Cooper Basin EGS site, Australia.
Image Source: The Future of Geothermal Energy, 2006

Geothermal Energy in Oregon

Assessing Site Suitability for Geothermal Energy Development

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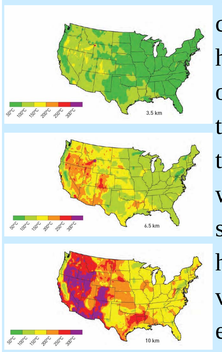
About Geothermal Energy

Geothermal energy is becoming increasingly important as the United States seeks to develop alternative, non fossil-fuel energy sources. There is potential for geothermal energy production in much of the United States, particularly in the western states.

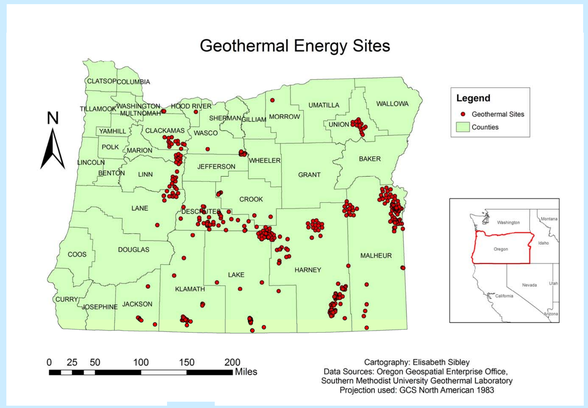
Enhanced (or Engineered) Geothermal Systems (EGS) is a method of extracting economical amounts of energy from low-permeability or low-porosity geothermal sources. The process works by creating a system of fractures in high-temperature, subsurface rocks, or accessing existing fractures. Water is circulated through the fractures, where it is heated by contact with the rocks and returned to the surface. The energy present in the hot water or steam can then be converted to marketable forms of energy.



Temperatures at depths of 3.5, 6.5, and 10 km.
Image source: The Future of Geothermal Energy, 2006

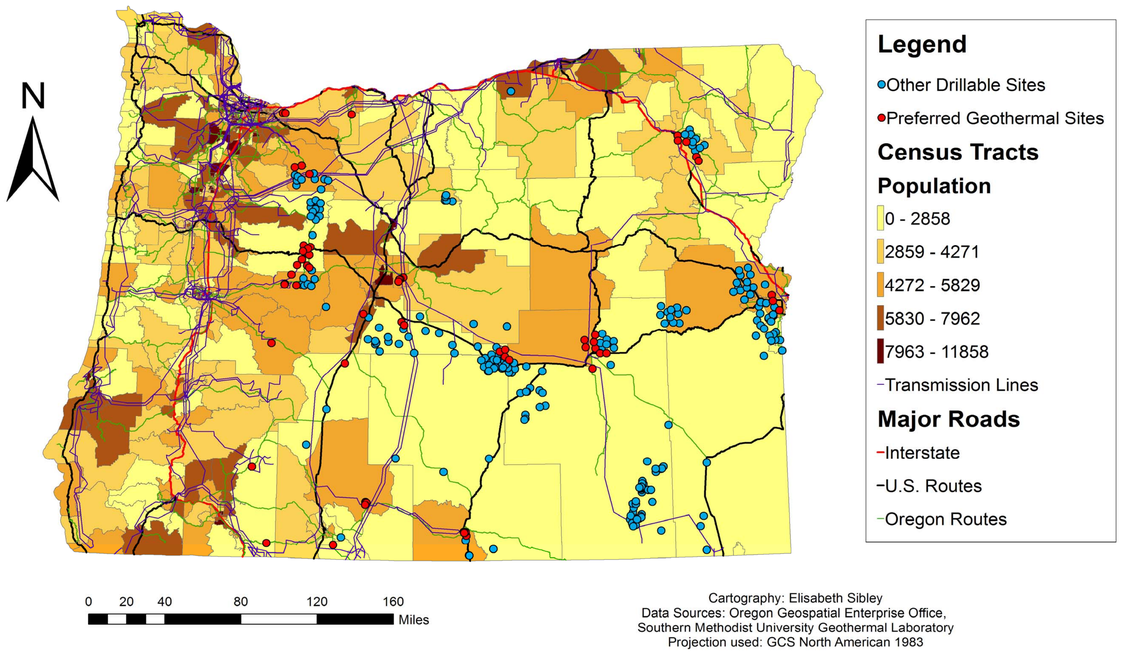
The geothermal energy extraction processes use an area of about 10 square kilometers for energy extraction, but very little surface land area. Because the energy production occurs underground, the area can be shared with other land uses such as agriculture and forestry.

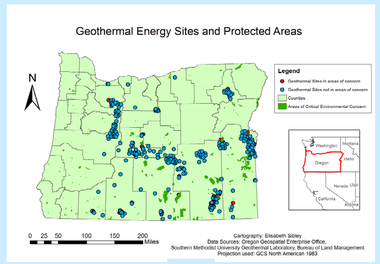
Introduction

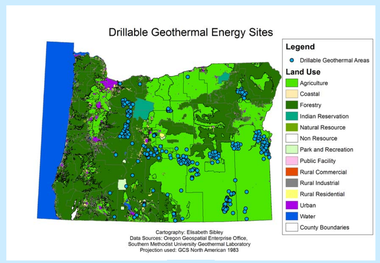


This project demonstrates some of the steps involved in using GIS for a site suitability analysis, using existing data about the locations of potential geothermal drilling sites obtained from the Southern Methodist University Geothermal Laboratory. These potential drilling sites were selected based on features necessary for the geothermal energy production process, such as temperature of the site and distance below the surface. This project will explore other factors influencing the feasibility of development, in order to determine which of the potential sites are preferred and should be given priority for development.

Preferred Geothermal Energy Sites







Methods

1. As shown above left, a map was created showing the positions of potential drilling sites by using the latitude and longitude information in the database to locate the sites within a base map of the state of Oregon.

2. Buffers were created around the data points to indicate the size of the area needed for energy extraction.

3. The buffered geothermal site data was overlain with data showing areas of critical environmental concern, where drilling and related construction should not be done.

4. The buffered geothermal site data was overlain with zoning data which shows developed areas, where drilling cannot occur, and areas with agricultural, forestry, or undeveloped land uses where drilling could likely be done.

5. As shown above right, the geothermal sites not excluded by the above analyses were overlain with maps showing major roads, transmission lines, and population density to determine which sites are most convenient within existing infrastructure and therefore preferred sites for development. Geothermal sites within 5 miles of both transmission lines and roads were marked as “preferred” sites.

References

The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century. 2006. Available online at http://geothermal.inel.gov/publications/future_of_geothermal_energy.pdf. Accessed 27 March 2007.

National Renewable Energy Laboratory. Available online at http://www.nrel.gov/gis/. Accessed 23 April 2007.

Oregon Geospatial Enterprise Office. Available online at http://www.oregon.gov/DAS/EISPD/GEO/. Accessed 21 April 2007.

Southern Methodist University Geothermal Laboratory. Available online at http://www.smu.edu/geothermal/georesou/resource.htm. Accessed 21 April 2007.

U.S. Department of the Interior Bureau of Land Management: Oregon and Washington. Available online at http://www.blm.gov/or/gis/index.php. Accessed 21 April 2007.