

Compressed Air Energy Storage

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Multiple renewable energy sources are intermittent in availability. This leads to fluctuations in electrical energy generation. Energy storage is used to provide ancillary energy to a system when electrical consumption nears production. Compressed Air Energy Storage (CAES) is a mechanical method of storing energy for grid scale systems. This system functions by utilizing excess energy for compressing air up to a storage pressure, when demand exceeds production air is released expanded through a turbine to convert the stored mechanical energy into electrical energy. Research was focused on downsizing current CAES systems to residential scale prototypes for independence from the grid. Original research focused on creating a low pressure prototype with storage pressures of 100 psi. The first prototype showed a 15% overall efficiency where most of the losses occurred during expansion and inadequate energy storage densities. A second prototype was constructed to build on the previous prototype's deficiencies. This included a higher storage pressure of 2000 psi and development of an alternate method of converting mechanical to electrical energy. This prototype was found to be >1% efficient while retaining a higher energy storage density. Low efficiencies were attributed to inefficient compression, heat losses, throttling losses and inefficient electrical conversion. Future research will focus on the development of a third prototype designed to address the issues found in the previous systems.