Liying Wang, Houqi Dong, Jialin Lin, and Ming Zeng, 2022, Multi-objective optimal scheduling model with IGDT method of integrated energy system considering ladder-type carbon trading mechanism, *Intl. J. of Electrical Power & Energy Systems,* vol. 143, December 2022, 108386.

Highlights

- Based on the energy hub, the architecture of the park-level integrated energy system is constructed considering the coupling and conversion between multiple energy sources and the demand response on the user side.
- A multi-objective robust model and opportunity model based on IGDT are established from the perspectives of risk aversion and risk preference, respectively.
- Compared with the traditional carbon trading mechanism, the introduction of the ladder-type carbon trading mechanism can significantly reduce carbon emissions.

Abstract In order to meet the challenge of global low-carbon development, the concept of integrated energy system (IES) has been proposed and demonstrated, and its low-carbon operation mode is the research hotspot at present. In this paper, a multi-objective optimal scheduling model considering the participation of park-level IES (PIES) in the carbon market is proposed, which takes into account the multiple uncertainties on the renewable energy and load. Firstly, for the PIES operator (PIESO) participate in the carbon market, this paper introduces the ladder-type carbon trading mechanism. Then, for the uncertainties of the renewable energy and load, this paper carries out uncertainty modeling from the perspective of PIESO risk aversion and risk preference based on IGDT method. Finally, a multi-objective optimal scheduling model including economic and environmental objective is established. The actual PIES is selected for case study, and the results show that the operating profit of PIESO under the risk aversion strategy decreases by 5.91%, the operating profit of PIESO under the risk seeking strategy increases by 6.12%. Aiming at the impact of ladder-type carbon trading on system operation profits and carbon emissions, three scenarios were set, including whether to introduce a ladder-type carbon trading mechanism, changes in the initial price and the tradable carbon emission ratio. The results show that compared with the traditional carbon trading mechanism, the introduction of the ladder-type carbon trading mechanism reduces carbon emissions by 2.73%, and the setting of reasonable ladder-type carbon trading price and tradable carbon emission ratio can significantly reduce the carbon emissions, improve operating profit of PIES.

Keywords Integrated energy system, IGDT, Multi-objective optimization, Ladder-type carbon trading mechanism, Uncertainty.