TERRESTRIAL HEAT REPOSITORY FOR MONTHS OF STORAGE (THERMS™)

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**DESCRIPTION OF TECHNOLOGY**

The terrestrial heat repository for months of storage (THERMS™) provides low-cost, large-capacity, long-duration energy storage to increase reliability, resilience, and intermittent renewable energy on the electrical grid and clean production of process heat. THERMS™ employs a novel radial thermocline system that can reduce the levelized cost of storage (LCOS) of utility-scale energy storage from ~$100–$300/MWₑ to less than ~$40/MWhₑ.

The system consists of a packed bed (solid media) of rocks which acts as the bulk energy storage medium; the heat transfer fluid is air. The energy storage component can be thermally charged with surplus, low-cost renewable electricity via resistive heating elements, high temperature waste heat, or with concentrating solar power. Stored heat can be used on demand when electricity generation is needed by the grid, as shown in Fig. 1.

Heat from the thermal energy storage is extracted from the packed bed of rocks by blowing air through the packed bed, generating steam from the heat, which then powers a conventional steam turbine-generator set. Electricity produced here is managed, regulated and handled the same as electricity from a conventional synchronous power generating source. The insulated rock pile can be installed above or below the ground, providing an ultra-low-cost solution for large scale, long duration energy storage. Above the ground, the rock pile can be designed to be self-supportive and below the ground, the natural soil can provide the structural support.

**SIGNIFICANCE OF TECHNOLOGY**

This form of energy storage has the potential to provide a clean, environmentally friendly, low-carbon solution to the energy storage needs of the evolving energy sector. While there is a strong push to increase renewable energy in the following few decades, the nature of the bulk renewable energy generation is inverter based, with the exception of geothermal, concentrating solar power and hydro-electric generation which are synchronous generation sources resembling conventional generation sources.

The main merit of this technology is the ultra-low-cost potential of bulk (GWh scale) energy storage. This can primarily be achieved by utilizing locally available material, like naturally crushed rocks, for this application. In comparison to the state-of-the-art, two-tank molten salt thermal energy storage that is used in the concentrating solar power environment today, solid media energy storage inherently mitigates some of the current identified issues:

1. *Freezing of the molten salt that requires extensive trace heating*

2. *Scaling of the energy capacity per unit (dependent on the manufacturing capability of these tanks)*

3. *High temperature energy storage (current nitrate based molten salts breaks down above 565 °C, where the rocks can go up to 1000 °C)*

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COMPETITIVENESS

Thermal energy storage in a solid medium bulk storage material, enables an ultra-low-cost solution for high temperature thermal energy storage. This method of energy storage can provide energy in the form of high quality heat to the power generation sector or heavy industry for use in high temperature processes. Since the bulk storage materials being used are naturally crushed rocks and air, this is a robust, clean and environmentally friendly solution that can easily be paired with a wide range of renewable energy technologies, solving the issues accompanying the intermittent nature of renewable energy technologies.

WOW! FACTOR

THERMS™ provides a safe energy storage solution that makes the transition to a carbon-free grid possible by maintaining reliability, scalability, and flexibility of existing infrastructure while avoiding significant costs.

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