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Development of a renewable energy-based cooling system for a mobile ground station

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This article addresses the development of a renewable energy-based cooling system for the purpose of minimizing the thermal problems observed in mobile ground stations. Thermal issues are a source of poor quality signals and responsible for premature destruction of the front end low noise amplifier. They are also a source of discomfort for the mission operators aboard the mobile ground station. Potential cooling techniques were explored and solar electric-powered systems were selected for their suitability and compliance with the clean, human and environment friendly standards of the International Energy Agency (IEA).

The principal difficulty in the system development was to design a photovoltaic (PV) topology that would ensure the solar panels were efficiently exposed to the sun regardless of the orientation of the truck; and this was the focus of this article. This was addressed by using multisided PV topology approach and several PV systems were studied.

Simulation results showed that a three-sided pyramid PV topology would be effective and most efficient when it comes to the use of sides and area. The specifications of the PV system were established. A battery system was suggested to first be charged and then directly supply power to the cooling system. The research was a success as the objective of the project met and the research questions were answered.

Keywords: cooling technologies; mobile station; photovoltaic topologies; PV power dynamics; reneable energy