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# Application of geothermal energy for sustainable agriculture and food security in Jordan

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**Abstract**

Jordan's diverse geological settings – ranging from geothermal hot springs to deep sedimentary reservoirs – offer significant untapped opportunities for renewable energy development. This research explores how geothermal energy can be harnessed to strengthen sustainable agriculture and food security in Jordan, particularly in arid and climate-stressed regions. The integration of geothermal systems into agriculture can help address challenges of rising energy costs, seasonal production gaps, and declining crop yields that disproportionately impact smallholder farmers. The project aims to develop a replicable geothermal-based agricultural model that not only enhances productivity but also contributes to national climate resilience, biodiversity conservation, and food security strategies. The research assess the potential of geothermal heating for greenhouse agriculture, demonstrating its dual role in stabilising crop yields and reducing carbon emissions through reduced fossil fuel reliance. Furthermore, it examines the contribution of geothermal interventions to biodiversity-friendly farming practices that conserve native species, enhance soil health, and support agroecological value chains. The study adopts a multi-scalar perspective by evaluating technical feasibility, socio-economic outcomes, and policy frameworks. Stakeholders include government agencies, academic institutions, private sector innovators, and rural communities, with a particular emphasis on empowering women and youth through training and access to sustainable technologies. Beyond technical solutions, the project addresses systemic challenges such as land tenure, market inequities, and socio-political constraints that influence adoption. It also examines policy alignment with Jordan's sustainable development strategies and the United Nations Sustainable Development Goals (SDGs). Outputs include a geothermal development roadmap, training modules for local capacity building, and policy recommendations to institutionalize renewable energy–agriculture linkages. By positioning geothermal energy as a driver of climate-smart agriculture and resilient food systems, this project has the potential to establish Jordan as a regional leader in integrating the Water–Energy–Food–Ecosystem (WEFE) Nexus within national development strategies.

**Keywords:** Climate resilience, food security, geothermal energy

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