

Using a Multi-Criteria Decision-Making Approach to Evaluate Sustainability of Renewable Energy Generation Sources in Uganda

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Abstract

There are increasing concerns on utilization of Renewable Energy (RE) resources. This results from perceived economic, technical, environmental and socio-political risks in the deployment of RE systems which negatively impacts their suitability and sustainability for energy generation. Uganda in particular has hydro power potential of about 2,200 MW, solar energy potential of about 200 MW, bioenergy potential of 1650 MW, geothermal energy of 450 MW, and wind speeds ranging between 3-5 m/s and yet still grapples with low energy access for her citizens. This research assesses the various generation sources in Uganda based on a multi criteria decision making approach to determine the most suitable energy generation resource alternative. This is done by utilizing Analytical Hierarchy Approach (AHP) which utilizes a pairwise comparison of the criteria in relation to the goal, sub criteria in respect to the parent criteria and finally the energy generation sources to the set criteria to rank RE generation sources in order of priority. The evaluation of the RE sources with respect to the goal of prioritization of energy generation sources based on four key criteria i.e. economic, technical, environmental and social political criteria revealed priorities as hydro, solar, wind, geothermal and biomass with weights of 27.0%, 22.1%, 15.9%, 14.2 % and 8.1% respectively. The assessment further revealed that operation and maintenance cost, technological maturity, emission reduction and job creation are important sub-criteria with respect to the main criteria with weights of 36%, 38.3%, 73.1% and 73.1% respectively. Based on these priorities evaluated using this approach, relevant information is provided to inform decision makers on what should be prioritized, enables investors in renewable energy to choose the most suitable alternatives to invest in, as well as financiers to make decisions on financing RE projects.

Key words: Renewable Energy; Sustainability; Multi-Criteria; Decision Making; Prioritization.

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