

GEOTHERMAL ACTIVITY IN UTAH

The information below goes over specific geothermal projects currently under operation in Utah, with details describing how each falls under one of the three types of geothermal systems (Heating-Cooling Exchange Systems, Direct Use Geothermal or Geothermal Power Production).

HEATING-COOLING EXCHANGE SYSTEMS (aka ground source heat pump, geothermal heat pump)

Over the last two decades, closed-loop heat exchange well systems for heating and cooling buildings have become increasingly popular in Utah due to lower operation costs and less of an environmental impact than conventional HVAC systems.

About **1,000 closed-loop systems have been installed in Utah since 2003** ranging from residential applications to large buildings including schools, commercial buildings and government buildings. Most new K-12 schools in Utah are equipped with closed-loop systems. Many of the state's universities have closed-loop systems including U of U, USU, Weber State and UVU.

Closed-loop systems consist of 1 to 10 closed-loop wells for residential application to hundreds of closed-loop wells for larger buildings. For larger applications, closed-loop fields are installed underneath parking lots, sports fields or other large open areas.

Between 5 to 20 open-loop heat exchange well systems are installed in Utah annually. These systems are less common than closed-loop systems because of the up-front drilling and long-term maintenance costs for water wells and injection wells, and for environmental concerns with reinjecting warmed water back into an aquifer. This creates a challenging process for obtaining a water right for this type of system.

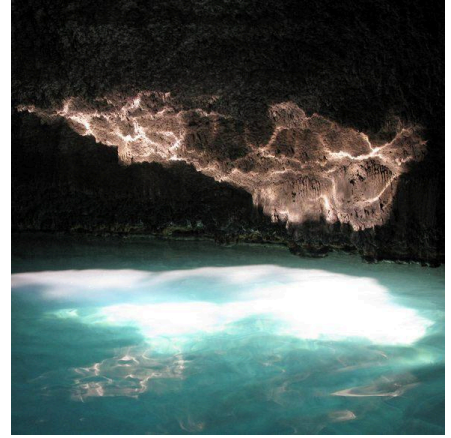


These systems can be used from residential applications to large building applications. An example of a larger project **(pictured above, right)** is at UVU where the school is pumping thousands of gallons per minute from wells to circulate through a heat exchanger to heat and cool many of their campus buildings. Then water is reinjected into the aquifer.

DIRECT USE GEOTHERMAL

Direct use of geothermal water from wells and springs with temperatures ranging from warm water to as high as 200°F water are used in Utah for a variety of direct applications including the following examples:

- **Direct building heating (100-200°F)**
 - Former State Prison
 - Midway area homes
- **Greenhousing (90-170°F)**
 - Milgro in Newcastle and Utah Roses in south Salt Lake valley
- **Mushrooming near Fillmore**
- **Recreational bathing/spas and scuba diving (70-120°F)**
 - Belmont, Crystal, Mystic, Fifth Water, Meadow, Pah Tempe, Bonneville Seabase, Homestead, Midway (*pictured to the right*), Monroe, etc.
- **Fisheries and Aquaculture (70-150°F)**
 - Hi-Tech Fishery in Bluffdale



GEOTHERMAL FOR POWER PRODUCTION

Traditional Geothermal Systems

Cove Fort Geothermal Power Plant

- Traditional hydrothermal Binary Cycle System producing 25 MW using superheated pentane as working fluid
- Operated by ORMAT Technologies, Inc. on BLM, Forest Service and private land
- Located about three miles south of Cove Fort
- Five production wells (2-4k feet deep) and three injection wells (4-6k feet deep)
- Production wells average 311°F, 175 psi and 23 CFS flow
- Reservoir is fractured Paleozoic quartzite and carbonate rock
- ORMAT is planning for a plant/well pump upgrade and development of two more plants with associated wells in the vicinity.



Blundell Geothermal Power Plant

- Traditional hydrothermal system using combination Flash (26 MW) built in 1984 and Binary Cycle (11 MW) built in 2006
- Operated by Rocky Mountain Power (PacifiCorp), located 10.5 miles northwest of Milford
- Brine separated from flashing is used in the binary system
- Five production wells (5000'), four injection wells (6000')
- Production fluid average is 345°F, 110 psi and 9 CFS
- Geothermal reservoir is naturally fractured granitic rock



THERMO NO.1 BE-01 Geothermal Power Plant

- Traditional hydrothermal Binary Cycle System producing 14 MW using superheated isobutane as working fluid
- Operated by CYRQ ENERGY on State and private land, and is located 19 miles southwest of Milford
- Four production wells (9-10k') and four injection wells
- Production wells average 260°F, 100-150 psi, and 15 cfs
- Cyrq Energy is planning new wells for the existing plant and expanding with a new plant with associated wells to the northwest of the existing plant which would more than double their MW capacity



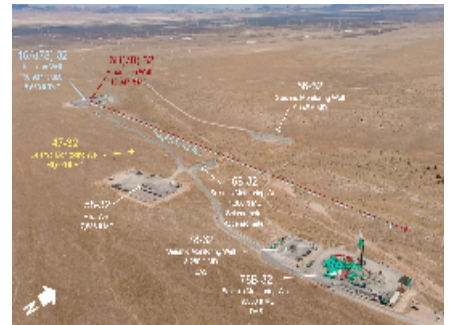
Current EGS Projects

Utah Frontier Observatory for Research in Geothermal Energy (FORGE)

Utah FORGE is a dedicated underground field laboratory sponsored/funded by the Department of Energy (DOE) and operated/managed by the University of Utah's Energy and Geoscience Institute for developing, testing, and accelerating breakthroughs in EGS technologies to advance the uptake of geothermal resources around the world. The FORGE mission is to enable cutting-edge research and drilling and technology testing, as well as to allow scientists to identify a replicable, commercial pathway to EGS.

The FORGE site is located 10 miles north-northwest of Milford. A very large volume of hot (~400-500°F at ~1.5-2 miles depth) unfractured rock underlies the FORGE site. The quantity of heat stored in this low-permeability rock has a huge power potential that can be tapped using EGS technology.

Since its inception in 2015, there have been seven wells drilled including the two main deviated EGS wells 16A(78)-32 and 16B(78)-3258-32, a deep test well, and four deep seismic monitoring wells. A FORGE water well has also been drilled to supply water for stimulation and testing purposes. Ongoing stimulation, cross-flow testing, and modeling are occurring on the EGS wells.



FERVO Energy Commercial EGS Project

- AKA Escalante Desert Resources Cape Station Project
- About 9 miles Northeast of Milford and adjacent to the FORGE site on mostly BLM land, with some State and private land.
- Planned 25+ Well Pads with 3-8 EGS wells/pad
- 400-MW goal; Power Purchase Agreements established in California

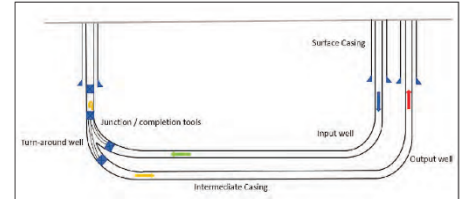


- 200 MW Phase 1 (900 acre lease area) to be operational by 2026; Phase 1 & 2 combined 5,000 acres leased and completed by 2028. FERVO has 60,000 acres under lease for geothermal development beyond Phases 1 & 2.
- Nine EGS wells and one deep vertical test well completed with 7 EGS wells in progress and 20 more EGS wells permitted. One EGS well pad with 4 wells is currently in the process of stimulation and cross-flow testing.

Current AGS Projects

RODATHERM Closed-loop Test Bed Project

- North of Milford just east of SR257 at Beaver-Millard Co. line on BLM land
- Anticipated start of drilling is 2024
- Fully sealed, cased, and pressure tested closed loop that will circulate a working fluid
- Modular design to produce 1-10 MW per unit
- Permitted for four deep deviated wells to be tied into one junction well at a depth of 1.5 to 2 miles



Geothermal Projects in Research, Development & Exploration Stages

ZANSKAR GEOTHERMAL & MINERALS, INC.

- Currently in the study and exploration phase
- Using AI, robust data and advanced sensing techniques to pinpoint developable geothermal systems
- To date, Geoprobe temperatures surveys and temperature gradient wells in the Meadow and Joseph areas
- Testing of an old 12k-foot geothermal exploration well near Beryl to determine development potential
- Many more areas to be explored throughout the state



ORMAT's Bailey Mountain Geothermal Project

- Proposed 19 geothermal exploration wells with of focus on traditional geothermal development
- Project is on BLM land and has their approval. Currently not permitted at the State-level

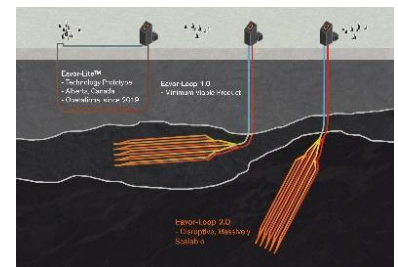
RENEWABLE ENERGIES LLC IN NEWCASTLE

- Traditional hydrothermal system on BLM land above Newcastle to the southeast near existing green houses
- Currently in testing/planning phase with exploratory drilling
- Still need to establish geothermal water rights
- Possibility of collaboration with green houses to use spent geothermal fluid which is still hot enough for direct use at the green houses before it is reinjected into the geothermal reservoir.



EAVOR TECHNOLOGIES AGS CLOSED-LOOP SYSTEMS

- Preliminary evaluations and lease acquisition in west-central Utah
- Closed-loops system with working fluid circulating naturally from thermosiphon effect
- Modular Organic Ranking Cycle turbo generator



GFE SUSTAINABLE, INC. (CALGEO)

- Exploration drilling in Sulfurdale just southeast of the Cove Fort geothermal plant located on BLM and private land.
- Evaluating potential for traditional geothermal with binary cycle power production or direct use application for green housing.

