Abstract

The intermittent nature of renewable energy sources (RESs) brings formidable challenges in the operation of power system. Long-term energy system planning models overlook the impact of renewable intermittency on system operations due to the computational burden associated with large model size and long planning horizon. Hence, strategies such as soft-linking multiple models are developed, but they do not assure the convergence and optimality of such incoherent modeling framework. In this context, this paper utilizes unit commitment (UC) extension of TIMES modeling framework to integrate operational constraints directly in a long-term power system planning model. This strategy eliminates the complexity of handling multiple models. Results indicate that incorporation of UC constraints improve the performance of conventional generators in terms of increased capacity utilization, and help to assess flexibility requirements with high RESs. Energy storage provides the balancing and flexibility needs with stringent generator constraints. Sensitivity analysis shows that improved flexibility of thermal generators enables increased renewable penetrations.

Keywords

TIMES energy model; Power system planning; Renewable intermittency; Unit commitment; Operational constraints