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ELUCIDATING STAKEHOLDER PRIORITIZATION FOR SUSTAINABLE OFF-GRID RENEWABLE ELECTRIFICATION USING THE FUZZY AHP-GPESTLE FRAMEWORK: A COMPREHENSIVE ANALYSIS

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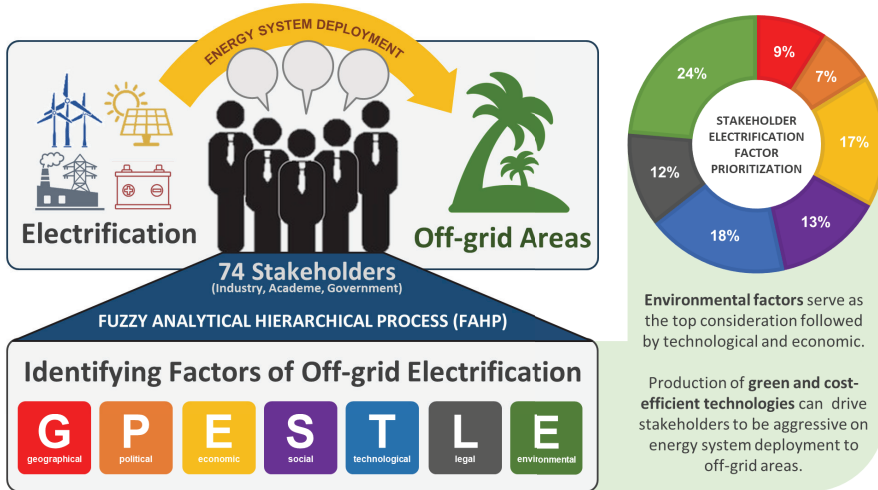
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Abstract – Poverty has been linked to the reality of the world’s developing countries, especially in farflung rural areas, where the lack of energy access plays a significant role in the misery of the poor and disadvantaged people. To achieve universal access to energy, the role of rural electrification was emphasized, and off-grid small-scale electricity generation from renewable sources was expected to be a promising solution. However, in the Philippines, where off-grid island communities are scattered along its archipelago, the deployment of such systems in rural areas is still a challenge among stakeholders due to the consideration of various conflicting factors that may put the potential economic gains and other social and environmental benefits at risk. To better understand the multifaceted nature of off-grid energy system sustainability through the perspective of its stakeholders, the Fuzzy Analytical Hierarchy Process (FAHP) was used to determine their most prioritized factors in determining the viability and sustainability of such systems following the GPESTLE framework. This provides a comprehensive and more relevant approach to performing sustainability analysis by looking into the geographical (G), political (P), economic (E), social (S), technological (T), legal (L), and environmental (E) dimensions of these assemblies. The prioritization of 74 expert stakeholders, coming from the industry, academy, and government institutions, has been elucidated by having them perform pairwise comparisons among the various GPESTLE criteria through a survey. Using FAHP, prioritization or weights were already generated per G-PESTLE criterion and sub-criterion. It was found out that among the three institutions, the industry players have the lowest environmental prioritization and can be increased by developing them with cost-efficient renewable technologies. The availability of technology manufacturers and transportation accessibility has been the main consideration in ensuring the reliability of the system’s operation. Minimizing LCOE and increasing the people’s capacity to pay should also be a priority to secure the project’s financial viability. The presence of a community comprehensive land use plan has also been highly favored among developers, which can allow faster processing of permits on the use of indigenous resources and agricultural lands. With these findings, this framework aims to guide policymakers to properly address the challenges of islands lying low in prioritization due to problems on certain sustainability factors. These insights can be relevant in the drafting of a transitional framework on the renewable electrification of off-grid islands, which were usually left out or minimally given attention in the national electrification plans of governments.

Keywords – AHP; PESTLE; renewable energy; sustainability



An overview of the combined Fuzzy AHP – GPESTLE methodology used in this study.

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