


# Chapter 5


## Geomatics Applications in Rooftop Solar PV Potential Mapping: A Case Study at The Papua New Guinea University of Technology

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### ABSTRACT

*PNG is rapidly embracing solar PV technology, especially in rural and peri urban areas, aligning with the government's ambitious target of achieving 100% renewable electrification by 2050. This study investigates rooftop solar potential at the PNGUoT using UAV photogrammetry integrated with GIS. The analysis generated rooftop solar energy maps, visually supporting quantitative estimations. Results revealed that three sampled rooftops could produce 90.32 MWh annually, far exceeding their combined demand of 21.49 MWh, leaving 68.83 MWh surplus for storage or export. This demonstrates that rooftop PV can fully meet residential electricity needs while generating excess energy. The study highlights UAV photogrammetry and GIS as cost*

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*efficient, reliable, and scalable tools for suburban scale solar assessment, offering a replicable model for campus wide and national renewable energy deployment. It underscores the importance of renewable energy awareness and knowledge dissemination to drive PNG's transition from fossil fuels, supporting policy, planning, and the 2050 electrification vision.*

## **INTRODUCTION**

Papua New Guinea's ongoing electricity crisis remain a significant constraint to the economic and socio-economic development of this resource-abundant nation (PNG Power Limited, & National Energy Authority, 2024). Whilst only 13-15% of the nation (PNG) have access to grid-supplied electricity, the remaining population turns to other alternatives such as solar lanterns, solar home systems, local mini-grids, and thermal generation etc. Furthermore, more than 25% of PNG's total population (31%) still do not have access to any form of electricity (Rahman & Koo, 2024). The PNG government's interest in addressing the adverse impacts of climate change positions solar energy and technology at the forefront of providing reliable, affordable and accessible electricity whilst combating the negative effects of thermal generation. However, the implementation of several Solar PV initiatives in PNG has had mixed successes, proving to be more challenging (Aiau et al.,2016). Thus, the transition from fossil fuel generation to climate-friendly energy sources requires an effective planning mechanism that deals with input from multiple stakeholders and is guided by continuous collection and analysis of site-specific data by local agencies, which results in a more coordinated approach (Rawali et al.,2019; Kezazy, et al., 2025).

Globally, GIS-based modelling approaches have become increasingly popular with the availability of Lidar data (Song et al.,2025; Eitel. et al., 2016; Mandla et. al., 2021) giving analysts the flexibility of systematically assessing the behaviour of solar radiation over multiple building rooftop surfaces. GIS is essential for spatial analysis and solar radiation modelling, UAV photogrammetry provides high-resolution 3D surface data through image-based reconstruction, and solar PV concepts relate to the conversion of solar radiation into electricity and estimation of energy potential. This approach starts by developing 3D models or using existing models from topographic data and calculating the solar radiation incident on the existing surface with considerations such as rooftop geometry (slope, aspect, elevation) and surrounding obstructions.

This approach enables the automatic computation of key rooftop PV characteristics, such as the slope, orientation, and total area of the rooftop, leading to accurate estimations of PV potential and adhering to the 5 key principles of assessing the solar PV potential of rooftops (Gassar et al., 2021; Long et al.,2025):

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