Geothermal Technologies Program

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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Low Temperature/Geopressured Team Lead

Advanced Energy 2010

Conference for Advanced Energy

Geothermal Technologies Session

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Benefits of Geothermal Energy

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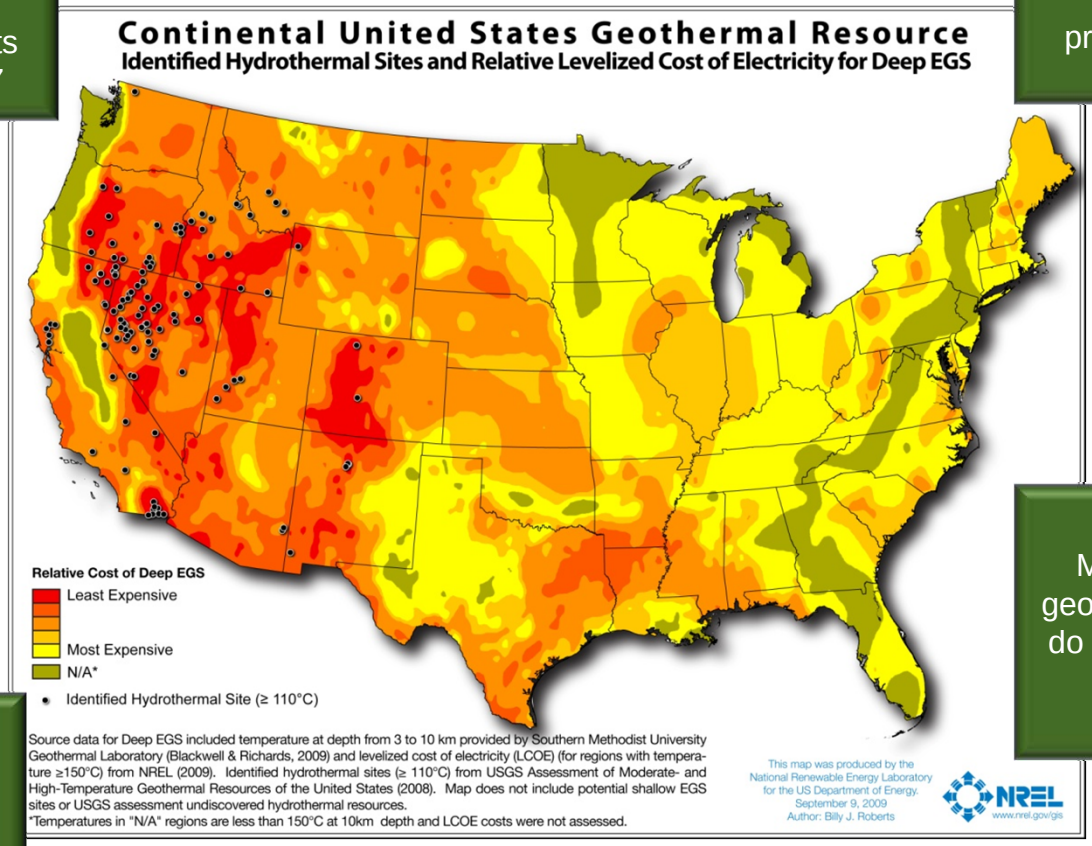
Geothermal energy is baseload, renewable, domestic and reduces greenhouse gas emissions.

The Advantages of Geothermal Energy

Baseload:
Geothermal power plants produce electricity 24/7

Domestic:
U.S. geothermal resources can be harnessed for power production without importing fuel



Clean:
Modern closed-loop geothermal power plants do not emit greenhouse gasses into the atmosphere

Renewable:
Geothermal resources can be utilized for years to come

Geothermal Program History
Annual Budget 1976-2007

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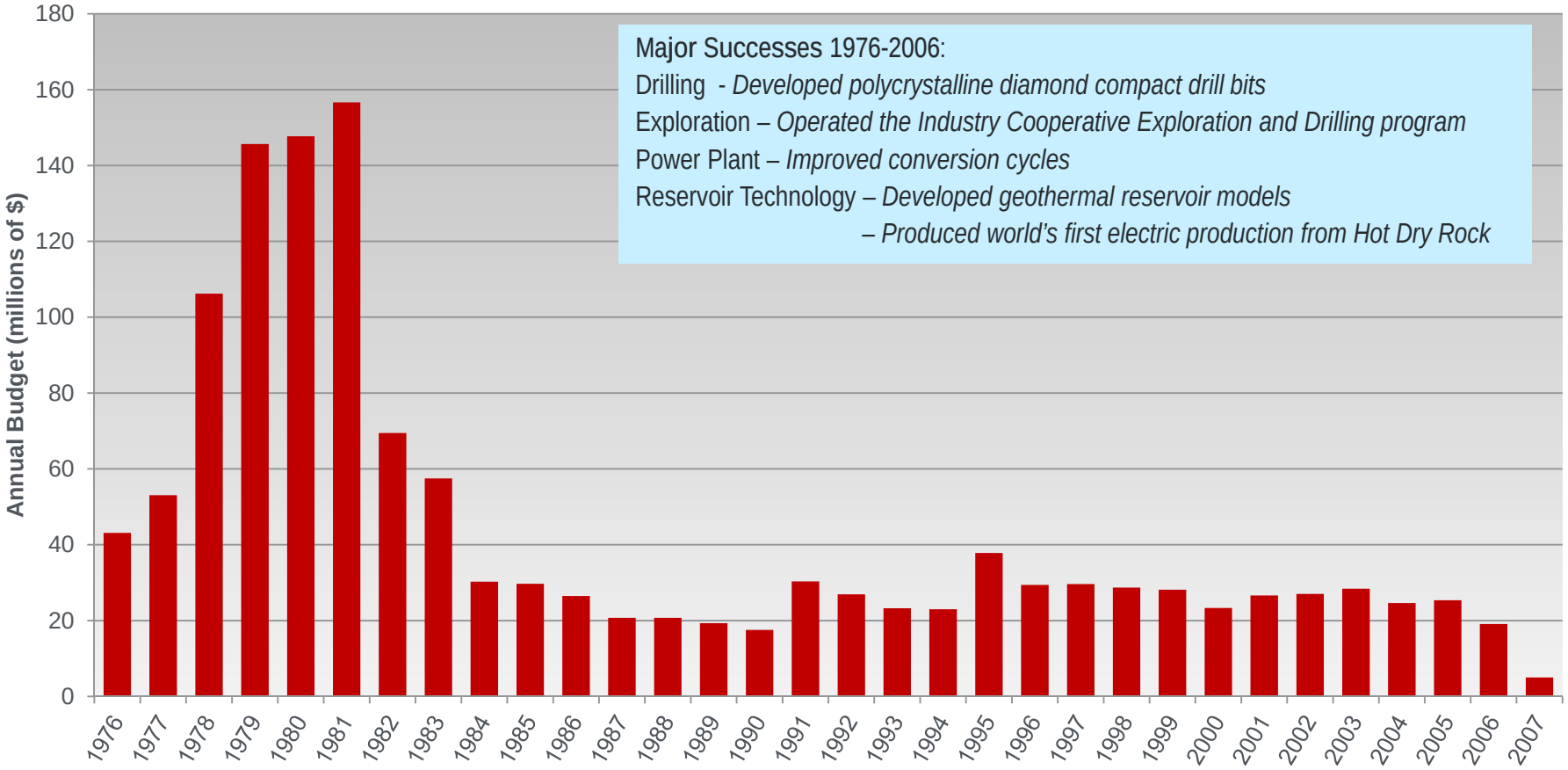
From 1976 to 2007, the Geothermal Technologies Program annual budget ranged from $5M (2007) to $156.6M (1981).

Annual Budget for the Geothermal Technologies Program 1976 - 2007



Geothermal Program
Recent Budget Trend

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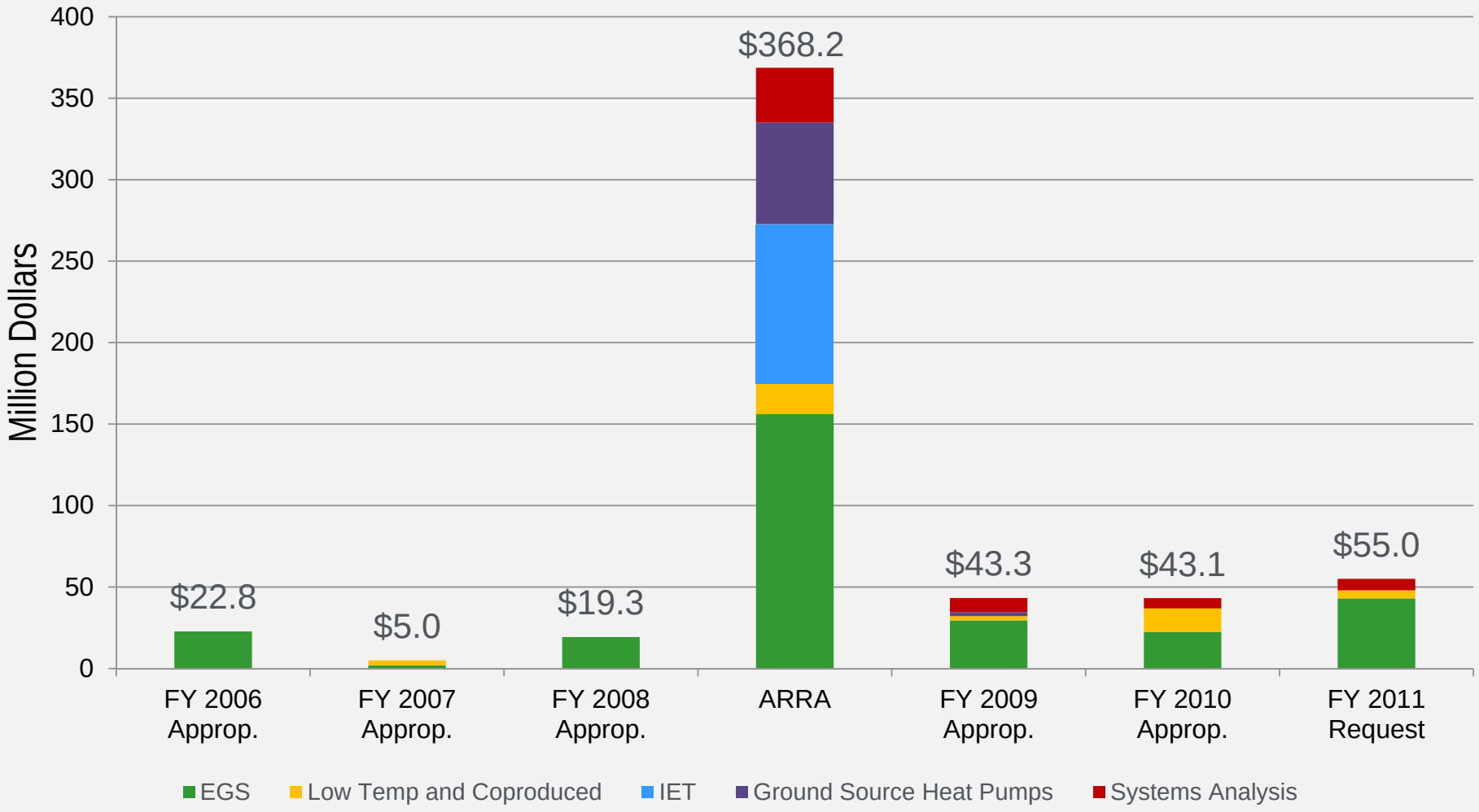
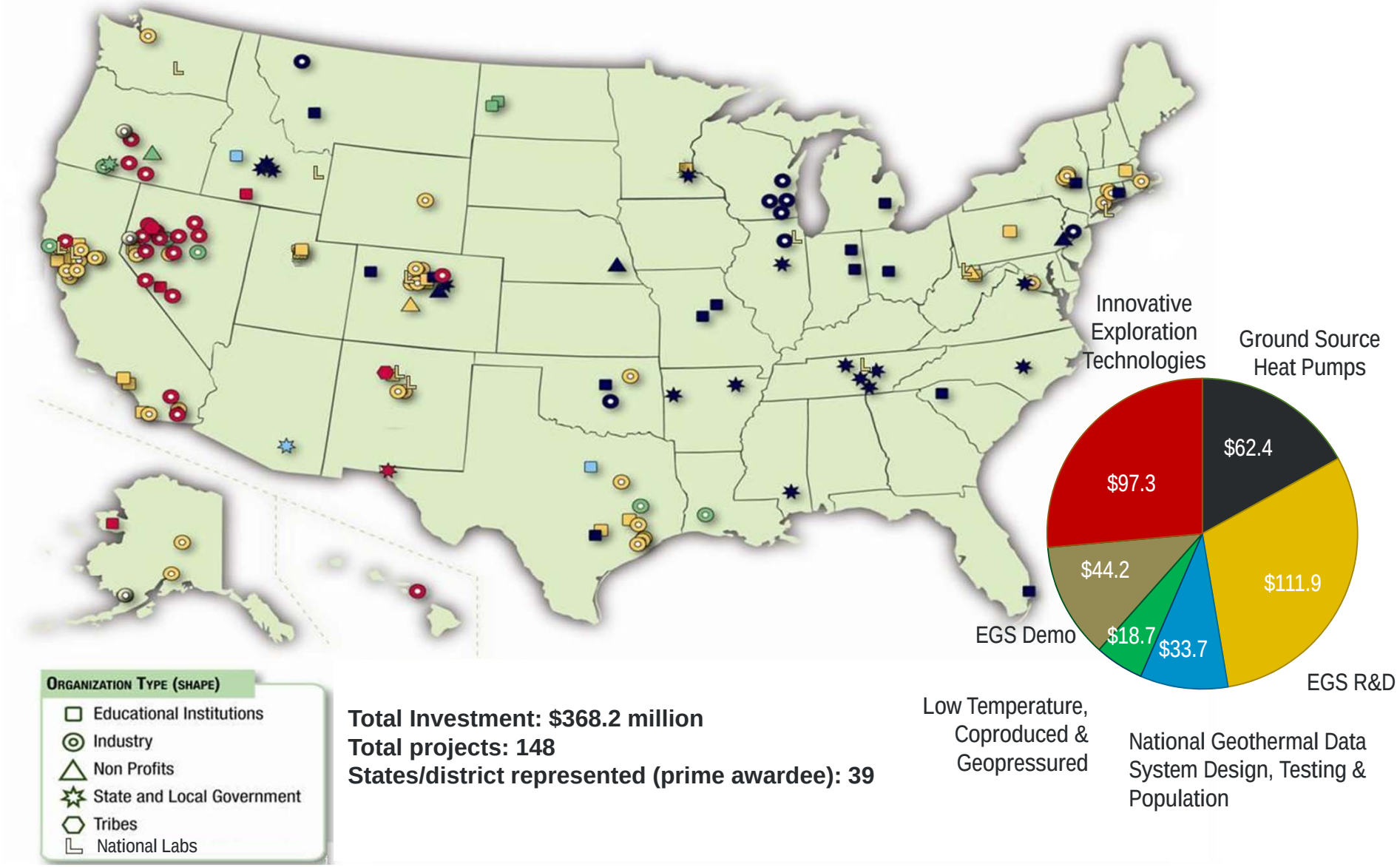
The Geothermal Program hit a low of $5.0 M in 2007, but was boosted by $368.2 M through the American Recovery and Reinvestment Act (ARRA) in 2009.



Geographic Diversity of Geothermal ARRA Prime Awardees: A National Impact



Total Investment: $368.2 million
Total projects: 148
States/district represented (prime awardee): 39

Geothermal Program Strategy

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For the near-term, lower costs of generation from coproduced geothermal resources and increase the exploration well success rate. For the long-term, lower costs of all geothermal technologies, including enhanced geothermal systems (EGS), and enable widespread access to a diversity of geothermal resources.

Near-Term

Long-Term

Low Temp, Coproduced and Geopressured

Conduct RD&D to lower the cost of low temperature, coproduced and geopressured resources and expand the use of geothermal resources

Innovative Exploration Technologies

Improve exploration tools to reduce costs and risks of exploration and increase installed capacity

Enhanced Geothermal Systems (EGS)

Demonstrate technical feasibility of power production from a 5 MW EGS reservoir by 2020

Invest in drilling, reservoir engineering, power plant and exploration technologies to reduce the costs of electricity for the entire spectrum of geothermal resources

Component R&D

Low Temperature, Coproduced and Geopressured

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Issue:

- Numerous resources too cool for flash steam generation.
- An estimated 10 barrels of water are produced per barrel of oil in North America.
- Facilities have lower cost, shorter lead time, broader geographic distribution than conventional geothermal.

Objective:

- Demonstrate production from oil and gas fields, geopressured fields, and low temperature resources across the U.S.

Action:

- Up to $18.7M in ARRA funds for 10 near-term energy projects including new hybrid plants, and speedy modular plant designs. Up to $20 mil in FY 10 & 11 funds for 7 innovative Low Temperature, Coproduced and Geopressured projects.

Innovative Exploration Technologies

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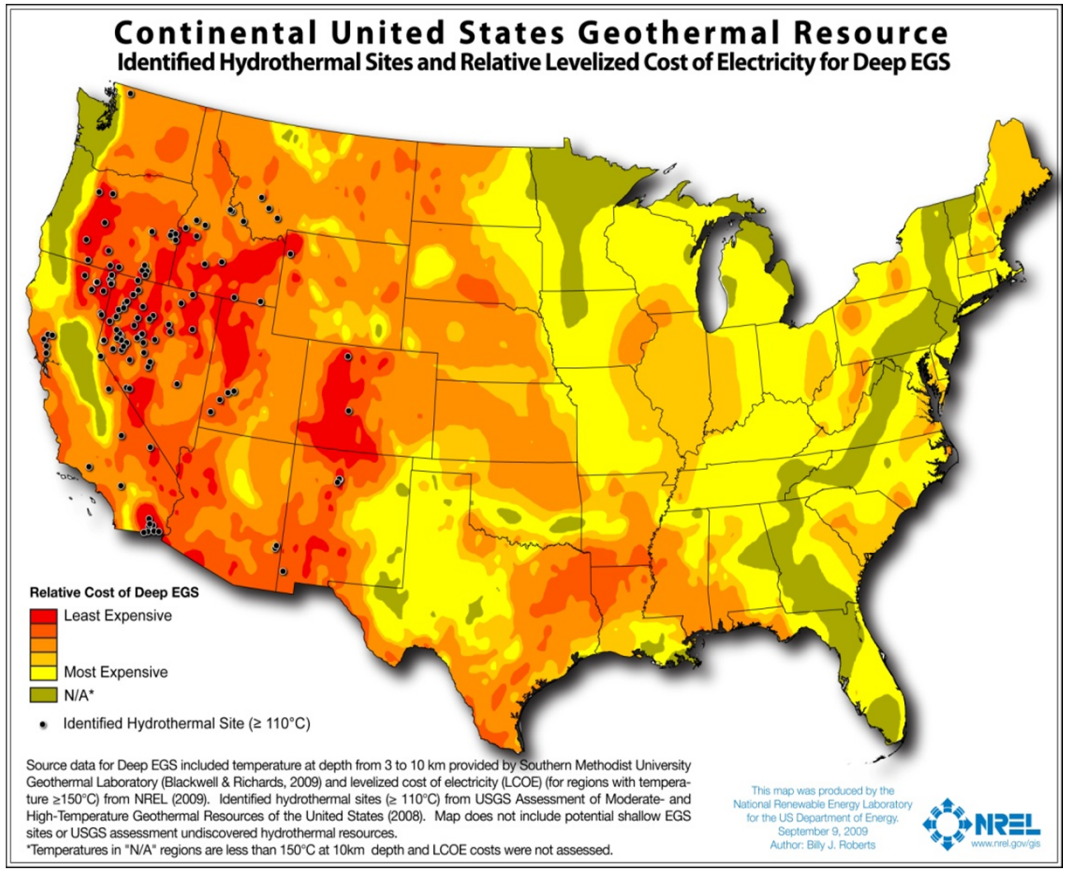
Issue:

- Upfront costs for early development and associated risk are prohibitively high.
- According to the USGS, there is a mean of 30GWe of undiscovered hydrothermal in 13 western states.

Objectives:

- Validate innovative exploration technologies to improve discovery success rate.
- Decrease exploration costs.
- Confirm new geothermal capacity.
- Provide data to the National Geothermal Database System (NGDS).



Action:

- Up to $98.1 M in ARRA funds invested in 24 grants to develop new, innovative methods of exploration and to contribute data to NGDS for resource assessment.

Enhanced Geothermal Systems

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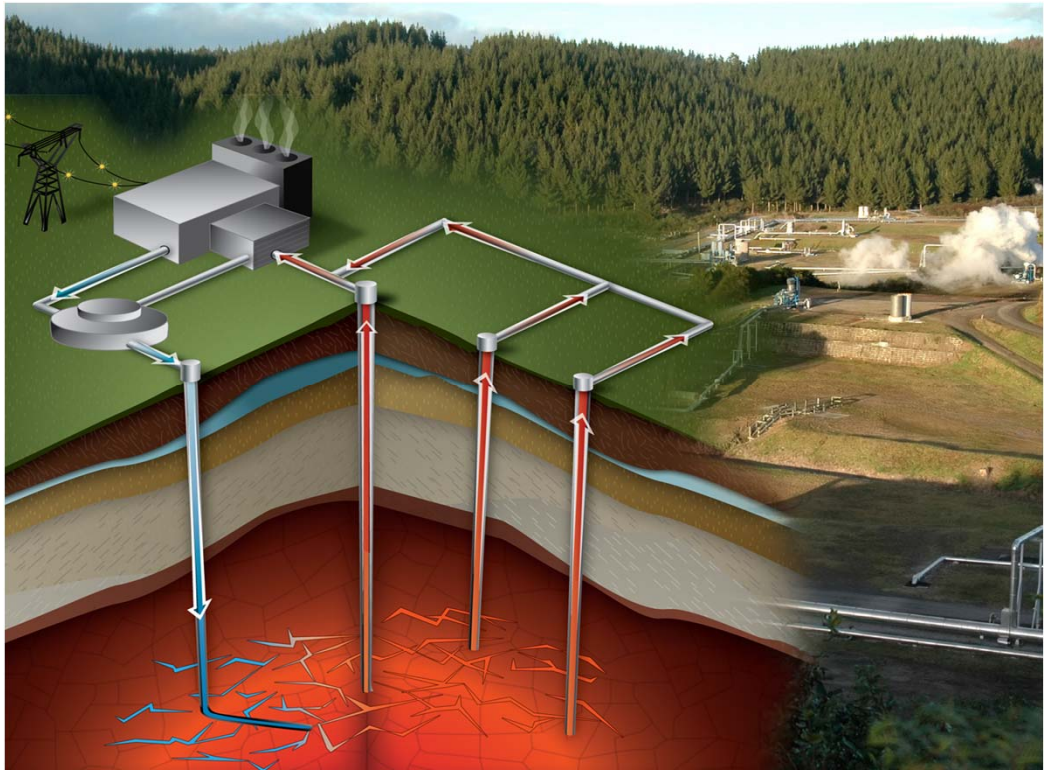
Issue:

- EGS has the highest potential payback, but is the highest risk technology in GTP portfolio.

Objective:

- Demonstrate EGS reservoir creation technology in various geologic formations and geographic regions.
- Quantitatively demonstrate and validate stimulation techniques that sustain fluid flow and heat extraction rates.
- Show that EGS can be scaled up to produce power economically.



Action:

- Four EGS projects underway in California, Nevada and Idaho.
- Up to $44.2 M in ARRA funds for three more demonstration projects in Nevada, Oregon and Alaska to rapidly commercialize technologies, help reduce upfront risk and pave the way for commercialization.

Component Research and Development

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Issue:

- High cost of component development limits the progress of geothermal technology.
- Oil field tools need to be adapted for hotter, more rigorous environments.

Objective:

- Support cost-shared R&D for both EGS and conventional geothermal to accelerate technology maturity.

Action:

- Up to $105.2M in ARRA funds to projects in EGS R&D at labs, universities and private companies.
- Targeting technologies with greatest cost reduction/game changing potential.
- R&D Projects in many technologies new to the Program, including:
  - Spallation drilling to increase drill speeds
  - Tracers
  - Thermo-hydro-chemo-mechanical modeling
  - CO_2 as heat mining fluid
  - Modeling and predicting induced seismicity
  - Measurement While Drilling tools for directional drilling.

Systems Analysis

What is the supply potential?

- Co-production
- Geopressured
- Hydrothermal: Estimated 6 GW identified, 30 GW undiscovered
- EGS: Estimated 16,000 GW

How do we describe the resource?

- In partnership with USGS, DOE is developing a geothermal resource assessment and classification.

What are the environmental impacts? GHG emitted? Water consumed?

- ANL estimated life-cycle impacts compared to other energy generation technologies.

How do we reduce the upfront risk of development?

- Develop National Geothermal Data System linking high-quality data sets.

Contact Us!

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Backup Slides

Energy Production with Innovative Methods of Geothermal Heat Recovery

Objectives:

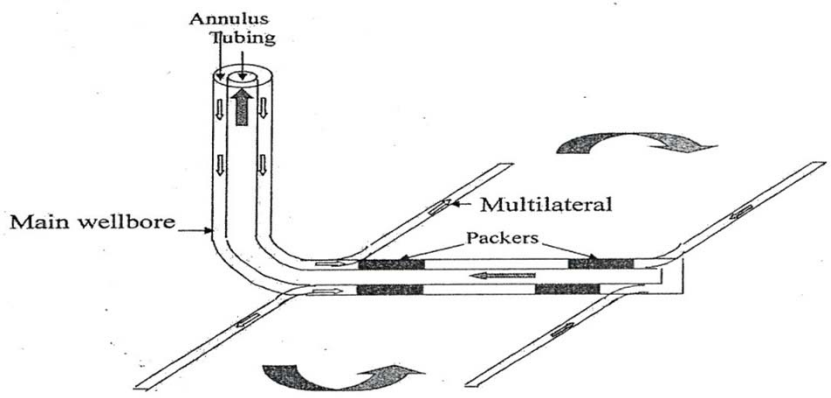
- Reduction of potential environmental risks
- Innovation in subsurface heat recovery methods & other aspects of total system design
- Reduction of financial risk

Areas of Interest:

- Innovative heat recovery methods in permeable sedimentary formations
- Geothermal energy production in conjunction with carbon sequestration projects
- Subsurface heat exchanger of multilateral wells

Funding Opportunity Announcement for 2 phases of work:

- Phase I – Feasibility Studies, Component Design(s) and Validation Plan(s)
- Phase II – Component(s) Development and Validation



Nalla & Shook 2004