عنوان مقاله:

A Computational Real-Time Energy Management Method withStochastic Optimization for a Hybrid Residential PhotovoltaicStorage System Consisting of a Solar Photovoltaic Generationand a Battery Energy Storage

محل انتشار:

ششمین کنفرانس ملی فناوری های نوین در مهندسی برق و کامپیوتر (سال: 1402)

تعداد صفحات اصل مقاله: 8

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خلاصه مقاله:

A computationally proficient real-time energy managementmethod with stochastic optimization is presented for a residentialphotovoltaic (PV)-storage hybrid system comprised of a solar PVgeneration and a battery energy storage (BES). Existing offline energymanagement approaches for day-ahead scheduling of BES suffer fromenergy loss in real time due to the stochastic nature of load and solargeneration. On the other hand, typical online algorithms do not offeroptimal solutions for minimizing electricity purchase costs to the owners.To overcome these limitations, we propose an integrated energymanagement framework consisting of an offline optimization modelconcurrent with a real-time rule-based controller. The optimization isperformed in receding horizon with load and solar generation forecastprofiles using deep learning-based long short term memory method inrolling horizon to reduce the daily electricity purchase costs. Theoptimization model is formulated as a multistage stochastic programwhere we use the stochastic dual dynamic programming algorithm in thereceding horizon to update the optimal set point for BES dispatch at afixed interval. To prevent loss of energy during optimal solution updateintervals, we introduce a rule-based controller underneath theoptimization layer in finer time resolution at the power electronicsconverter control level. The proposed framework is evaluated using areal-time controller hardware-in-the-loop test platform in an OPAL-RTsimulator. The proposed real-time method is effective in reducing the netelectricity purchase cost compared to other existing energy managementmethods.

کلمات کلیدی:

Deep learning, energy management, energy storage, loadforecast, real-time control

لینک ثابت مقاله در پایگاه سیویلیکا: