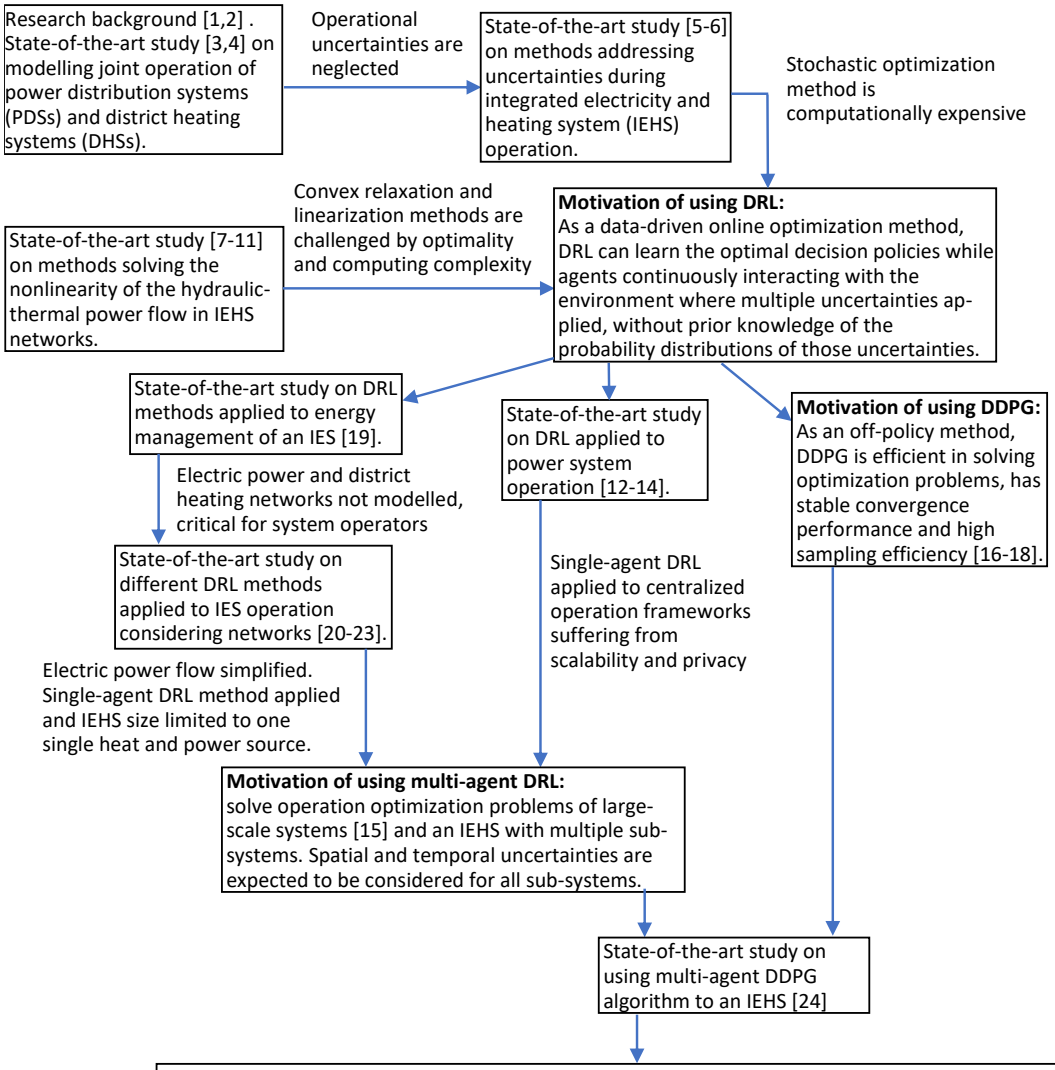

Motivation of the manuscript: To solve the research gaps as follows:

- DHS hydraulic-thermal flow and PDS power flow models are either not considered or simplified with fixed supply temperature, thus losing accuracy.
- Existing hydraulic-thermal flow algorithms are not compatible with the DRL methods.
- Uncertainties caused by geographically distributed power generation, electrical and thermal loads, as well as temporal intermittencies have not been fully considered or specifically addressed.

Contributions of the manuscript:

- A distributed optimization model is addressed for joint operation of IEHSs and for privacy protection, with consideration of spatial and temporal uncertainties.
- A new hydraulic-thermal flow algorithm is proposed for DHS operation, where supply and return temperatures of combined heat and power plants, and mass flow rate are all optimized. Such an algorithm is compatible with DRL methods.
- A multi-agent DDPG method is applied to the proposed distributed optimization problem, where each power and district heating area coordinated with a combined heat and power plant is optimized by an agent, to achieve a data-driven optimal joint operation of IEHSs.

Innovation Highlight:

It is the first time for this paper to handle the accurate hydraulic-thermal flow model with a DRL algorithm and to address both spatial and temporal uncertainties of IEHS