A novel system for large-scale storage of electricity as synthetic natural gas using reversible pressurized solid oxide cells - DTU Orbit (19/11/2018)

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The ongoing reduction of greenhouse gas emissions entails increased use of intermittent renewable energy technologies such as wind and solar. This raises the need for cost-effective and efficient electricity storage. In particular seasonal variations in supply and demand will require tremendous storage capacity. In this paper we present a truly large-scale electricity storage system which uses pressurized reversible solid oxide cells combined with catalytic reactors to store electricity as synthetic natural gas. By storing the produced gas in existing natural gas grids the system can create a strong and efficient link between the electricity and gas markets. In addition, the system is able to operate reversibly using gas from the grid to satisfy the electric power demand.

The system performance is analyzed with a component-based thermodynamic modeling tool which shows that electricity can be stored as synthetic natural gas with an energy efficiency of 89%. The gas to electricity efficiency is equally high, resulting in a round-trip storage efficiency of 80% (DC-to-DC).

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