ANALYSIS OF TEMPERATURE TRANSIENTS OF UNDERGROUND AIR STORAGE IN A SALT DOME DURING CAES PLANT OPERATION

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ABSTRACT

This paper presents a discussion of the computer models developed to quantify the effects of transient processes occurring during injection, storage, and withdrawal of compressed air from underground storage in a salt dome.

The following mechanisms are considered when modelling the thermodynamic behavior of the compressed air within the cavern:

1) Temperature variations due to the compression and expansion of the air.

2) Heat transfer by convection at the cavern wall.

3) Heat transfer by conduction inside the salt formation.

4) Enthalpy and relative humidity changes as air is injected into and withdrawn from the cavern.

The paper presents the basic methodology utilized in the program, the comparison of results to actual measured data and other predictions, and the effects which the cavern transients can have on overall plant performance and cost. In addition, a description of the proposed methods to be provided by EPRI for measuring the cavern conditions of pressure, temperature, and humidity to further verify the program at the Alabama Electric Cooperative Compressed Air Energy Storage (CAES) plant are presented.