POTENTIAL FOR ELECTRICITY GENERATION FROM BIOMASS WASTE IN BRAZILIAN ISOLATED SYSTEMS

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Brazil has a vast transmission network that connects electricity power supply to load, the so-called National Interconnected System (*SIN* in Portuguese, *Sistema Interligado Nacional*). However, according to EPE (The Energy Research Office in Portuguese, *Empresa de Pesquisa Energética*) there are 251 locations that are not linked to the *SIN*, for technical or economic reasons; they are the Isolated Systems (*SISOL* in Portuguese, *Sistemas Isolados*), which are concentrated in the states of the Legal Amazon region and in Pernambuco state (Fernando de Noronha island). To guarantee the power supply, each location has a thermoelectric plant, provided mainly by diesel fuel. *EPE* estimates that in 2018 there was a consumption of 800,000 m^3 of diesel oil to supply these locations, resulting in direct emissions of around 2.1 $MtCO_2$. It is important to note there, besides such isolated locations fueled with diesel oil, there are around 990 thousand people in the region with no electricity access at all .

In addition to the huge existing energy potential - strategic for distributed generation – sustainable management for forestry production, as well as the use of the several biomass wastes available, have well-known environmental, economic and social advantages. Waste conversion to energy can reduce methane emissions; such emissions result from the decomposition of organic matter in biomass from different sources (forestry, urban waste, animal waste and agro-industrial waste), as well as contribute to avoid emissions by replacing the current use of diesel oil in electricity generation in isolated systems.

In this context, it is important to identify the potential for the use of renewable sources in these isolated systems, specifically bioenergy resources, considering the universe of the 251 isolated systems and the basis of *EPE* studies, mapping the renewable resources available in each location, and pointing out technical, economic and socio-environmental challenges in the use of these resources, as well as proposing solutions.

This research evaluated the potential for generating electricity from forestry wood wastes (sawmills and forestry management), urban (wastewater treatment plant - WWTP and municipal solid waste - MSW), animal (cattle, swine, poultry and buffalo) and agricultural wastes (corn, coffee, soybean, *açai*, rice, banana, cassava, orange, lemon, beans, coconut and sugar cane) in the Amazon region to meet the demand for electricity in the isolated systems considered. Table 1 presents the potential for electricity generation from the selected wastes, consolidated by each Brazilian state having isolated systems, as well as the total available electric energy and the potential to meet the energy demand in relation to the total load forecasted for the year 2023.

In this way, it is expected that the results obtained from this research will contribute to the development on a larger scale of the energy use of waste to meet the demand for electricity in the Brazilian isolated systems and, consequently, in the renewability of its electricity mix with the consequent reduction of greenhouse gas emissions, since fossil fuels used in energy generation will be replaced in locations that are not connected to the *SIN*, in addition to guaranteeing the power supply in the studied communities.

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Table 1 - Potential for electricity generation from biomass wastes, by Brazilian states that have isolated systems.

State	MSW - Organic Fraction	MSW - Gasification	WWTP	Animal Wastes	Agricultural Wastes	Sawmill Wastes	Forestry Management Wastes (branches)	Main raw material	TOTAL potential for electricity generation (MWh/year)	Scenario for load in 2023 (MWh)	Potential to guarantee 2023 load
Acre	8,218	30,630	1,668	61,473	124,918	0	0	Agricultural Wastes	226,907	261,246	87%
Amazonas	69,177	252,063	14,861	222,925	424,187	10,498	184,472	Agricultural Wastes	1,178,182	2,055,186	57%
Amapá	14,853	47,710	5,026	22,100	28,228	46,924	110,410	Forestry Management Wastes (branches)	275,252	64,501	427%
Mato Grosso	1,271	4,739	317	95,644	15,266	0	0	Animal Wastes	117,238	0	Interconnected
Pará	86,073	277,568	18,250	188,762	253,447	76,508	305,930	Forestry Management Wastes (branches)	1,206,539	291,791	413%
Pernambuco	127	473	27	11	0	0	0	MSW - Gasification	637	25,971	2%
Rondônia	25,851	85,411	6,613	808,491	467,395	0	0	Animal Wastes	1,393,761	14,389	9,686%
Roraima	17,133	55,891	4,726	108,580	233,520	0	0	Agricultural Wastes	419,851	1,538,935	27%
Total	**222,702**	**754,485**	**51,488**	**1,507,987**	**1,546,962**	**133,930**	**600,812**	-	**4,818,367**	**4,252,019**	-

Source: Own elaboration (2022).