


CHAPTER 126

Study of energy alternatives based on renewable generation sources for the electrification of isolated systems in the Amazon

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ABSTRACT

The electric sector in the Amazon needs to diversify fossil fuel supply sources, as well as encourage the use of renewable energy sources, so the project carried out a critical study of energy generation sources and their use to ensure the supply of electricity from an environmentally sustainable way to electrify isolated systems in the Amazon. From this, an art study was carried out on the main sources of renewable energy used in Brazil and the Amazon, characterizing the current costs of electricity generation in these isolated communities, with this it became evident that for these systems the sources of renewable energy generation most viable according to the cost analysis carried out in this work are solar and biomass.

Keywords: Amazon, Biomass, Renewable Energies, Isolated Systems, Solar Photovoltaic System.

1 INTRODUCTION

The current Brazilian energy matrix is favorable to the use of renewable sources, but still has in large majority the presence and dependence of resources from fossil fuels, mainly in the isolated systems of the Amazon where the costs of transport and fuel are very high. In these isolated systems, in some cases, the energy distribution services are precarious or even non-existent.

The north of the country is home to a huge number of non-electrified communities, with different sociocultural and geographical characteristics. Due to the immense territorial dispersion, energy distribution in the interior of the Amazon is generally considered unfeasible by concessionaires due to the extensive networks composed of kilometers of wires and several poles to serve a very small number of residents (FREITAS; SANTOS; CASTRO, 2019).

In November 2003, the Federal Government launched the “Light for All” Program (PLT) with the objective of universalizing access to electricity throughout the country. Since the publication of Decree No. 4,873, of November 11, 2003, and its extension from 2015 to 2018, the program has already made investments that exceed 22.7 billion reais. About 15.5 million people have already been served throughout

the country. (FREITAS; SANTOS; CASTRO, 2019).

Access to electricity can facilitate the integration of isolated communities to public services and social programs. It is also expected that it will be possible to improve water supply, health services, education, as well as allow access to household appliances and equipment to support rural production (FREITAS; SANTOS; CASTRO, 2019).

Promising renewable sources such as wind energy, photovoltaics and biomass have currently stood out in power generation. Among them, biomass has been indicated as an alternative capable of reversing the “scenario without light” in the Brazilian Amazon. Biomass is any renewable resource derived from organic matter (of animal or vegetable origin), by-product of agricultural, rural, forestry, agro-industrial activities, such as husks, sugarcane bagasse, rice straw, sawmill residues, food residues, poultry, swine and cattle, whey, remains of oilseeds used for oil extraction, which can be used as fuel. It is available in large quantities on farms, does not require transport, is low cost and can be operated in individual systems. The option to use biomass, in a rational and sustainable way, in the Amazon, values the standing forest and, therefore, contributes to its conservation .

Another very promising alternative is the use of energy from photovoltaic panels, given the great potential for solar incidence in the Amazon region, as well as the low maintenance costs of these systems and the minimum environmental impact caused in these communities. however, they require a high initial investment and depend on the seasonality of the region, so the adoption of hybrid systems such as biomass-fuels or solar-fuels will be good alternatives and can meet the demands of these systems efficiently and safely.

Therefore, the general objective of this work is to carry out a study of energy alternatives based on renewable generation sources for electrification in isolated systems in the Amazon.

The place of analysis will be the isolated systems of the Amazon, characterized by riverside communities, indigenous areas and quilombola communities and conservation units that are not served by the National Interconnected System (SIN). Bibliographic researches were carried out in books, articles, monographs, theses, manuals, catalogs and magazines published in the last five years and that are relevant to deepening the subject under study and collecting data and information relevant to the work.

2 MATERIALS AND METHODS

The research project is characterized by the realization of a state of the art on energy generation for the electrification of isolated systems in the Amazon, as well as the execution of analyzes of energy alternatives that can be used to meet the needs of these communities. The place of analysis was the isolated systems of the Amazon, characterized by riverside communities, indigenous areas and quilombola communities, in addition to conservation units that are not served by the National Interconnected System (SIN).

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Based on these bibliographic researches, the identification and mapping of isolated systems in the Amazon was carried out. Featuring its current ways of generating electricity . And with this mapping , a study of the potential of these isolated systems is carried out to determine which source of renewable energy is most appropriate to meet the energy demands of these regions. It was determined that the renewable energies that best fit these regions were Photovoltaic and Biomass Energy, with this a survey of the costs of implementing these renewable sources in the isolated systems identified was carried out. Finally, a study of the environmental and socioeconomic impacts was carried out after electrification in these communities.

3 RESULTS

Based on the results obtained from the research, two tables were created referring to the cost of implementing such energies in communities in isolated systems in the Amazon:

Table 1. Concerning the costs of a biomass system for a 1 kW gasifier.

INVESTIMENTO		
Descrição	Qtd	Total
Grupo Gerador 2KVA à Gasolina monofásico (Frete Incluso)	1	R\$ 3.325,15
Microventilador 138/127W	1	R\$ 309,00
Bateria Estacionária 150 ah	2	R\$ 1.786,00
Bomba d'água 12vdc/48W	1	R\$ 220,00
Carregador de bateria	1	R\$ 378,00
Área coberta com piso para GG e Biogás	1	R\$ 1.500,00
Biogás (Reator, Sistema de lavagem, Tubulação, dep. Água, Extrator de Cinzas)	1	R\$ 7.000,00
TOTAL (Investimento) = R\$ 14.518,15		
MANUTENÇÃO		
Descrição	Qtd	Total
Visita do técnico (manutenção elétrica) duas vezes ao ano	1	R\$ 500,00
Transporte de Ida/Volta Belém-Tucuruí	2	R\$ 283,52
TOTAL (Manutenção) = R\$ 783,52		
COMBUSTÍVEL		
Gasolina (0,3 l/h)	-	R\$ 894,24
TOTAL (Combustível) = R\$ 894,24		
TOTAL (Geral) = R\$ 16.195,91		

Source: Adapted from BRAZILIAN, 2017

Table 2. Regarding the costs of a 275 Wp Photovoltaic system .

INVESTIMENTO			
Descrição	Qtd	Preço	Total
Módulo FV Yingli 275Wp	2	R\$ 759,00	R\$ 1.518,00
Controlador MPPT Epsolar 20 A 12/24V	1	R\$ 589,00	R\$ 589,00
Inversor Xander Xpower 1500W	1	R\$ 1.399,00	R\$ 1.399,00
Baterias de 220 Ah	6	R\$ 1.289,00	R\$ 7.734,00
Estrutura de Fixação/p2 módulos	1	R\$ 500,00	R\$ 500,00
material Elétrico	1	R\$ 400,00	R\$ 400,00
Projeto	1	R\$ 400,00	R\$ 400,00
Instalação	1	R\$ 1.600,00	R\$ 1.600,00
Frete para Baterias	-	R\$ 1.600,00	R\$ 1.600,00
Frete para Módulos, Controlador e Inversor	-	R\$ 800,00	R\$ 800,00
TOTAL (Investimento) = R\$ 16.540,00			
MANUTENÇÃO			
Descrição	Qtd	Preço	Total
Visita do técnico (Manutenção elétrica) duas vezes ao ano	1 Técnico	R\$ 250,00	R\$ 500,00
Transporte de ônibus Ida/Volta Belém - Tucuruí	4 Passageiros	R\$ 70,88	R\$ 283,52
TOTAL (MANUTENÇÃO) = R\$ 783,52			
TOTAL (Geral) = R\$ 17.323,52			

Source: Adapted from BRAZILIAN, 2017

4 CONCLUSION

According to the research carried out, it can be concluded that the most viable alternatives for the electrification of isolated systems in the Amazon are solar photovoltaic energy, a clean source with availability of solar radiation throughout the day and good efficiency, as well as biomass, which is a source renewable resource that can be generated through the community's own agricultural activities and does not cause major environmental impacts, in addition to hybrid systems that are safer and more stable as they do not depend on seasonality and local climate.

The electrification of isolated systems in the Amazon through renewable sources is extremely important because it generates more employment and income opportunities, improves education and health, in addition to providing a more dignified life to the population of these communities.

These energy sources do not strongly harm the environment and generate sustainability since the residents of these regions can use the residues of their agricultural productions to generate energy, for example.

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