Experimental Testing of a 100 kWh Radial Packed Bed Thermal Energy Storage System

Concentrating Solar Technologies

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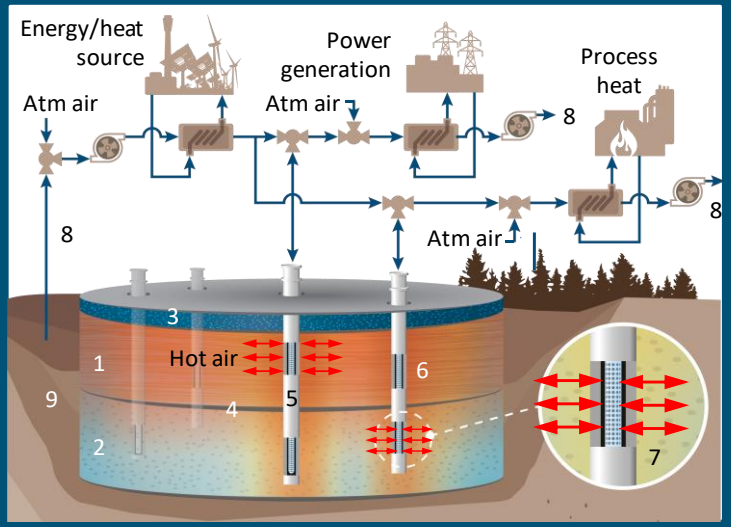
Problem Statement

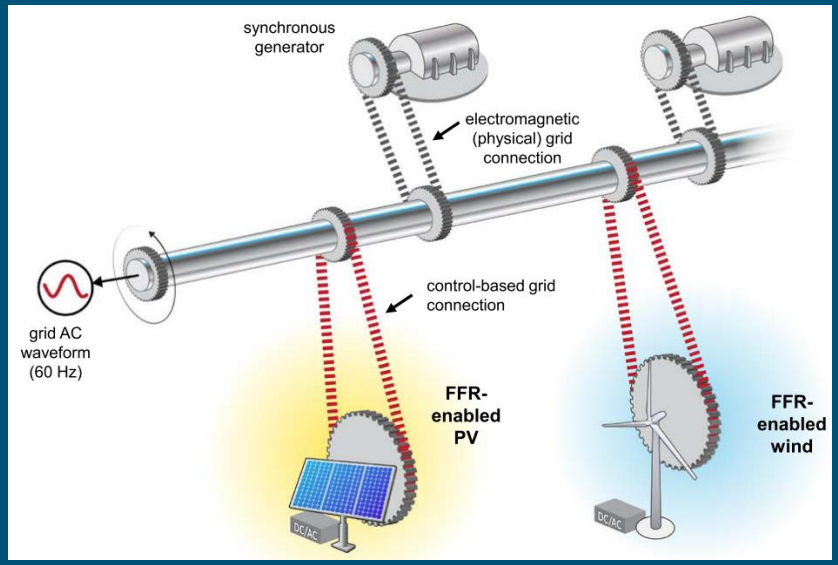
- Transition: conventional to renewable energy electricity generation
- Need for utility scale energy storage
- Supply-demand balancing capability – grid stability and reliability
- Ultra-low cost solution needed: Thermal Energy Storage?

Proposed Solution

- Thermal HEat Repository for Months of Storage (THERMS)
- Radial packed bed configuration
- Ultra-low cost natural crushed rock as the storage medium
- Air as the heat transfer fluid
- Potential of retrofitting existing thermo-electric power plants
- Enable synchronous electricity generation



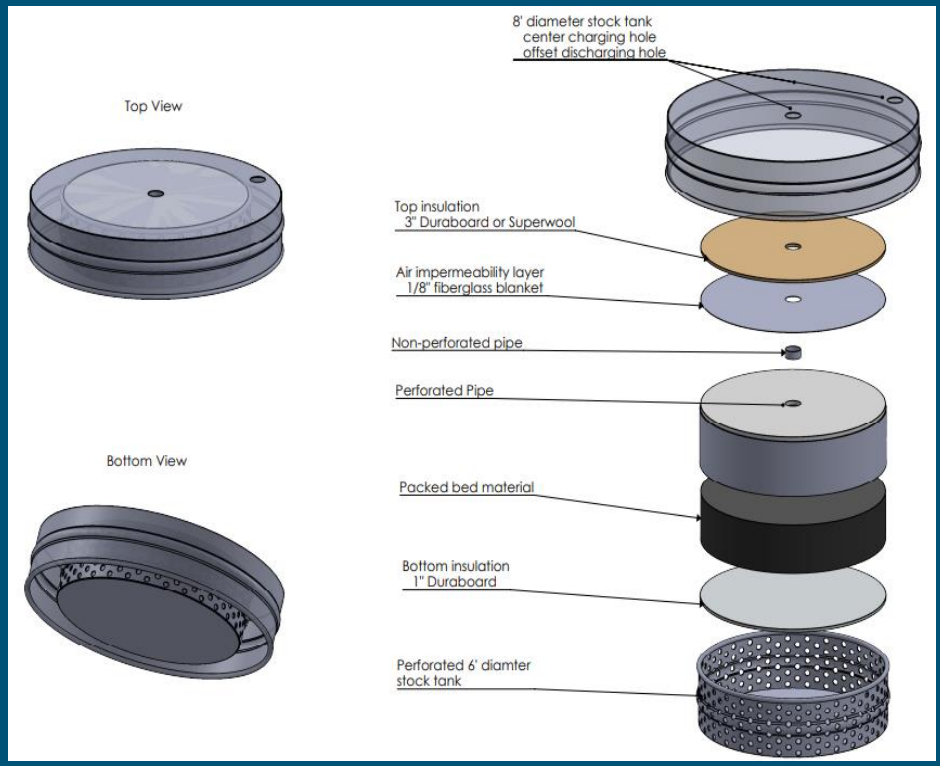
Ho and Gerstle
https://doi.org/10.1115/ES2021-63066



Denholm et al.
https://www.nrel.gov/docs/fy20osti/73856.pdf

Test Demonstration

- 100 kWh_{th} storage size
- Gravel size: 3/8” & ¾”
- Charge rate: 25 kW_{th}
- Discharge rate: 25 kW_{th}
- Max Temperature: 500 °C
- Propane air heater
- Demonstrating thermal energy storage capability only
- Construction is underway



Schroeder et al. SolarPACES 2022 abstract in progress

Path Forward – Potential Impact

- Larger scale experimental testing
- Pilot scale configuration design
- System Integration design
- Utility Scale techno-economic analysis
- Packed bed geometry refinement
- Ultra-low cost utility scale energy storage
- Second life for thermo-electric power stations
- Utilizing mature electricity generation technologies


Thank you.
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