Large-scale electricity storage utilizing reversible solid oxide cells combined with underground storage of CO\textsubscript{2} and CH\textsubscript{4} - DTU Orbit (05/08/2019)

Electricity storage is needed on an unprecedented scale to sustain the ongoing transition of electricity generation from fossil fuels to intermittent renewable energy sources like wind and solar power. Today pumped hydro is the only commercially viable large-scale electricity storage technology, but unfortunately it is limited to mountainous regions and therefore difficult to expand. Emerging technologies like adiabatic compressed air energy storage (ACAES) or storage using conventional power-to-gas (P2G) technology combined with underground gas storage can be more widely deployed, but unfortunately for long-term to seasonal periods these technologies are either very expensive or provide a very low round-trip efficiency. Here we describe a novel storage method combining recent advances in reversible solid oxide electrochemical cells with sub-surface storage of CO\textsubscript{2} and CH\textsubscript{4}, thereby enabling large-scale electricity storage with a round-trip efficiency exceeding 70% and an estimated storage cost around 3 b kW\textsuperscript{-1} h\textsuperscript{-1}, i.e., comparable to pumped hydro and much better than previously proposed technologies.

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