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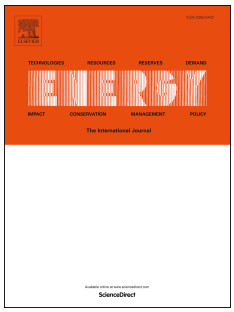

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Cryogenics-Based Energy Storage:

Evaluation of Cold Exergy Recovery Cycles

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Abstract

Competitive specific costs, remarkable energy density, long cycle life, moderate efficiencies the possibility of using proven technologies, and the absence of geographical/geological restrictions make cryogenic energy storage (CES) systems very promising low-carbon bulk energy storage technologies. CES is a thermo-electric energy storage unit, which uses surplus electricity to liquefy a gas (cryogen), which is subsequently stored at cryogenic temperature. Subsequently, the thermal energy of cryogen is partially regained in a cold exergy recovery cycle. This paper reviews and evaluates concepts of CES systems and reports the results from exergy analysis. Two cold exergy recovery cycles are considered: (a) direct expansion of liquid air, and (b) expansion of liquid air in combination with an ORC. The addition of an indirect Rankine cycle increases the specific power output of the discharge unit by up to 25 %. The usage of cold recovery and storage increases the liquid yield to 0.6 and doubles the exergetic efficiency of the

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