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A study of an LNG cold energy cascade utilization system coupled with liquid air energy storage

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Liquefied natural gas (LNG) is considered an advantageous energy source in the current transition stage of energy structure reform due to its cleanliness and high quality. A large amount of high-grade cold energy is released in the process of LNG regasification. However, most of the LNG receiving stations in China fail to utilize LNG cold energy effectively in the actual operation process, and there is a large waste of cold energy. Liquid air energy storage (LAES) is a large-scale energy storage technology that is easy to realize multi-energy coupling. An LNG cold energy cascade utilization system incorporating LAES technology was proposed in this paper. Facing the demand of LNG cold energy utilization in Tangshan City, China, the high-grade cold energy is first used to achieve cryogenic compression of air, the medium-grade cold energy is applied to refrigerated warehouses with different temperature zones in a temperature-controlled sequence, and the remaining cold energy is used to achieve cooling of data centers. Thermodynamic sensitivity analysis and economic analysis of integrated system parameters were performed. The performance of an optimized LNG cold energy cascade utilization system was obtained.

Submitters Country

China

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

Presenter: Dr GAO, Zhaozhao (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences)

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