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Algorithm for Maximum Power Point Tracking through Load Management

-Solar energy systems generate power intermittently, for example based on varying cloud coverage and other conditions. This inherent variability can lead to significant inefficiencies in utilizing the renewable energy source. The conventional approach is to utilize a central power converter in the solar energy system for maximum power point tracking. The power converter incurs cost and power losses. It also limits the size and reliability of the solar system.

Researchers at Arizona State University have developed an improved maximum power point tracking algorithm for solar photovoltaic systems through load management. This algorithm estimates the optimum switch points to connect and disconnect loads, minimizes unsuccessful switches, and maximizes photovoltaic energy delivered to load(s). A switch is a connection or a disconnection of a load. The algorithm has been tested and validated on a real-world (outdoor) photovoltaic system.

This algorithm for maximum power point tracking is related to Maximum Power Point Tracking through Load Management (M21-055P).

Potential Applications:

- For intelligent control of loads driven by solar energy systems, e.g., used in the following:
  - Industrial electrolysis
  - Solar energy storage
  - Electric vehicle charging
  - Green hydrogen production

Benefits and Advantages:

- 10% lower upfront system cost
- 25% higher system energy efficiency (almost 100% efficiency)
- 35% lower levelized cost of electricity over traditional solar systems
- Scalability from a few kilowatts peak to a gigawatt peak
- Improved system reliability by eliminating power converter failures