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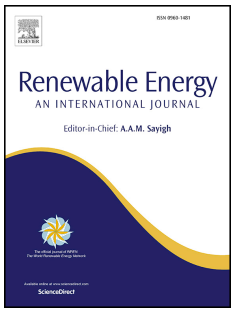

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A Method to Estimate the Location and Orientation of Distributed Photovoltaic Systems from their Generation Output Data

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Abstract: Distributed PV systems, mostly on household, commercial and industrial rooftops, represent around half of global PV capacity. Their orientation (tilt and azimuth) often depends on the particular rooftop on which they are installed, rather than being designed for optimal performance. Furthermore, data collection, and particularly validation, of their configurations is often lacking. However, their generation output is usually well monitored given this determines cashflows. Rooftop PV systems therefore pose important performance assessment challenges. Large databases of distributed PV generation performance now exist. However, there is often little information on the actual system installation, or quality checks on provided information, which is a major problem for performance assessment. We therefore present a method for estimating tilt, azimuth, and even location for PV plants by fitting a model to their time-series generation. The method is tested for three case studies: (1) simulated generation of a theoretical PV system using weather data; (2) measured generation of PV systems with validated location and orientation; and (3) measured generation from PV systems with self-reported information. Results suggest that the proposed method can estimate array tilt, azimuth, longitude, and latitude with Mean Absolute Deviations of 2.75°, 5.85°, 0.2°, and 4.08° respectively, for a typical PV system.

Keywords: PV orientation, PV location estimation, PV performance analysis

1 Introduction

Global installed Photovoltaic (PV) capacity has grown from 5.1GW to 227GW over the past decade, and represented some 34% of total renewable generation capacity added in 2015, and 20% of all added capacity including coal, gas and nuclear [1]. Unlike almost all other generation options, PV is highly scalable and around half of global PV capacity consists of distributed PV systems installed, largely, on household, commercial and industrial roofs [2, 3]. In some jurisdictions, the great proportion of PV generation is from small (less than 10kW) PV systems on housing. For example, as of June 2016, 83% of Australia's 5.3GW of PV capacity is from some 1.5 million household systems [4].