Analyzing Non-Chemical Storage Solutions for the Grid-Scale Energy Problem

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Grid-scale energy storage systems are an integral part of a clean future. Some sources of renewable energy cannot consistently produce electricity, leading to gaps between electricity supply and demand in what is called intermittency. Energy storage systems fill these gaps to consistently deliver sustainable energy when it is needed. Although lithium-ion batteries are efficient and compact, they have a number of disadvantages, the most alarming of which is environmental damage due to mining. This experiment is designed to prototype three types of alternative energy storage systems: hydroelectric, gravitational potential, and elastic potential. These storage systems could overcome the weaknesses of chemical batteries, promoting a cleaner and more sustainable energy grid. Prototypes of the three types of energy storage systems were created and tested to compare their strengths and weaknesses. The experimental design reviewed factors like energy capacity, power output, round-trip efficiency, and discharge rate, while keeping in mind potential biases in order to thoroughly investigate the potential benefits of each type. The experimental results suggest that each of the tested prototypes could fulfill a different energy need. The hydroelectric storage system had a high storage capacity, making it potentially feasible for massive-scale implementation. The elastic potential energy storage system had a swift discharge rate, indicating its viability to support power surges. The gravitational potential energy storage system was versatile for all of the criteria, suggesting that it could fulfill many generic energy needs.

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