

## Enhanced Geothermal Energy Field Laboratory

Through collaborations fostered by the Center for Advanced Energy Studies<sup>1</sup> (CAES), Idaho's universities (University of Idaho, Boise State University, and Idaho State University) and the Idaho National Laboratory (INL) are conducting research and educating the future work force that supports the development of geothermal energy from enhanced or engineered subsurface reservoirs. Enhanced Geothermal Systems (EGS) have the potential to revolutionize the utilization of this important source of renewable-base load energy by increasing the number of and enhancing the characteristics of sites where geothermal power plants can be located.

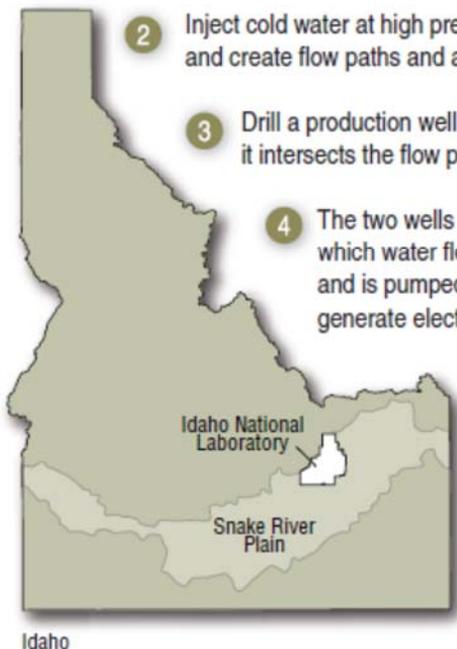
Currently, geothermal power plants are located where the required hot rocks have sufficient water and permeability to carry the heat to the surface for power generation. By making use of advances in drilling and fracking technologies, EGS has the potential to revolutionize geothermal energy by enabling power production nearly anywhere hot rocks are found. Horizontal and angled drilling coupled with hydraulic fracturing can create permeability, and by circulating water through a network of fractures the water is heated to temperatures sufficient for power generation. Because rock at several kilometers of depth is commonly hot enough for geothermal energy generation, EGS technology

could potentially exploit an enormous energy reserve. The U.S. Department of Energy's (DOE) Geothermal Technologies Office is actively pursuing EGS research, development, and deployment activities to bring concepts to the field demonstration. DOE has determined that a field research laboratory devoted to EGS is needed to facilitate technology validation and deployment, reduce costs, and improve performance. Although several places in the western U.S. are good candidate sites, the shallow high-temperature subsurface at the INL, combined with favorable geologic and hydrologic conditions, make it an ideal location for the DOE's EGS Field Laboratory.

Idaho has a long and rich history of utilizing geothermal energy. In 1892, Boise installed the world's first geothermal district heating system, a system that is still in operation today. One of the first demonstrations of

### How to create EGS systems:

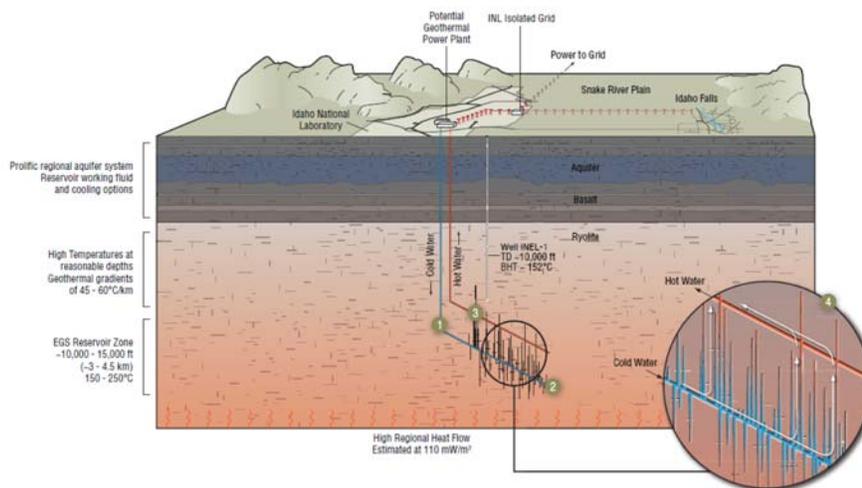
- 1 Once a site is identified, drill an injection well into hot rock.
- 2 Inject cold water at high pressure to fracture rock and create flow paths and a heat reservoir.
- 3 Drill a production well through the fractures so it intersects the flow paths.
- 4 The two wells create a circulation loop in which water flows through the heat reservoir and is pumped out of the production well to generate electricity.



<sup>1</sup> The Center for Advanced Energy Studies is a public/private partnership between the State of Idaho through its academic research institutions, Boise State University, Idaho State University, the University of Idaho, and the federal government through the Department of Energy and its Idaho National Laboratory, which is managed by the private entity Battelle Energy Alliance. Through its collaborative structure, CAES combines the efforts of these four research institutions to provide timely research support on both technical and policy issues.

binary power cycles for geothermal energy occurred at the Raft River Geothermal Field in the early 1980's, and advances made there on dual boiling cycles are now the industry standard. In addition, early tests of technologies to stimulate well production occurred in Idaho. Recently, the U.S. Geological Survey has estimated that there is potentially up to 92,000 megawatts of enhanced geothermal electric production capacity within the state of Idaho.

Of particular interest are the resources of the Eastern Snake River Plain (location of the INL) which was formed over geologic time by volcanic activity associated with the relative movement of the Yellowstone Hot Spot across the state of Idaho. Today the area is characterized by high heat flows and elevated subsurface temperature, abundant water, and extensive infrastructure. These characteristics, coupled with the long history of leadership in geothermal research by INL and the CAES Idaho universities, make the INL the ideal location for an EGS Field Laboratory. The EGS Field Laboratory will enable at-scale field testing (in collaboration with industry partners) of new field subsurface methods



and surface engineering technologies. CAES will serve this Field Laboratory, providing the research and computation infrastructure necessary to evaluate the effectiveness of new methods and technologies. The EGS Field Laboratory would be operated for the benefit of DOE and the nation by INL and its CAES collaborating universities, and it is estimated to require 5 to 7 years to develop and construct at an approximate cost of \$50 million. Establishing DOE's EGS Field Laboratory on the Snake River Plain will once again position Idaho to lead the technical advances in geothermal energy and bring the science firmly into the 21<sup>st</sup> century. Idaho has significant untapped geothermal resources that could bring additional revenues and employment to the state.

**Request:** Support funding for the study to plan for establishment of an EGS Field Laboratory on the Snake River Plain.

**Account:** Account: Energy and Water; DOE; Science; EERE

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