

Uses for Closed Coal Mines: Construction of Underground Pumped Storage Hydropower Plants

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Abstract : Large scale energy storage systems (LSESS) such as pumped-storage hydro-power (PSH) are required in the current energy transition towards a low carbon economy by using green energies that produce low levels of greenhouse gas (GHG) emissions. Coal mines are currently being closed in the European Union and their underground facilities may be used to build PSH plants. However, the development of this projects requires the excavation of a network of tunnels and a large cavern that would be used as a powerhouse to install the Francis turbine and motor-generator. The technical feasibility to excavate the powerhouse cavern has been analyzed in the North of Spain. Three-dimensional numerical models have been conducted to analyze the stability considering shale and sandstone rock mass. Total displacements and thickness of plastic zones were examined considering different support systems. Systematic grouted rock bolts and fibre reinforced shotcrete were applied at the cavern walls and roof. The results obtained show that the construction of the powerhouse is feasible applying proper support systems.

Keywords : closed mines, mine water, numerical model, pumped-storage, renewable energies

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