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Harnessing renewable energy in cloud datacenters: opportunities and challenges

Abstract:

The proliferation of cloud computing has promoted the wide deployment of largescale datacenters with tremendous power consumption and high carbon emission. To reduce power cost and carbon footprint, an increasing number of cloud service providers have considered green datacenters with renewable energy sources, such as solar or wind. However, unlike the stable supply of grid energy, it is challenging to utilize and realize renewable energy due to the uncertain, intermittent and variable nature. In this article, we provide a taxonomy of the state-of-the-art research in applying renewable energy in cloud computing datacenters from five key aspects, including generation models and prediction methods of renewable energy, capacity planning of green datacenters, intra-datacenter workload scheduling and load balancing across geographically distributed datacenters. By exploring new research challenges involved in managing the use of renewable energy in datacenters, this article attempts to address why, when, where and how to leverage renewable energy in datacenters, also with a focus on future research avenues.