



Donnerstag, 29. Februar 2024, 14.00 Uhr
Baden Arena Kongress 1 – Tiefe Geothermie

Thursday, 29 February 2024, 2.00 pm
Baden Arena Congress 1 – Deep Geothermal Energy



Sustainable and Cost-Effective Storage Solutions for Europe from Mechanical and Geothermal Energy Technologies

Nachhaltige und kosteneffiziente Speicherlösungen für Europa aus mechanischen und geothermischen Energietechnologien

Dr. Jeanette Hagan¹, John Ashbridge¹, Cindy Taff², Dr. Lev Ring², Mike Eros², ¹ZeroGeo Energy, ²Sage Geosystems

The growth of intermittent wind and solar power generation will significantly increase the demand for reliable storage solutions to replace fossil fuel baseload power production and mitigate marginal pricing. We present a new energy storage technology developed by Sage Geosystems to be deployed in Europe by TerraThermo Limited, similar to pumped storage hydropower (PSH) but instead of pumping water up a mountain, we pump it into the subsurface, where we store and harvest pressure and heat within a borehole.

TerraThermo Ltd is a European focused geothermal technology and projects development company intending to deliver energy storage projects (including mechanical and geothermal storage) and geothermal baseload power generation at competitive costs, leveraging Enhanced Geothermal System (EGS) technologies. Sage Geosystems is a US technology company focused on energy storage and geothermal solutions for a sustainable energy future. Utilizing existing oil and gas equipment and technologies, Sage has developed energy storage solutions that include mechanical storage (EarthStore™) and geothermal storage (Battery+™). These novel technologies can be paired with intermittent renewables (such as solar and wind farms) to store mechanical energy that can then be dispatched during times of peak demand. They rely on currently available equipment and can be adapted to a broad range of subsurface conditions.

EarthStore and Battery+ are estimated to be considerably less expensive than current surface storage alternatives on a Levelized Cost Of Storage (LCOS) basis, which considers the full lifetime cost of ownership divided by the annual usable MW.

EarthStore injects water downhole into an artificial subsurface reservoir, stores it for a period of hours or longer, then re-opens the valves on the borehole and generates energy from the pressurised water that jets to surface. EarthStore can be installed anywhere regardless of geothermal characteristics to provide efficient and cost-effective energy storage and power generation. Based on recent 2022-2023 field testing in South Texas, USA and modelling it has an estimated round-trip efficiency of 70-75% and offers discharge times of 1 hour and up to 18 hours with the potential for more which can be used for daily, weekly, or even seasonal storage. Some existing oil and gas boreholes can be re-purposed for EarthStore, depending on well integrity.

When the temperature is greater than 150° C at the bottom of the borehole, a Battery+ system is modelled to capture both the pressure and heat of the water, enhancing performance, efficiency, and generating geothermal electricity. It delivers more energy to the grid than is expended to store that energy, with a 200% efficiency.

EarthStore and Battery+ can substantially lower the Levelized Cost of Storage in Europe, have low to zero carbon emissions, a minimal footprint, and are sustainable requiring no supply chain. By drilling deeper and reaching hotter rocks, they can deliver geothermal baseload energy. Sage Geosystems can pair mechanical storage with solar to generate 24/7 baseload energy using proven technologies in the near term, including within the normally-pressured, low-permeability formations of Paleozoic basins of Central Europe.