ABSTRACT/SUMMARY

THERMAL MODELING OF SUBTERRANEAN BATTERY ENERGY STORAGE SYSTEM OPERATION FOR RESIDENTIAL AND COMMERCIAL BUILDINGS

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Battery energy storage systems for stationary applications continues to grow, to meet our energy needs and providing storage solutions to energy systems. The siting of the battery is an important consideration for continued deployment and underground installations have yet to be considered for potential installation sites, although they have benefits such as safety and limited structural footprint. Due to the complexity of access to the battery installed underground for thermal management, a battery thermal model is developed in this study for investigating the thermal behaviour and performance of a battery sited underground and utilizing the ground for passive thermal management. The thermal properties of the ground governs heat transfer in the ground and strongly influences the battery performance in terms of capability, therefore it is important to investigate the thermal dynamics. Modeling and simulation in this study utilizes finite element analysis for thermal study of the battery operated with varying residential application signals. The model results are compared with experimental results from subterranean battery operation. The model results revealed a strong dependence of the temperatures on the battery signal and thermal properties of the soil, and less dependence on other variables such as the ground temperature and battery geometry.

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