

Assessment of Solar Energy Resources and Solar Power Plant Design in the Kakheti Region

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This Master's thesis evaluates the development prospects of solar energy and assesses the solar resource potential within the Kakheti region. The study examines contemporary trends in renewable energy, the physical principles of solar energy, radiation processes, and the advancement of photovoltaic technologies, both from a global perspective and within the context of Georgia's national energy system. Special emphasis is placed on the strategic significance of solar energy in enhancing energy security, driving decarbonization, and fostering sustainable development.

The research analyzes the physical-geographic conditions, climatic characteristics, topography, solar radiation intensity, and insolation metrics of the Kakheti region. It explores the monthly and annual dynamics of solar radiation, the correlation between direct and global radiation, and sunshine duration indicators, establishing a comprehensive baseline for evaluating the region's solar energy potential.

A core component of this thesis addresses the design principles of solar power plants in the Kakheti region and analyzes the challenges associated with their integration into the electrical grid. Furthermore, the paper investigates state support mechanisms for micro-generation development, identifies existing sectoral challenges, and outlines the strategic measures necessary for future advancement.