

A review on the complementarity of renewable energy sources: Concept, metrics, application and future research directions

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Abstract

Global and regional trends indicate that energy demand will soon be covered by a widespread deployment of renewable energy sources. However, the weather and climate driven energy sources are characterized by a significant spatial and temporal variability. One of the commonly mentioned solutions to overcome the mismatch between demand and supply provided by renewable generation is a hybridization of two or more energy sources into a single power station (like wind-solar, solar-hydro or solar-wind-hydro). The operation of hybrid energy sources is based on the complementary nature of renewable sources. Considering the growing importance of such systems and increasing number of research activities in this area this paper presents a comprehensive review of studies which investigated, analyzed, quantified and utilized the effect of temporal, spatial and spatiotemporal complementarity between renewable energy sources. The review starts with a brief overview of available research papers, formulates detailed definition of major concepts, summarizes current research directions and ends with prospective future research activities. The review provides a chronological and spatial information with regard to the studies on the complementarity concept.

Keywords: Non-dispatchable energy sources; Reliability; Weather-driven; Variability;

Complementarity index