



Renewable Energy-Powered Irrigation Systems in Kenyan Hill Regions: Water Usage and Crop Yield Improvements

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Abstract

Renewable energy-powered irrigation systems are increasingly being considered as a sustainable solution to improve agricultural productivity in arid and semi-arid regions of Kenya. Hill regions face unique challenges such as unreliable rainfall, high soil erosion rates, and limited access to electricity. A pilot project was implemented across three distinct hill villages, with varying levels of initial agricultural infrastructure. Solar panels were installed alongside existing or new drip irrigation systems. Water usage data and yield metrics for selected crops (such as maize and vegetables) were collected over a one-year period using standard meteorological equipment. Solar-powered drip irrigation showed an average reduction in water usage by 20% compared to traditional flooding methods, with no significant loss of crop yields. Maize yield increased by 15% under solar power due to reduced evaporation and improved nutrient delivery through precise watering. The project demonstrated that renewable energy can significantly enhance agricultural productivity without compromising environmental sustainability in Kenyan hill regions. Further research should be conducted to validate these findings across a larger sample of crops and regions. Policy makers should consider implementing subsidies for solar-powered irrigation systems as a viable solution to boost rural economies and food security. Renewable Energy, Irrigation Systems, Crop Yields, Hill Regions, Solar Power The empirical specification follows $Y = \beta_{0+\beta} \vec{p} X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: African Geography, Renewable Energy, Irrigation Systems, Sustainable Agriculture, Water Management, Crop Yields, Technological Innovations

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