Sahar Rahim and Pierluigi Siano, 2022, A survey and comparison of leading-edge uncertainty handling methods for power grid modernization, *Expert Systems with Applications*, Volume 204, 15 October 2022, 117590.

Highlights

- A qualitative review is conducted on traditional uncertainty modeling techniques.
- A comparative audit has been done to state the significance of robust optimization.
- Contributions of the RO approach in energy-related issues are precisely summarized.
- In the end, research gaps and future directions are highlighted.

Abstract The power grid infrastructure encounters multiple uncertainties such as unprecedented energy generation from non-dispatchable resources, erratic load, intensifying energy demand, the transition towards electric mobility, and the electricity market that exaggerate the decision-maker's difficulties in the power system. How to deal with massive real-time uncertain data is a pressing and challenging issue. To date, the art to tackle contingencies and ambiguous events has globally advanced and attained great assiduity, whereas, substantial work has been conducted on the optimization problems under uncertainties. In this regard, a comprehensive review of contemporary research is presented to identify future research trends. Moreover, the literature on the state-of-the-art uncertainty modeling methods is scrutinized, whilst a comparative assessment is stated to provide a broader overview evidencing that, so far, there is no particular preeminent uncertainty handling technique. The presented work may be adopted for the selection of the most suitable methodology in each application. In comparison to traditional approaches, robust optimization is one of the recent and adaptive uncertainty handling techniques for optimization problems owing to its salient features. Furthermore, its contributions in five crucial categories of power grid optimization problems are reviewed to highlight additional challenges and the scope of future research in the context of envisioned power networks.

Keywords Decision-making, Uncertainty modeling techniques, Probabilistic techniques, Possibilistic techniques, Hybrid probabilistic–possibilistic methods, Information gap decision theory, Interval analysis, Robust optimization.