

Geologic Thermal Energy Storage (GeoTES) Using Depleted Oil Reservoirs

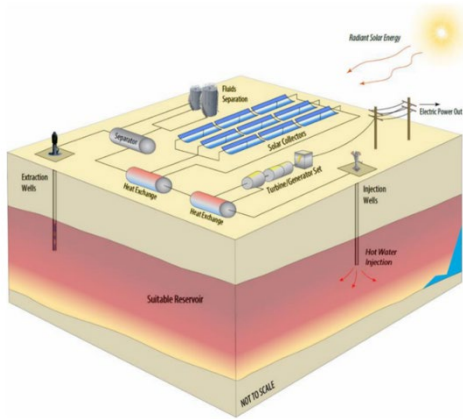


Figure 1 Pilot plant layout

The goal of this project is to demonstrate daily and long duration storage for CST using Geological Thermal Energy Storage (GeoTES).

Background: CST-GeoTES works by producing brackish water from a geological formation using a production well. The water is heated by the solar thermal collectors (to $\sim 200^{\circ}\text{C}$) and then re-injected into the reservoir via an injection well. Later, the stored hot water is produced and either used directly in industrial processes or converted into electricity.

GeoTES can have extremely large energy capacities in surprisingly small subsurface volumes. For example, a cubic formation with a 275m side-length can store enough $\sim 200^{\circ}\text{C}$ water to drive a 100 MW_e power cycle for 1500 hours (150 GWh_e). Furthermore, the cost of this storage is predicted to be very low – once the wells have been drilled, additional *energy* capacity is effectively “free”. PRM estimates a levelized cost of energy to be $\$0.063/\text{kWh}_e$ at full development. Consequently, GeoTES can enable CST systems to manage daily and seasonal variations in energy supply and demand, as well as increasing system reliability by managing unexpected grid events. CST-GeoTES systems will play a critical role in decarbonizing fossil-dependent industries and decarbonizing power generation

The project team has the expertise required for the design, analysis, and deployment of GeoTES systems, as well as a track record of commercial development of CST technologies. PRM’s combination of experience and project site offers a unique opportunity to advance CST technology for the purpose of decarbonizing traditional fossil fuel assets while offering integral energy seasonal storage. NREL has developed techno-economic analysis tools of CST-GeoTES designs and systems that hybridize CST and geothermal technologies.

Proposed Technology: thermal energy storage (TES) system to facilitate daily and seasonal energy management for Concentrating Solar Thermal (CST) installations - Figure 1. The project comprises the following goals:

1. Install a $>100 \text{ kWe}$ demonstration power plant with >12 hours storage, using a concentrated solar thermal field.
2. Demonstrate the storage and recovery of solar heat in the GeoTES and deliver electrical power.
3. Create community benefits: local jobs and manufacturing to disadvantaged communities, clean and affordable power, reliable energy storage.
4. Conduct techno-economic analysis for a full-sized deployment of CST-GeoTES.

This demonstration of integrating existing technologies will show that CST-GeoTES is feasible. PRM has a commercial CST-GeoTES development planned after this demonstration.

Premier Resource Management – GeoTES News

NREL and Premier Resource Management Launch Partnership

[NREL-Led Team Explores Potential of Underground Geothermal Energy Storage for All Seasons](#)

NREL Presentation at Society for Petroleum Engineers' Energy Transition Symposium 2023

[Techno-Economic Analysis and Market Potential of Geological Thermal Energy Storage \(GeoTES\) Charged with Solar Thermal and Heat Pumps into Depleted Oil/Gas Reservoirs and Shallow Reservoirs: A Technology Overview](#)

NREL Advancing Geothermal Research 2023

[NREL-Led Team Exploring Underground Thermal Energy Storage for All Seasons](#)

OnePetro – Society of Petroleum Engineers

[Geothermal Energy Storage \(GeoTES\) Using Traditional Oil Reservoirs](#)

Department of Energy Solar Energy Technologies Office

[DOE Announces \\$33 Million to Deploy Solar Technologies to Decarbonize America's Industrial Sector](#)

NREL Presentation at Stanford Geothermal Workshop 2024

[Geological Thermal Energy Storage \(GeoTES\) Charged with Solar Thermal Technology Using Depleted Oil/Gas Reservoirs and Carnot-Battery Technique Using Shallow Reservoirs](#)

NREL Techno-Economic Analysis 2024

[Techno-Economic Analysis and Market Potential of Geological Thermal Energy Storage \(GeoTES\) Charged With Solar Thermal and Heat Pumps](#)

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[Can a California oil field be retrofitted to store solar energy?](#)

San Diego Union Tribune

[Turning California's oil fields into energy storage sites](#)

Fast Company

[These abandoned oil wells near Bakersfield could store enough solar power for 300,000 homes](#)

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