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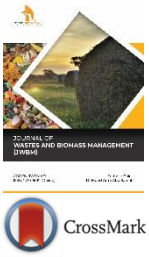

REVIEW ARTICLE

LINEAR DISTANCE ANALYSIS OF BIOMASS PRODUCTION IN ABUJA MUNICIPAL AREA COUNCIL (AMAC) ABUJA, NIGERIA

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ABSTRACT

The production of biomass is an assessment of organic matter used as fuel or electricity generation. Site suitability for biomass facilities encompasses a wide range of considerations. Environmental factors play a significant role, as the availability and quality of biomass feedstock are critical for the operation and viability of such facilities. The assessment involves evaluating the quantity and accessibility of biomass resources in the surrounding area, taking into account factors such as forestry practices, crop yields, waste management practices, and the potential for sustainable biomass production. Additionally, the assessment considers the environmental impacts associated with biomass sourcing, such as land use changes, impacts on ecosystems and biodiversity, and the carbon footprint of the facility. The biomass production was obtained once a month and once annually with the total capacity of 37.5% which is enough to generate or conduct electricity in some part of the Abuja. Biomass production in Abuja Municipal Area Council (AMAC) has been analyzed to provided high per capita generation of 33.33%, and production pollutants with 37,5%, while increase in pathogens with 25%. Biomass production is capital intensive, therefore government should play vital role in investing on the massive production of alternative energy for the growth and development.

KEYWORDS

Biomass, Organic matter, Biodiversity, sustainability, electricity

1. INTRODUCTION

Assessing the availability and suitability of land for biomass facility establishment is essential. This involves evaluating factors such as land ownership, land tenure, land access, and land-use regulations (Arome and Ejaro, 2012). The site should have adequate land area to accommodate the biomass facility infrastructure, including processing units, storage facilities, and other necessary infrastructure. Additionally, the land should be suitable for biomass cultivation, if applicable, considering factors such as soil quality, topography, drainage, and nutrient availability (Sarigiannis et al., 2014).

Land Use Planning and Zoning Consideration of land use planning and zoning regulations is critical to ensure compliance with local, regional, and national guidelines. It is important to evaluate if the proposed biomass facility location aligns with the designated land use category and zoning restrictions (Riebsame et al., 1994). Compliance with these regulations helps avoid conflicts with existing land uses, protects environmentally sensitive areas, and ensures compatibility with surrounding land uses (Long and Qu, 2018).

Biodiversity and ecological impact of biomass facility operations on biodiversity and ecosystems is essential (Guo et al., 2012). This involves considering the presence of protected areas, endangered species, and ecologically sensitive habitats in the vicinity of the proposed site. Evaluating the potential direct and indirect impacts on flora and fauna, as well as ecosystem services, helps minimize adverse effects and preserve biodiversity (Cincotta et al., 2000).

Preventing deforestation and minimizing land conversion for biomass cultivation are key considerations for sustainable biomass facilities (Triebel and Damm, 2008). It is important to ensure that biomass feedstock is sourced from sustainable forestry practices, energy crops cultivated on marginal lands, or agricultural residues that do not contribute to deforestation or the conversion of natural ecosystems (Fonji and Taff, 2014).

Considering land conservation and restoration efforts is crucial in promoting sustainable land use practices (Adisa, 2012). Assessing the potential for reclamation and reforestation of degraded or previously utilized lands can contribute to the ecological restoration of the site and surrounding areas (Ayodele et al., 2018). These efforts can help offset any negative land-use impacts associated with the biomass facility and contribute to overall landscape and ecosystem sustainability (Bergeron, 2014).

Addressing land-use conflicts and involving relevant stakeholders in decision-making processes are important considerations (Pojasek, 2003). Engaging with local communities, indigenous groups, and other stakeholders helps identify and address concerns related to land use and land cover changes (Kabir, 2018). It fosters transparency, social acceptance, and ensures that the biomass facility's location aligns with the aspirations and needs of the local community (Sarigiannis et al., 2014) .

Considering sustainable land management practices is essential to mitigate adverse land-use impacts (Vaccari et al., 2019). This involves promoting responsible land-use practices, including soil conservation, erosion control, and Agroforestry approaches where applicable (Azeez et al., 2016). Implementing best practices for land management helps minimize soil degradation, improve soil fertility, and promote long-term

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sustainability of the land (Grimm et al., 2008).

Through the emphasis of land use and land cover considerations, sustainable biomass facilities can minimize negative environmental impacts, preserve biodiversity, and contribute to responsible land stewardship (Guo et al., 2012). Integrating these factors into the site suitability assessment ensures that biomass facility locations are selected in a manner that aligns with sustainable land use practices and supports the overall objectives of the facility (Borsboom-van Beurden et al., 2007).

Spatial data collection and integration allows for the collection, organization, and integration of diverse spatial datasets relevant to site suitability assessment (Jianya and Zongguo, 1999). This includes data layers such as land cover, land use, soil types, vegetation indices, climate data, water resources, protected areas, and transportation networks (Yao and Li, 2018). By integrating these datasets, GIS provides a comprehensive spatial database for analysis (Xu and Zhang, 2022).

The site suitability for sustainable biomass facilities location has a direct impact on ecosystems and biodiversity (Bullen, 2007). The establishment and operation of biomass facilities can result in both positive and negative effects on natural ecosystems and biodiversity (Takada et al., 1994).

2. Examining The Proximity Of Biomass Utilities

The biomass proximity depends on the distance and it indexes. The Table 1 is the list of the utilities in the FCT Abuja that are near to the biomass production.

Table 1: Biomass Proximity Index of AMAC, Abuja

UTILITY	DISTANCE (m)	RESULT INDEX
Electricity	200	600
Pipe borne Water	500	1000
Gas Station	1000	0
Petrol Station	2000	0
Forest Land	350	850
Sunlight	50	100
Human Faeces	400	900
Animal dump	300	800

This analysis in figure 1 clearly indicates the highest impact of the utilities with the petrol station and gas station having the negative effect with longest distance from the rest of the utilities.

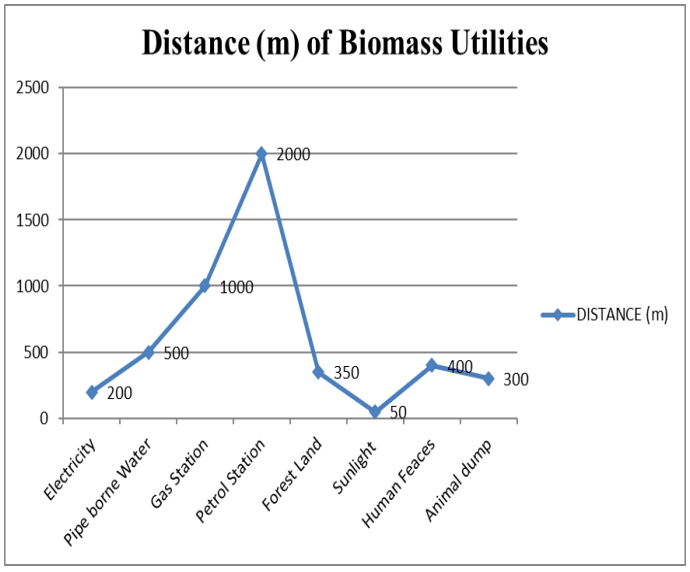

Figure 1: Trend Analysis showing the distance of the utilities of Biomass in AMAC, Abuja

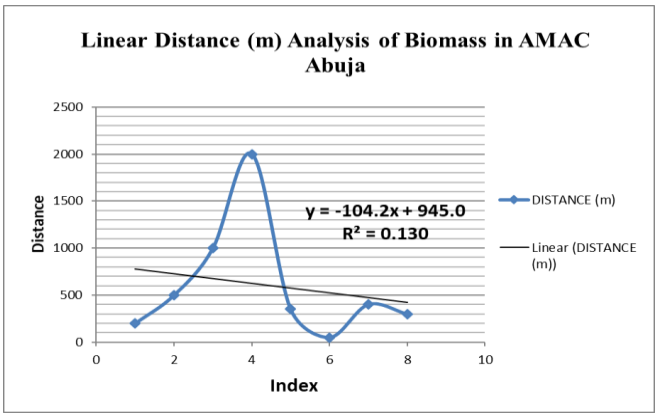

Figure 2: Linear analysis of Biomass in AMAC Abuja

The linear equation has shown decline in the 8 different indexes variables. Here the lowest index is the animal dump (8), and the highest index is the electricity (1). But in terms of Proximity, the lowest is the sunlight and the highest is the petrol station as indicated in figure 2.

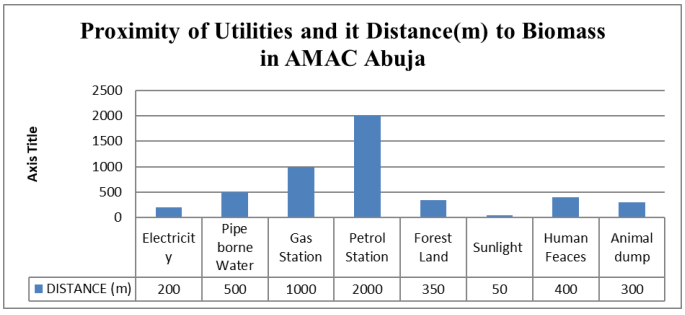

Figure 3: the highest and lowest proximity of Utilities to Biomass in AMAC, Abuja

Figure 4 has indicated the result of distance from individual utilities while figure 3, compared between the distance and their indexes.

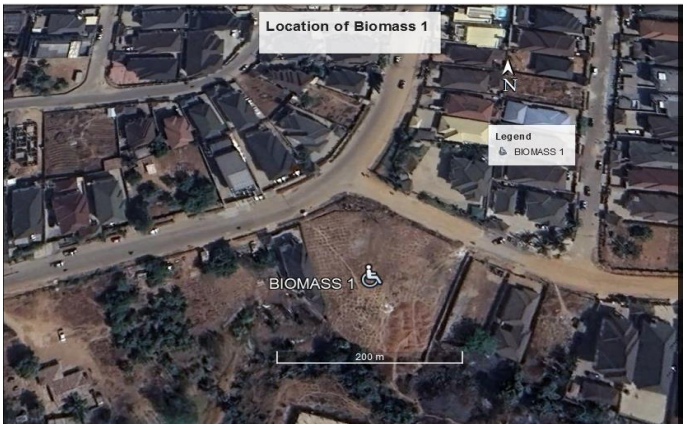

Figure 4: Position of Biomass 1 in the Federal capital Territory Abuja

Figure 5: Satellite image of Biomass 2 in the Study Area

Figure 6: Satellite image of Biomass 3 in the Study Area

Figure 7: Satellite image of Biomass 4 in the Study Area

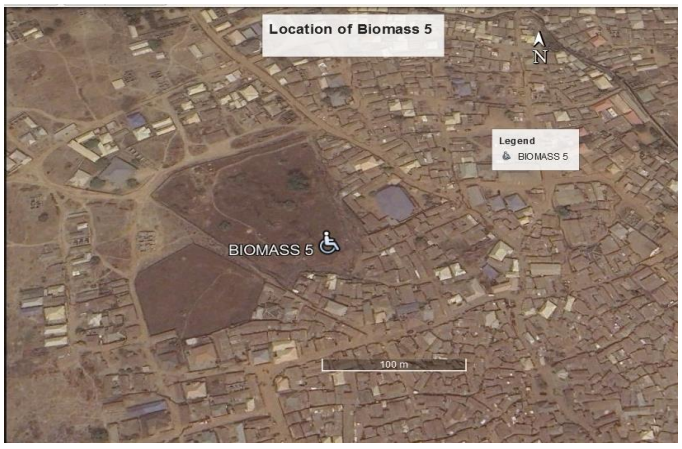

Figure 8: Satellite image of biomass 5 in the Study Area

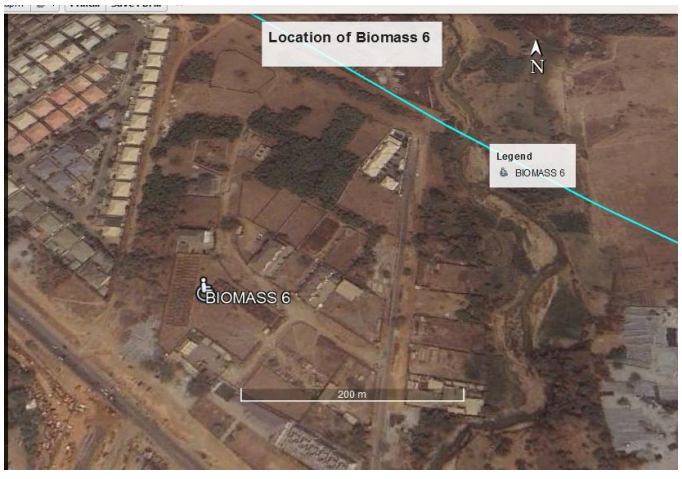

Figure 9: Satellite image of biomass 6 in the study area

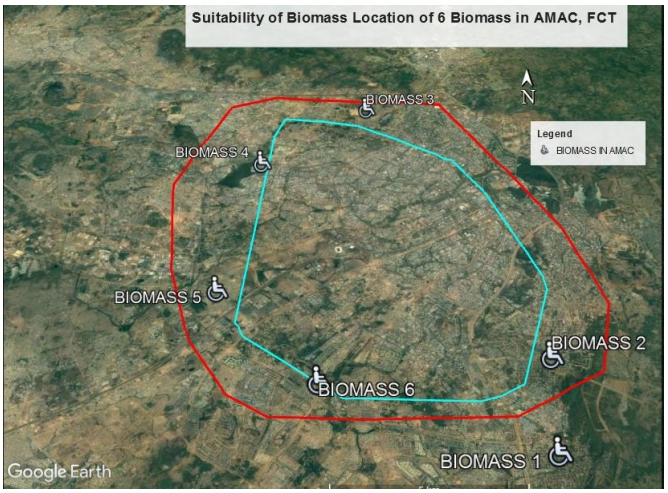

Figure 10: Satellite image of perimeter Survey plan of the total Biomass in the Study Area

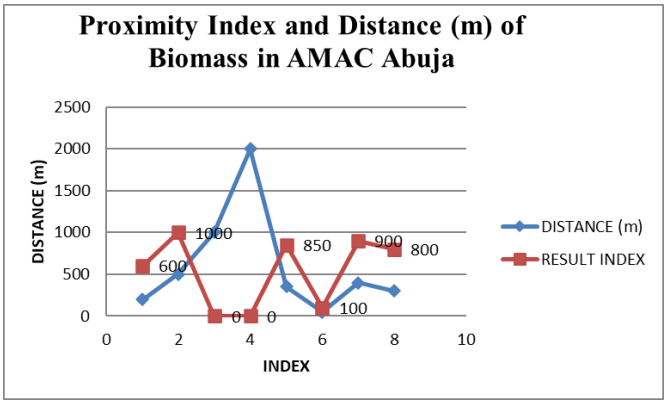

Figure 11: The distance of indexes of the Biomass production in AMAC, Abuja

The result of the utility of the biomass index has been obtained with the highest index of pipe borne water (1000) followed by sunlight (100), electricity (600), animal dump (800), forest land (850), human faeces (900) and the remaining two utilities of gas and petrol station having negative impact of the biomass production in AMAC, Abuja.

3. Summary

Biomass is proven to be one of the effective means of providing clean energy in our environment and households. About six (6) sites for biomass suitability has been selected and analysed. Both their locations and the distances have been measured in Abuja Municipal Area Council (AMAC), Abuja. The use of Geographic Information System (GIS) has produced the sites suitable for the production of biomass in the selected study area.

4. Conclusion

The recent discovery of biomass production has provided opportunities of job creation that enhanced economic growth and development in the study area. This is the first objective, biomass production is not for a short time, and this is because it has to undergo series of production that might take weeks, months or years. From this study, biomass is being produce in AMAC with high percent of 20.85% weekly and 37.5% are being produced monthly and annually.

Biomass production in AMAC has been analyzed to provided high per capita generation of 33.33%, and production pollutants with 37,5%, while increase in pathogens with 25%. From this analysis, it can be concluded that despite the energy production of biomass, a lot of pollution is being produced coupled with the prevalent of bacteria since it undergoes decomposition processes. In the second objective, the six (6) vital biomasses has be located and evaluated with the approximate distance of each biomass. The far the distance of utilities to the location of biomass the lesser impact it has to the biomass production. In this study, it was discovered that petrol and gas stations are having zero (0) or negative index while the rest of the six(6) utilities has positive impact of biomass production in AMAC, Abuja.

RECOMMENDATIONS

Biomass production is capital intensive, therefore government should play vital role in investing on the massive production of alternative energy for the growth and development of not only AMAC but the whole FCT and Nigeria at large.

There should be greater involvement of private partnership participation to enhance development of biomass production in AMAC, Abuja.

Pollution risk should be curtailed and other environmental hazard must be addressed during the production of biomass.

For the suitability analysis one has to make a thorough land survey of the biomass production and investigation of the high production zones of the biomass

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