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Renewable Energy Sources in the Province of Manabí

Rolando Neptalí Ponce-Macías
Technical University of Manabí, Portoviejo, Manabí, Ecuador
Faculty of Engineering and Applied Sciences, Electrical Engineering Career Portoviejo-Manabí
Corresponding author email: rponce8925@utm.edu.ec

Vicente Andrés Chica-Anchundia
Technical University of Manabí, Portoviejo, Manabí, Ecuador
Faculty of Engineering and Applied Sciences, Electrical Engineering Career Portoviejo-Manabí
Email: vchica2990@utm.edu.ec

Cristhian Xavier Vélez-Solórzano
Technical University of Manabí, Portoviejo, Manabí, Ecuador
Faculty of Engineering and Applied Sciences, Electrical Engineering Career Portoviejo-Manabí
Email: cvelez6021@utm.edu.ec

José Mauricio Alarcón-Quiroz
Technical University of Manabí, Portoviejo, Manabí, Ecuador
Faculty of Engineering and Applied Sciences, Electrical Engineering Career Portoviejo-Manabí
Email: jalarcon5717@utm.edu.ec

***Abstract*---**The energy transition towards renewable sources is necessary to guarantee universal access to electricity, especially in regions with difficulties connecting to the electrical grid, such as the province of Manabí, in Ecuador. The objective of this research was based on analyzing the main renewable alternatives available in the region: solar, wind, biogas, wood, and biodiesel; under a methodology based on documentary or bibliographic review, case studies, technical analysis and impact evaluations, through a type of positivist research where the descriptive and analytical method was used, in which specific opportunities and challenges of these technologies were identified in the Manabí context. The results show that a well-structured implementation strategy could transform Manabí into a model of sustainable energy development, improving the quality of life of its communities and protecting its environment.
Keywords*---*energy transition, Manabí, renewable energies, rural development, sustainability.

Introduction

It is evident that countries worldwide face the great challenge of maintaining energy sustainability but with greater emphasis on developing countries, where access to electricity directly affects rural communities in a greater percentage (Bhattarai et al., 2022; Cantarero, 2020).

Referring particularly to Ecuador in the province of Manabí, it is currently going through an uncomfortable situation regarding the gap in continuous access to electricity, likewise, there are difficulties in the validity of energy in isolated rural areas. Based on the aforementioned (Rodríguez et al., 2018), in Manabí, the lack of rural electrification limits social and economic development. According to the National Institute of Statistics and Censuses (INEC, 2020), 22% of rural communities in Manabí lack access to reliable electricity, perpetuating poverty and

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inequality conditions. However, the province has great potential to take advantage of renewable energy due to its unique climatic and geographical characteristics (p,268).

On the other hand, this research focuses on five main renewable technologies: solar energy, wind energy, biogas, wood, and biodiesel. Its benefits, barriers, and practical applications in the local context are analyzed, providing recommendations to promote its adoption (Ruggerio, 2021; Singh et al., 2012).

Solar energy is a form of renewable energy that is obtained from solar radiation, produced when sunlight is converted into electrical energy. Regarding its use Perpiñan (2020), states that the reason for its use is Reducing costs by using less active material is still an objective to be achieved, but it can be achieved through diversification.

Wind energy is obtained based on the kinetic energy of the wind where it is generated through the use of wind turbines or windmills. Regarding its correct use Moragues & Rapallini (2023), mention that it is necessary to take into account the potential that exists where the average speed, gusts, dominant directions, and possible obstacles are included to select if the conditions are suitable for the inversion.

Biogas energy is obtained based on the decomposition of organic matter, such as agricultural waste, food scraps, and other biodegradable materials. In this sense Rincón & Castiblanco (2021), provided that this type of source constitutes an alternative to produce thermal, and electrical energy or as vehicle fuel, using urban and rural organic solid waste as raw material. In this sense, the province of Manabí has resources that can be exploited.

Regarding the energy obtained from wood, it is an alternative that has been used for centuries, but despite this, it is little used, corroborates Bueno (2016), describing that "The use of wood with energy purposes in the country is very small about the potential of its forests: less than one percent of the annual volumetric increase" (p.1).

Biodiesel energy is obtained from the transformation of vegetable oils and animal fats from a liquid fuel similar to Diesel, based on the above (Rojas et al., 2011), referring to the fact that this is a product of transesterification. of oils and fats with short-chain alcohol, in the presence of an acidic, basic or enzymatic catalyst. The types of renewable technologies mentioned above are vitally important sources that can contribute positively to the validity of energy in rural areas isolated from the electrical grid.

Materials and Methods

The research focuses on positivism as a critical guide for the development of quantitative research, Fernández & Vela (2021), positivism is linked to the methodology in the research, a documentary search was carried out, studying more than 50 scientific articles, and government reports and international databases related to renewable energies, among these studies, geographical and climatic analysis was taken into account, where data on solar radiation, wind speed, and biomass availability in Manabí were examined; plus some case studies international, including successful projects in Latin America, such as hybrid systems in Peru and biodigester programs in Colombia, to extract lessons applicable to Manabí, the assessment of the social, economic and environmental impacts of each technology (Tombo et al., 2021).

Analysis and Discussion of the Results

Following the sequence and development of the research, in terms of the methodological process, Figure 1 was created to facilitate the analysis of results in an orderly and synthesized manner for its introduction. Revealing the five main renewable technologies on which our research focused, likewise, fulfilling its objective, which was to analyze the main renewable alternatives available in the region: solar, wind, biogas, wood, and biodiesel (Salemink et al., 2017; Lowe et al., 2019; Barrios, 2008).

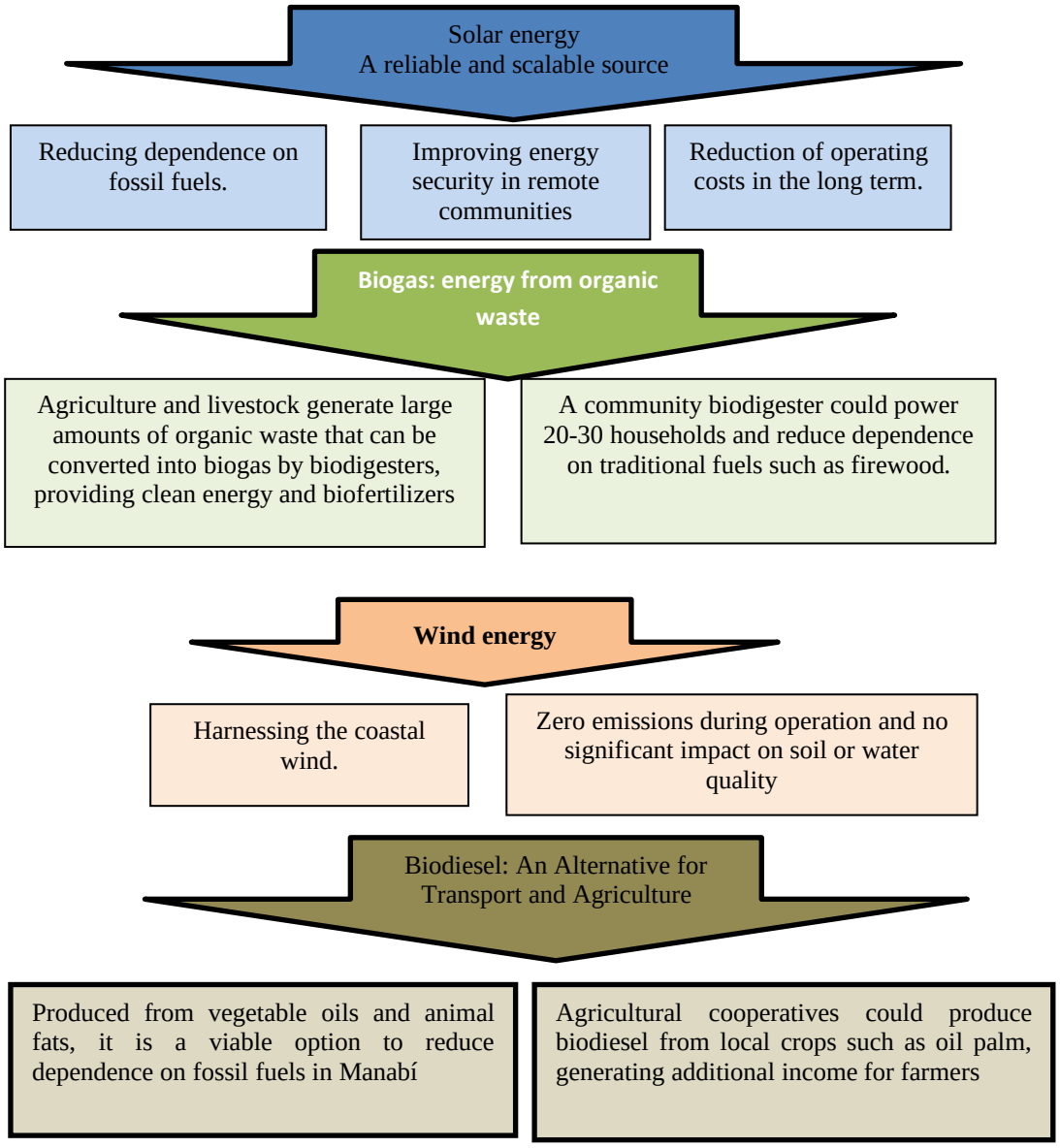

Figure 1. Facilitate the analysis of results in an orderly and synthesized manner

The figure proposes how renewable energy should be implemented in Manabí, a province that presents a unique opportunity to address energy access problems, promote sustainable development, and reduce carbon emissions. One of the aspects that must be taken into account is public policy proposals such as: Establishing tax incentives for renewable projects; creating education and technical training programs in clean energy; promote public-private alliances to finance initial infrastructure (Østergaard et al., 2022; Panwar et al., 2011; Manzano-Agugliaro et al., 2013).

Conclusions

Manabí has the potential to lead the energy transition in Ecuador through the adoption of renewable technologies adapted to its local characteristics. If the initial barriers are overcome, these technologies can transform the province

into a model of sustainable development, taking into account that these renewable technologies do not require large amounts of water for their operation, and would also contribute to reducing diseases and pollution.

References

Barrios, E. B. (2008). Infrastructure and rural development: Household perceptions on rural development. *Progress in planning*, *70*(1), 1-44. https://doi.org/10.1016/j.progress.2008.04.001

Bhattarai, U., Maraseni, T., & Apan, A. (2022). Assay of renewable energy transition: A systematic literature review. Science of The Total Environment, 833, 155159. https://doi.org/10.1016/j.scitotenv.2022.155159

Cantarero, M. M. V. (2020). Of renewable energy, energy democracy, and sustainable development: A roadmap to accelerate the energy transition in developing countries. *Energy Research & Social Science*, *70*, 101716. https://doi.org/10.1016/j.erss.2020.101716

Fernández, A., & Vela, L. (2021). The paradigms and methodologies used in the research process: a brief review. *Undergraduate thesis, Institutional Repository of the University of Alicante*, 1-8.

Lowe, P., Phillipson, J., Proctor, A., & Gkartzios, M. (2019). Expertise in rural development: A conceptual and empirical analysis. *World Development*, *116*, 28-37. https://doi.org/10.1016/j.worlddev.2018.12.005

Manzano-Agugliaro, F., Alcayde, A., Montoya, F. G., Zapata-Sierra, A., & Gil, C. (2013). Scientific production of renewable energies worldwide: An overview. *Renewable and Sustainable Energy Reviews*, *18*, 134-143. https://doi.org/10.1016/j.rser.2012.10.020

Moragues, J., & Rapallini, A. (2023). WIND ENERGY. *Argentine Institute of Energy General Mosconi*, *12*(1), 198-246.

Østergaard, P. A., Duic, N., Noorollahi, Y., & Kalogirou, S. (2022). Renewable energy for sustainable development. *Renewable energy*, *199*, 1145-1152. https://doi.org/10.1016/j.renene.2022.09.065

Panwar, N. L., Kaushik, S. C., & Kothari, S. (2011). Role of renewable energy sources in environmental protection: A review. *Renewable and sustainable energy reviews*, *15*(3), 1513-1524. https://doi.org/10.1016/j.rser.2010.11.037

Perpiñan, O. (2020). *Photovoltaic Solar Energy Book.* Madrid: Progensa publishing house.

Rincón, N., & Castiblanco, C. (2021). Policies and regulations on renewable energies for the development of biogas in Colombia. A review. *Revistas.unal.edu.co*, *24*(1), 1-19.

Rodríguez, M., Vázquez, A., Vélez, A., & Saltos, W. (2018). Improving energy quality with photovoltaic systems in rural areas. *Scientific magazine*, *33*(3), 265- 274.

Rojas, A., Chaparro, Ó., & Ospina, C. (2011). Evaluation of biodiesel-diesel mixtures. *engineering magazine*, *15*(2), 319-336.

Ruggerio, C. A. (2021). Sustainability and sustainable development: A review of principles and definitions. *Science of the Total Environment*, *786*, 147481. https://doi.org/10.1016/j.scitotenv.2021.147481

Salemink, K., Strijker, D., & Bosworth, G. (2017). Rural development in the digital age: A systematic literature review on unequal ICT availability, adoption, and use in rural areas. *Journal of Rural Studies*, *54*, 360-371. https://doi.org/10.1016/j.jrurstud.2015.09.001

Singh, R. K., Murty, H. R., Gupta, S. K., & Dikshit, A. K. (2012). An overview of sustainability assessment methodologies. *Ecological indicators*, *15*(1), 281-299. https://doi.org/10.1016/j.ecolind.2011.01.007

Tombo, G. B. E., Gámez, M. R., Pérez, A. V., & Quiroz, C. A. B. (2021). The geoportals of renewable energy sources in Latin America. *International Journal of Engineering and Computer Science*, *4*(1), 1-6. https://doi.org/10.31295/ijecs.v4n1.1651