Contribution ID: **175** Type: **Poster**

C1Po3C-05: Investigation of cold energy transfer characteristics in the liquefaction unit of the liquid air energy storage system

Monday 19 May 2025 14:00 (2 hours)

In the global pursuit of energy transition, energy storage technologies play a pivotal role in integrating renewable energy into the grid, maintaining grid stability, and ensuring energy security. Liquid air energy storage (LAES) technology offers a scalable, cost-effective, and geographically unconstrained solution for large-scale, long-duration energy storage, making it a promising solution for the future energy storage market. The liquefaction unit serves as the core part of the LAES system, which includes components such as the large-scale cold energy storage equipment and heat exchanges, responsible for recovering, storing, and utilizing the cold energy of liquid air. However, existing research on the LAES system predominantly focuses on system-level analysis, with limited attention given to the mechanisms of cold energy transfer within the liquefaction unit. To address this, the study investigates the cold energy transfer characteristics within the liquefaction unit of the LAES system, with a specific emphasis on the exergy destruction during the cold energy transfer process. The thermodynamic model and heat exchanger model for the liquefaction unit are established and validated. Subsequently, the cold energy transfer characteristics are analyzed, and sensitivity analyses are conducted on the key design parameter.The results reveal the asymmetric characteristics of the cold energy transfer process and identify the primary components contributing to cold exergy destruction, providing a unique perspective on the design of the liquefaction unit. The research provides a fundamental understanding of cold energy transfer in the LAES system, paving the way for the further optimization and broader application of the LAES technology.

Authors: FAN, Xiaoyu (Technical Institute of Physics and Chemistry, Chinese Academy of Sciences); LI, Junxian (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences); LI, Yihong (Technical Institute of Physics and Chemistry, CAS); WANG, Zhikang (Technical Institute of Physics and Chemistry, Chinese Academy of Sciences); DU, Jiamin (Technical Institute of Physics and Chemistry, Chinese Academy of Sciences); GAO, Zhaozhao (Technical Institute of Physics and Chemistry, Chinese Academy of Sciences); Mr JI, Wei (Zhonglv Zhongke Energy Storage Technology Co., Ltd.); Dr CHEN, Liubiao (Technical Institute of Physics and Chemistry, Chinese Academy of Sciences); WANG, Junjie (Technical Institute of Physics and Chemistry, Chinese Academy of Sciences)

Presenter: FAN, Xiaoyu (Technical Institute of Physics and Chemistry, Chinese Academy of Sciences)

Session Classification: C1Po3C - Liquid Air, CO2, Ar Liquefaction and Storage