Hybrid Renewable Energy System Design Using Synthetic Time Series Based on Historical Data and Designated Scenario

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Sudden increases of electricity demand and global climate change make CO2-free and locally available energy sources attractive alternatives to traditional electricity sources. Well known examples of these sources are solar and wind energy. In addition, energy storage systems for stable supply of electricity and supplementary generators for short-period peak demand are attached to consist hybrid renewable energy system (HRES). However, HRES has high fixed cost and generated electricity has stochastic property. Overestimation of system size causes excessive fixed cost requirement, while underestimation causes increase in operation time, fuel cost and maintenance cost. In severe case it will fail to meet the electricity demand. To minimize total cost of the HRES system while achieving operation stability, it is essential to use time series that have realistic distribution property. In this study, we performed a HRES design optimization using synthetic time series based on actual data and compare that to previous research with simplified assumptions. Scenario analysis on a few cases of electricity supply-demand change is also performed.