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Technoeconomic and Life Cycle Analysis of Energy Storage Systems

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The effects of climate change have begun to become more apparent in recent years. Extreme weather events are observed in greater frequency, affecting the livelihoods of tens of millions around the globe. Renewable energy sources, such as wind energy and photovoltaics, are the preferred option for power generation since they can be decentralised and drastically reduce the emission of greenhouse gases. However, power output from wind turbines and photovoltaic panels apart from being variable cannot be simply switched off even when demand is much lower. This results in increased grid instability risk. In extreme cases of imbalance between power demand and power output blackout can occur with significant consequences. Therefore, the implementation of large-scale energy storage systems has increased value for the protection of the stability of the grid as well as for optimisation of the benefits drawn from renewable energy sources. In this paper, we discuss the advantage and disadvantages of different energy storage systems based on batteries, hydrogen and other means, together with a qualitative technoeconomic and life cycle analysis.