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Some geomechanical aspects of compressed air energy storage (CAES) in salt caverns

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Abstract:

Because the availability of wind is time dependent whereas the need of electric power is continuous, an intermediate storage of wind power is required. The intermediate storage of wind power basically could be done by compressing air in times with more wind power than needed for the grid and decompressing air in times with less wind power than needed for the grid. The compressed air itself potentially could be stored in salt caverns. From the geomechanical point of view this simple idea causes some problems regarding to the cavern stability. In comparison to the well known geomechanical design of natural gas storage cavities four significant differences between gas and compressed air storage in salt caverns must be pointed out: (1) The cyclic turnover between fluid injection and withdrawal for compressed air energy storage is a multiple of that used by natural gas storage. (2) The maximum cavern inside pressure for compressed air energy storage is limited by the allowable turbine input pressure which is in a level between 30 and 80 bar. (3) Cyclic loading by compressed air energy storage requires to superimpose thermal induced and mechanical stresses. (4) Compressed air energy storage is defined by the need of an ordinary operation phase with atmospheric cavern inside pressure.

Key words: Compressed Air Energy Storage (CAES), Cavern Design, Computer Modeling, Rock Mechanics