

Compressed Air Energy Storage in a Lined Rock Cavern

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Abstract

Compressed air energy storage (CAES) is one of the most available options for large-volume electrical energy storage. CAES is an approach by which excess electricity is used to compress air, which is then injected into underground caverns. In two existing commercial CAES plants, compressed air is stored in salt dome. However, the lined rock cavern (LRC) could allow the realization of underground CAES at shallow depths and result in significant construction cost reduction, along with providing greater flexibility in site selection.

A pilot scale research was carried out to verify the applicability of compressed air storage in LRC. For the research, a cavern with a diameter of 6m and a length of 12m was excavated at a depth of 100m below the surface ground in a mine. The cavern was lined with concrete outside and steel plate inside.

Hydraulic test was carried out to evaluate the performance of LRC structure and to examine construction quality of LRC. During the test, the storage cavern was filled with water at a maximum pressure of 3.5 MPa. The displacement of the plug and rock around the cavern were converged to be less than 2.0 mm within the radial range of potential elastoplastic zone like excavated damaged zone. From the test, we could found that the variation of displacement, strains and pore pressure of surrounding rock is highly correlated with injection of compressed air.