

Cost-Effective and Energy-Efficient PV DC Systems for Commercial Applications



A joint India-U.S. research consortium funded under the *Joint Clean Energy Research & Development Center (JCERDC)*

Scientific Achievement:

Our analysis, which predicts the cost- and energy-efficient use of DC solar-power systems in commercial buildings, is being validated in India using rooftop PV for DC-powered buildings. This includes designing and installing power conditioning units to supply DC loads (DC LEDs, BLDC fans and DC power adapters for other electrical units including LED TVs, laptops and mobile phones). Solar water pumps and air conditioners using BLDC motors are also being integrated into the building facilities.

Significance and Impact:

A residential building for demonstrating DC loads is being “DC”-structured within the IIT-Madras campus. DC loads such as LED lighting systems and BLDC fans have been installed. Power conditioners to power these loads were designed and installed, and testing has commenced. Monitoring for electricity savings compared to AC equivalents is providing validation for these approaches.

Research Details:

- LED lights (9-W and 15-W power ratings), working with 48 V_{DC}, were specified to meet the building and occupant needs.
- Commercial BLDC fans with 30-W power rating designed for 48 V_{DC} input were identified.
- Both the lighting systems and fans have been installed. The solar power processing systems (48 V_{DC}) were designed and tested. DC loads are powered from these 48 V_{DC} solar units.
- The solar water pump and air conditioners system specifications have been defined, the preliminary design has been completed, and the units are being manufactured.

Prices at Indian Energy Exchange (IEX) INR / MWh

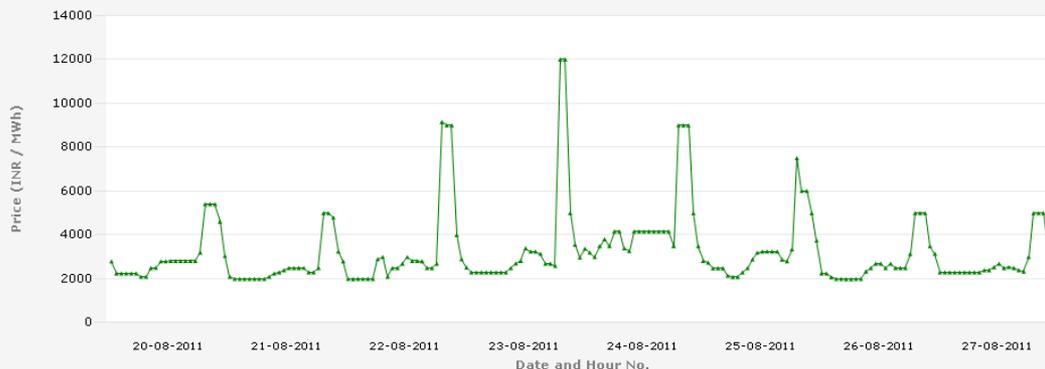


Figure 1. Fluctuating electricity prices in current India markets are foundational to the cost-effectiveness of solar DC power in commercial buildings.

Publications: “Solar Powered DC Commercial Buildings,” Ashok Jhunjunwala, Lakshminarasamma, Krishna Vasudevan, *Proc. IEEE PVSC-2013*, Tampa, Florida (IEEE, NY); “Analysis of Subsystems and Performance Evaluation of Solar Photovoltaic Powered Water Pumping System,” Sadashivam P, Kumaravel M, Krishna Vasudevan, , Ashok Jhunjunwala, *Proc. IEEE PVSC*, Tampa (IEEE, NY).

Contact(s): Ashok Jhunjunwala (ashok@tenet.res.in) & Lakshminarasamma (lakshmin@ee.iitm.ac.in)

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