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Abstract With the expanding and increasing researches about modeling and scheduling of multi-carrier energy systems (MCES) in recent years, the scope of the concept of energy hub as an appropriate solution is increased in order to provide the sufficiency and safety of consumer energy demand. The optimal management of the energy hub requires precise modeling, and the accurate and close-to-reality modeling that is possible just by considering the uncertainties in systems. There are various sources of uncertainty in multi-energy system (MES) which we will discuss in the following. Due to the flexibility of energy hub, appropriate modeling of uncertainty in operation and planning of them enhance these systems' profitability for various decision makers (customers, producers, operators, etc.). Different modeling methods of these uncertainties have different accuracy, computational burden, and responsibility speed. The goal of this study is to review these uncertain parameters and their modeling techniques in the optimal operation of multi-carrier energy systems (MCES) on the concept of energy hub in order to address the research gap for future works.

Keywords Energy hub, Multi-carrier energy systems, Uncertainty, Uncertainty modeling methods, Hybrid energy systems