mentioned, the parameters are more influential, in descending order.

With regard to the Cultural component, one can perceive a negative impact in the community, mainly due to a diminishing interest of older people to participate in the festivities due to noise pollution. It is important to clarify that in the research another negative component came to the fore, including with absolute values higher.

The energy impacts dimensions evaluated in order: social, economic, cultural, spatial and environmental. Relevant indicators are food preservation, which contributes to education, specifically in school meals; income on avoiding food waste and use of existing in the region, and in health, while avoiding the consumption of spoiled food. It was also mentioned on several occasions that there was access to the media, both in homes and at school. These were seen as tools that connect the community with other areas and with modernity, and as such they strengthen critical thinking and participation.

Table 3. Impacts in the Engenho II

Category	Components	Parameters	Score
Social	Education	Learning and use of equipment in the school	37
		School Supply	30
		Literacy of young people, adults and the elderly	17
	Social Organization and participation	Government Programs presents	15
		Youth participation in events	12
	Public Health	Management of the community's needs	8
		Health Center and resources	58
		Conservation of food	39
		Vaccination Programs for children and animals	27
	Economic	Income	Conservation of food
Products prepared with electrical equipment			25
Culture	Culture	Reduction of expenditure on products for lighting and power generation	28
		Media and culture	33
		Leisure activities and cultural evening	21
		Interest in traditional cultural activities	-1

Source: (Echeverry, 2014).

Table 4 shows that the inhabitants of the two villages experienced significant change in their lives when they received electricity. They benefitted from the electrification from the grid extension, which provided them with a 24-hour service. They experienced more freedom from electricity as a social opportunity. The use and availability of light and electric appliances provided better planning and management for

the households and the community infrastructure like health center, schools, agro-industry, LAN house, etc. As a result, they have more time to study, more work opportunities, access to more information on local, regional, national and international themes, which allows them to create a critical sense and the ability to participate in social and economic life.

Table 4. Comparison between communities according to vision of Sen

Instruments	Activity	Impact/effect Brownsweeg village	Impact/effect Engenho II village
Economic facilities	Participation in trade and production	Increased economic activities. Longer business hours of shops. Refueling at later time.	Preparation of products for sale and food preservation. Reduction of expenditure on products for lighting and power generation.
Social opportunities	Education and health services	Access TV and radio for more leisure time. Household management. Study opportunities at different periods of time. Improvement of medical service	Electrical equipment in the school. School supply. Literacy of young people, adults and the elderly. Health center and resources. Vaccination programs for children and animals. Media and culture. Leisure and cultural activities at night.
Political freedoms	Free expression and elections	The political process during the preparation of electrification project lacked transparency in terms of assessment and accountability	Opportunity to create a critical sense and the ability to participate in social and economic life

Source: Adapted from Burnett (2014) and Echevery (2014).

Conclusions

Infrastructures such as rural electrification constitute a freedom which is instrumental in the formation of social and economic opportunity for the relationship that they have with the generation of income, education, health, communication, mobility, and sanitation. The economy is streamlined because the sources of income are diversified, decreasing the dependence on income transfer programs of the government, from which many families are benefiting because of their situation of social and economic vulnerability.

In this way, rural electrification should be analysed on the basis of the losses in accordance with economic, environmental and social factors for the people that do not have them. The preservation of the cultural heritage of Afro

descendants, as well the environmental services provided by their own communities and the formation of social capital are at stake when these people are forced to leave their community due to the lack of this service. It can be stated that the Afro descendants' tradition has been strengthened and confidence in community management has been added, because electricity is a clear link to modernity for these excluded communities. It is a step in the direction of inclusion, on the part of the State, and the acquisition of citizenship and rights, on the part of the communities.

It can be concluded that the close relationship between rural electrification and development in traditional Afro descendants' communities is evident. However, the extent of the effects varies depending on the social, economic, and

political circumstances as well as the geographical location.

Therefore, rural electrification can act as a facilitator for development. In the community Engenho II, endogenous changes were identified, based on exploiting capabilities and leveraging opportunities through the use of own local resources and the formation of social capital. The income of the majority of the Kalunga families comes from agricultural activities and governmental income transfer programs. However, the results of the research in Engenho II showed that the rural electricity expanded income, by aggregating value to local products and services in the region, development of handicrafts, as well as ecotourism. Electricity in households goes far beyond lighting and the use of small appliances. It allows the realization of economic activities. In Engenho II a lot of the youth that had left the community returned after having worked abroad or having finished their studies, owing to the presence of educational, health or communication services. In this community there is a process of endogenous changes with strengthening of opportunities through the access to services and the use of their own resources.

In the case of Brownsweg it can be concluded that rural electrification has also proven to be a significant factor for sustainable development. Transmigration had a huge impact on the Saramaka Maroon communities, making the arrival of grid electricity a very memorable event. Although no generalizations could be made, the outcome would probably be the same given the homogenous nature of the sub villages of Brownsweg. There is a high rate of adoption resulting in increased electricity consumption like in urban areas. According to the research, electrification as a social opportunity is preferred over the economic facility that it can create. However, the reliability appears to be as a constraint. The traditional authorities recognize the positive effects of electricity on development, but emphasize the need for more institutional and government support and consultation regarding the implementation of these kind of projects.

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