

Low Temperature Potential in the Near-Term

Low-temperature and co-produced resources represent a small but growing sector of hydrothermal development, in geothermal resources below 150°C (300°F). Considered non-conventional hydrothermal resources, these technologies are bringing valuable returns on investment in the near-term, using unique power production methods.



1 The **Beowawe Power Plant**, a low-temperature, binary cycle plant, uses waste heat from an existing geothermal plant at the facility, which has added 1.8 MW to the existing plant's nameplate capacity of approximately 17.7 MW. The project was funded in part by the geothermal technologies Office under the American Recovery and Reinvestment Act. *Photo courtesy of Terra-Gen*

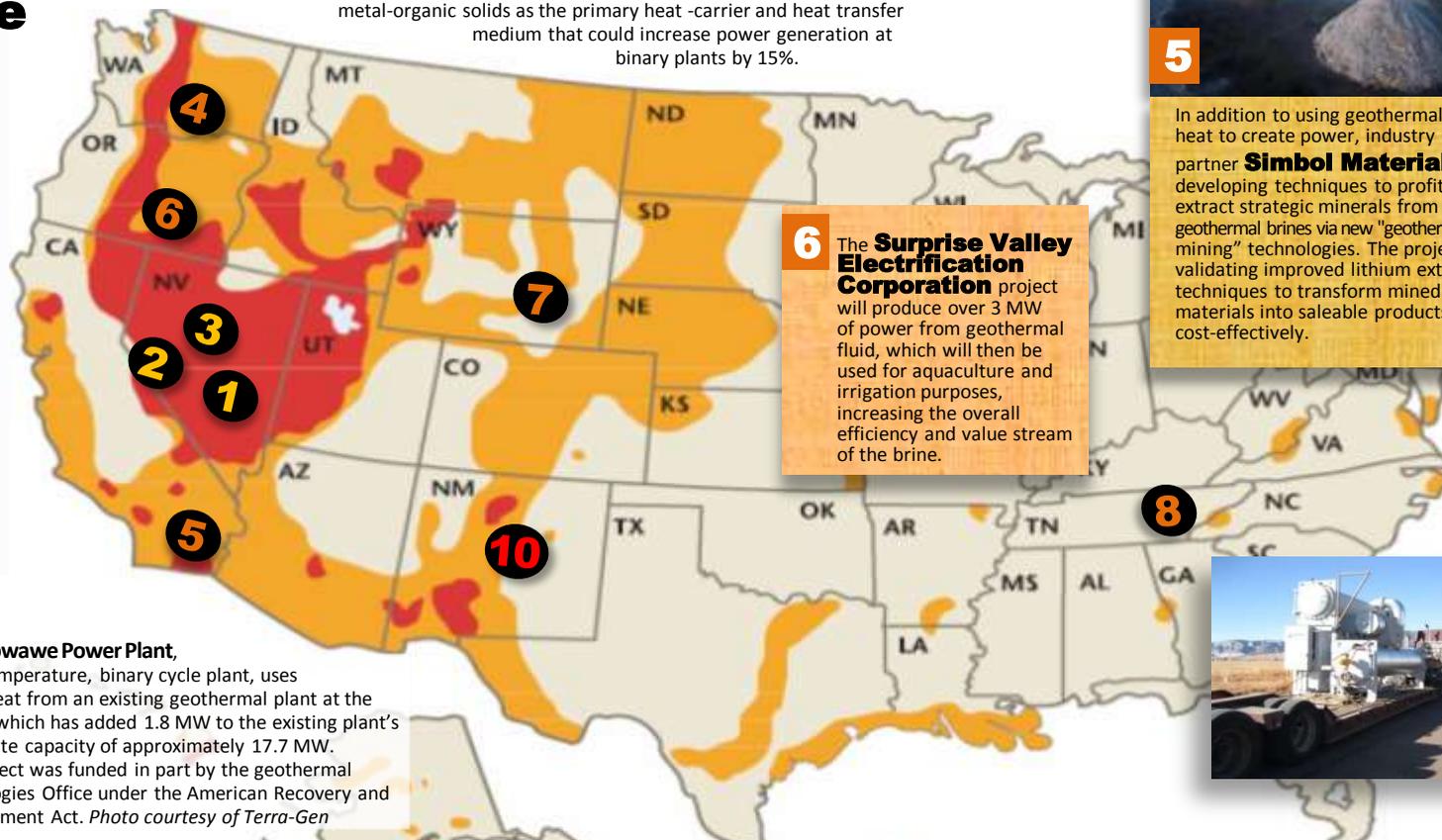


2 Terra-Gen at **Dixie Valley** is demonstrating the technical and economic feasibility of nonconventional geothermal resources (223°F), employing the first commercial use of a supercritical cycle at a geothermal power plant inlet temperature of less than 300°F. Since September 2012, the plant has been online and producing 6 MW.



3 **Small Scale Power Generation from Co-Produced Geothermal Fluid – Electratherm** has successfully demonstrated the technical and economic feasibility of geothermal energy production through a state-of-the-art Organic Rankine Cycle (ORC) heat-to-power generator.

Pacific Northwest National Laboratory (PNNL) is developing microporous metal-organic solids as the primary heat-carrier and heat transfer medium that could increase power generation at binary plants by 15%.



6 The **Surprise Valley Electrification Corporation** project will produce over 3 MW of power from geothermal fluid, which will then be used for aquaculture and irrigation purposes, increasing the overall efficiency and value stream of the brine.



5 In addition to using geothermal heat to create power, industry partner **Simbol Materials** is developing techniques to profitably extract strategic minerals from U.S. geothermal brines via new "geothermal mining" technologies. The project is validating improved lithium extraction techniques to transform mined materials into saleable products cost-effectively.

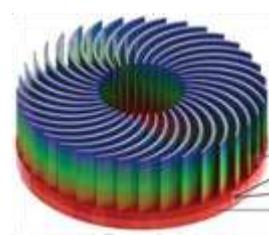


7 The **Rocky Mountain Oilfield Testing Center (RMOTC) Relocation Project** is designed to reduce the risks associated with co-production by operating binary units in commercial oil and/or gas fields. Technical site data will be collected to significantly reduce cost and performance uncertainties and lower the barrier for market uptake.



- 1. Beowawe
- 2. Dixie Valley
- 3. Electratherm

- 4. Pacific Northwest National Laboratory
- 5. Simbol
- 6. Surprise Valley Electrification Corporation (SVEC)
- 7. Rocky Mountain Oilfield Testing Center Relocation project
- 8. Oak Ridge National Laboratory



- 9. FY2014 Funding Opportunity
- 10. Sandia National Laboratory project **Innovative Rotating Heat Exchanger** Sandia National Lab

The innovative rotating heat exchanger prototype is an emerging technology addressing several barriers that conventional technologies presently face, including heat transfer bottleneck, noise levels, and dust fouling. The effort produced promising results in the lab and the prototype -- 10X smaller than current state-of-the-art CPU coolers and offers potential for even greater impacts on energy efficiency through up-scaling from use in electronics to vehicles, HVAC systems, and potentially power plants.

Significant Growth Opportunities in the Future

9 A **Funding Opportunity Announcement (FOA)** is slated for release in FY 2014 by the U.S. Dept. of Energy's (DOE) Geothermal Technologies Office (GTO) to advance thermal energy conversion processes and promote technologies that capture, concentrate, and purify strategic materials within geothermal brines for economical extraction and added revenue streams.