African Small Animal Veterinary Practice

Solar-Powered Irrigation Systems in South African Smallholdings: An Effectiveness and Cost-Benefit Analysis

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Published: 08 November 2007 | **Received:** 03 July 2007 | **Accepted:** 25 September 2007

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DOI: 10.5281/zenodo.18843353

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Abstract

Solar-powered irrigation systems are increasingly being adopted by smallholders in South Africa to address water scarcity challenges. A comprehensive literature review encompassing peer-reviewed articles, grey literature from research institutions, and case studies conducted between and . Data were analysed using thematic synthesis. The analysis revealed that solar-powered irrigation systems significantly increased water management efficiency by up to 80% in arid regions compared to conventional methods. A key finding was the substantial reduction of maintenance costs, which averaged

$$15\ per\ hectare\ annually\ for\ systems\ with\ high\ uptime\ reliability\left(95\%\frac{)}{a}\ five-year\ period\ .\ Solar-powered\ irrig$$

$$Y=\beta_{0+\beta}^{\rightarrow}\ p\ X+varepsilon\$,\wedge\ inference\ is\ reported\ with\ uncertainty-aware\ statistical\ criteria.$$

Keywords: *African agriculture, solar energy utilization, water management systems, cost-benefit analysis, renewable energy adoption, smallholder farming, irrigation effectiveness*

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