Vahid Khaligh, Mohammad Kazem Ghasemnejad, Azam Ghezelbash, Jay Liu and Wangyun Won, 2023, Risk-constrained energy management of an isolated multi-energy microgrid enhanced with hydrogen storage, *Journal of Energy Storage,* Volume 63, July 2023, 107103.

Highlights

- A comprehensive risk-constrained energy management model is presented.
- Multiple energy conversions between electricity, hydrogen, and gas are considered.
- Risk-averse and risk-seeking modeling strategies of the proposed MEMG are presented.
- Various uncertainties are incorporated and tackled by the IGDT method.
- The role of HSS in the risk management of the MEMG is assessed.

Abstract Hydrogen energy has proven to be a key player in transitioning towards a carbon-neutral society. However, integrating it into existing multi-energy microgrids (MEMGs) is challenging due to uncertainties in hydrogen vehicle (HV) demand, gas and electricity demand, renewable energy output, and prices. To address this, a computationally feasible risk-constrained energy management model is developed using the information gap decision theory (IGDT) method. This model provides both robust and opportunistic strategies. The MEMG system includes electricity, hydrogen, and gas subsystems, and allows for conversions between power to hydrogen (P2H), hydrogen to power (H2P), hydrogen to gas (H2G), and gas to power (G2P). Liquified natural gas (LNG) is used as an external energy source to improve system security. The study also explores the use of hydrogen storage systems (HSS) and renewable energy for sustainability. While the problem is a mixed integer nonlinear programing model, it is converted into a mixed integer linear programing model to ensure global optimality. The proposed risk-based energy management model was tested on a case study and results showed a 2 % decrease in profit for the robust strategy and a 4 % increase in profit for the opportunistic strategy, with final profits of $4876.102 (robust) and $5171.624 (opportunistic).

Keywords Multi-energy systems, Risk management,Robust Hydrogen storage, Electrolysis, Uncertainty, Renewables