Contribution ID: **178** Type: **Poster Presentation (120m)**

Optimizing pre-cooling methods for liquid air energy storage power stations: A focus on cooling of tanks

Tuesday 23 July 2024 14:00 (2 hours)

Liquid Air Energy Storage (LAES), characterized by its large-scale energy storage capacity and geographical flexibility, represents a promising solution to address the intermittency and volatility of renewable energy. In the construction phase of a LAES power station, the pre-cooling procedure for the cold energy storage fluid and its corresponding tank assumes critical significance, as it profoundly impacts both the round-trip efficiency and the overall economic viability of the station. Traditionally, the liquid-phase cold energy storage method employs a methanol-water solution and propane as the cold energy storage fluid. However, direct injection of the low-temperature cold energy storage fluid into the tank can lead to excessive stress, potentially compromising the tank's integrity. Hence, it is crucial to pre-cool the methanol-water solution tanks, propane tanks, liquid air tanks, and their associated pipelines to the appropriate temperatures prior to fluid injection. This paper proposes the use of liquid nitrogen spraying for tank cooling and evaluates the impact of various cooling rates on tank stress levels. A tank pre-cooling calculation model is subsequently developed to analyze the effects of ambient temperature, external wind speed, and pre-cooling rate on liquid nitrogen consumption. Taking into account the influence of cooling rate on thermal stress and liquid nitrogen usage, the paper provides a recommended pre-cooling rate range for storage tanks.

Submitters Country

China

Authors: WANG, Zhikang (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China); Mr FAN, Xiaoyu (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China); Mr LI, Yihong (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China); Mr LI, Junxian (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China); Dr GAO, Zhaozhao (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China); Dr JI, Wei (Zhonglv Zhongke Energy Storage Technology Co., Ltd., 18 Lishi Hutong, Dongcheng District, Beijing, P. R. China); Dr CHEN, Liubiao (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China); Prof. WANG, Junjie (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China)

Presenter: WANG, Zhikang (Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China)

Session Classification: Tue-Po-1.1

Track Classification: Tracks ICEC 29 Geneva 2024: ICEC 01: Large scale refrigeration and liquefaction