



Geothermal Technologies Program 2011 SMU Geothermal Conference

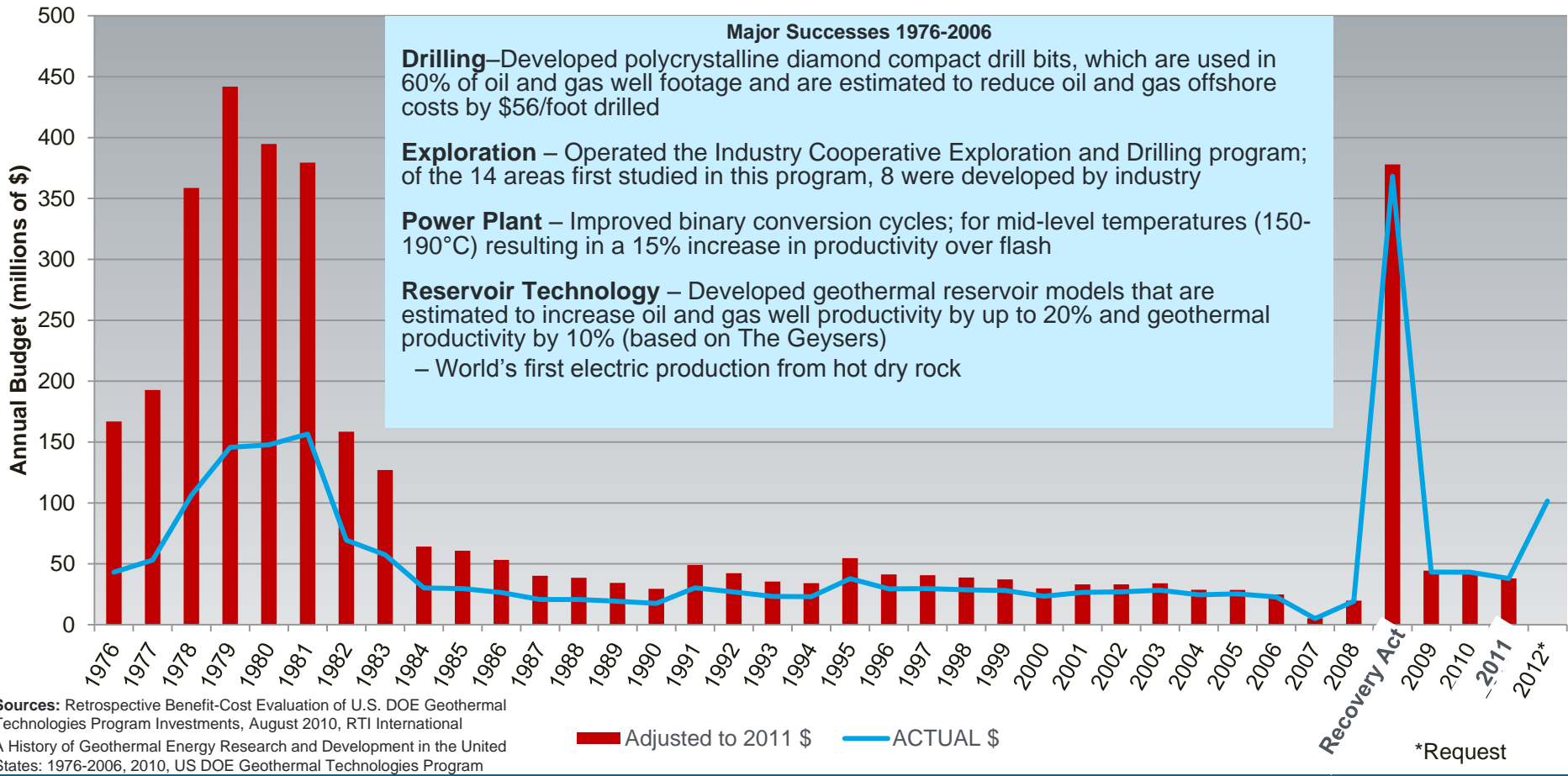
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- Program's past
- Present status of ARRA projects
- Program's near future

Geothermal Program History 1976-2012

The Geothermal Technologies Program annual budget peaked in the late 1970s, enabling advances in drilling, exploration, power plant systems, and reservoir modeling.

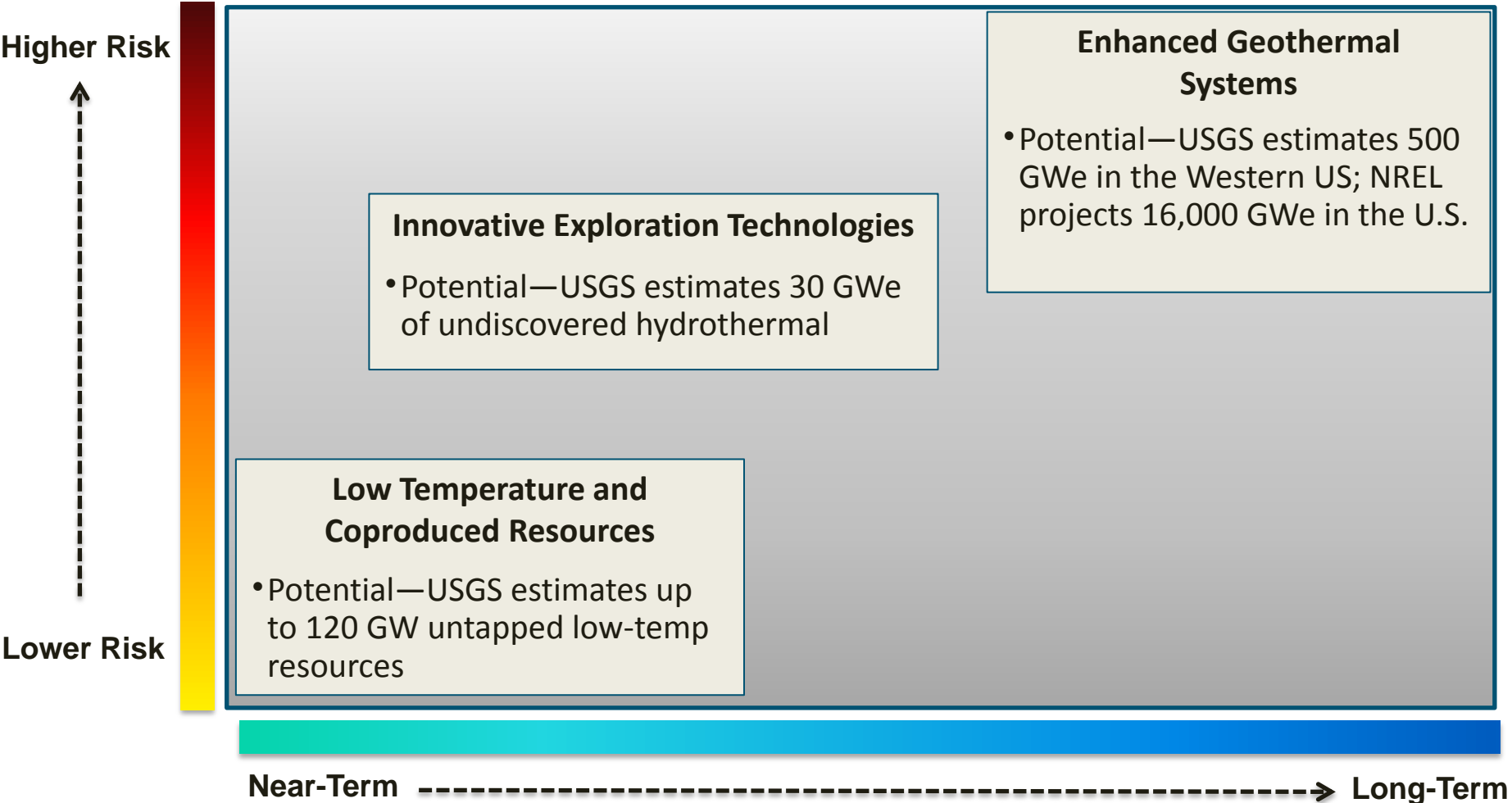
Annual Budget for the Geothermal Technologies Program 1976 - 2012



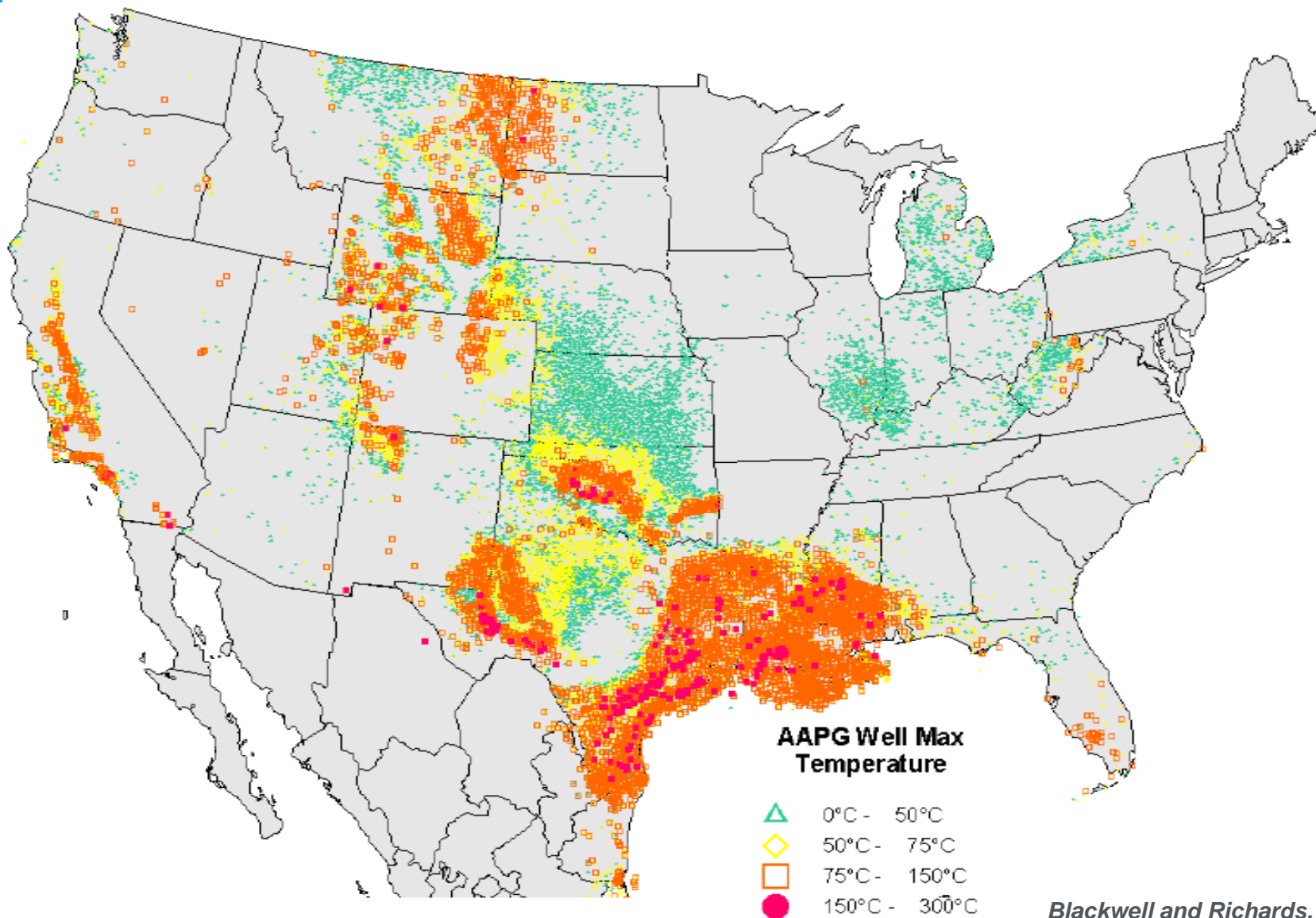
Recovery Funding Enabled Expanded Geothermal Program Portfolio

The Program currently supports a diverse portfolio that spans near- to long-term resources and low to high risk technology development. Almost \$400 million in Recovery Act funding enabled this strategy.

Current program pathways to increase geothermal power generation



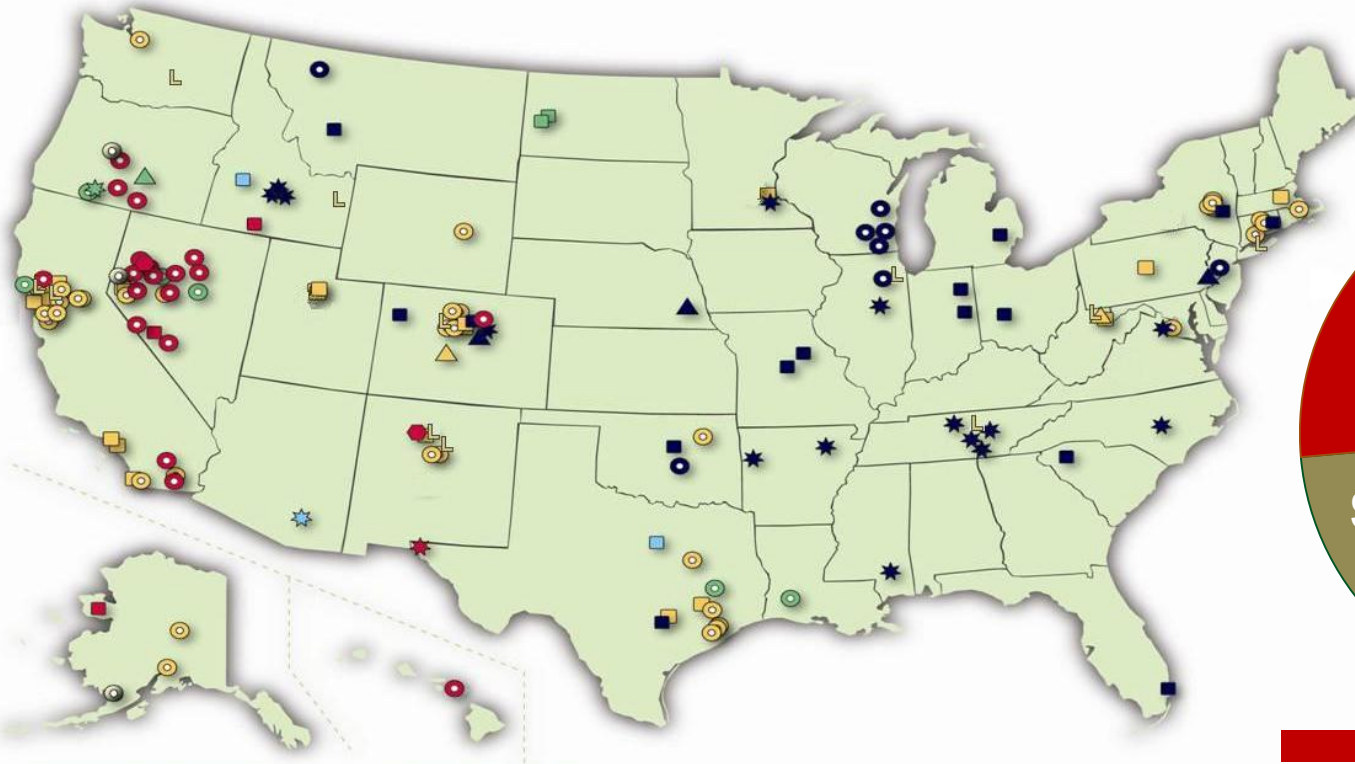
Low Temperature, Coproduced & Geopressured



Blackwell and Richards, 2005

The Recovery Act has provided a much needed boost to geothermal RD&D

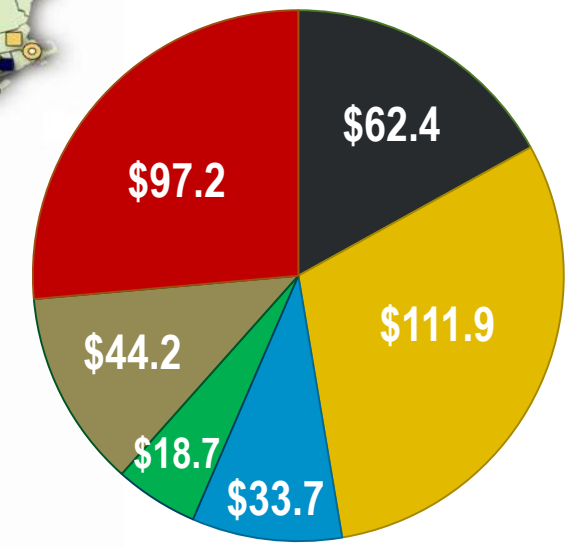
Under Recovery, DOE has invested \$368.2 million in geothermal projects in 39 states.



ORGANIZATION TYPE (SHAPE)

- Educational Institutions
- Industry
- △ Non Profits
- ★ State and Local Government
- ⬡ Tribes
- ⌒ National Laboratories

- Total Investment: \$368.2
- Total Projects: 148
- States/Districts Represented (Prime Awardee) 39



- Innovative Exploration Technologies (\$97.2)
- Ground Source Heat Pumps (\$62.4)
- Crosscutting R&D (\$111.9)
- National Geothermal Data System Design, Testing & Population (\$33.7)
- Low Temperature, Coproduced & Geopressed (\$18.7)
- EGS Demonstrations (\$44.2)

ARRA Low Temperature Geothermal Demonstrations

FOA Objectives:

To demonstrate the technical and economic feasibility of geothermal energy from non-conventional geothermal resources, and to promote the development and commercial application of energy production from the following Subtopic Areas:

- A. Low-Temperature Geothermal Fluids at temperatures between 150-300° Fahrenheit (F)
- B. Geothermal Fluids Coproduced from productive, unproductive, or marginal oil and/or gas wells (or other hydrocarbon production).
- C. Geopressured Gas Resources that show potential for economic recovery of the heat, kinetic energy, and/or gas.

Funding: Up to \$18.7M in Recovery Act funds to rapidly commercialize technologies and reduce upfront risk

FOA: DE-FOA-0000109, **Close date:** 7/22/2009



ARRA Low Temperature Geothermal Demonstrations

ARRA Topic	Grantee	Project Title	Objective	Status
Geothermal Demo	Beowawe Power, LLC	Beowawe Bottoming Binary Project	Installed a new low temperature binary unit that is attached to an existing plant providing 10% additional power.	Operational
Geothermal Demo	City of Klamath Falls	Klamath Falls Geothermal Low Temperature Power Plant	Construct a low temperature power plant combined with a district heating system to help power the city of Klamath Falls, OR.	In process of returning federal funds
Geothermal Demo	Johnson Controls, Inc.	Novel Energy Conversion Equipment for Low Temperature Geothermal Resources	Develop equipment that generates electricity from low temperature geothermal resources at a cost at least 20% below that of the currently available technology by improving on existing binary ORC systems through experimentation using alternative refrigerants.	Progressing
Geothermal Demo	New Mexico Institute of Mining and Technology	A Geothermal District Heating System and Alternative Energy Research Park on the NM Tech Campus	New Mexico Institute of Mining and Technology will construct a district heating system at the NM Tech Campus.	Withdrawn
Geothermal Demo	University of North Dakota	Electric Power Generation from Low-Temperature Geothermal Resources	Demonstrate the technologic and economic feasibility of generating electricity from low temperature (T~210 °F) geothermal water using binary, organic Rankine cycle (ORC) technology with air as the condensing medium.	Progressing
Geothermal Demo	Oasys Water	Osmotic Heat Engine for Energy Production from Low Temperature Geothermal Resources	Oasys Water plans to develop a new method for utilizing low temperature geothermal fluids to produce power.	Progressing

ARRA Low Temperature Geothermal Demonstrations

ARRA Topic	Grantee	Project Title	Objective	Status
Geothermal Demo	Surprise Valley Electrification Corporation	Rural Cooperative Geothermal Development Electric and Agriculture	Low-temperature modular binary system will utilize a 239°F resource for power generation with co-use for aquaculture.	Drilling production well
Geothermal Demo	Terra-Gen Sierra Holdings, LLC	Dixie Valley Bottoming Binary Project	Funding for Terra-Gen Sierra Holdings will facilitate the installation of a low temperature binary unit that will add to power generation from the existing 60 MW Dixie Valley power plant.	Progressing
Geothermal Demo	Universal GeoPower LLC	Technical Demonstration and Economic Validation of Geothermally-Produced Electricity From Coproduced Water at Existing Oil/Gas Wells in Texas	Universal GeoPower LLC will utilize a modular low temperature binary unit to produce power from oil and gas wells in Liberty County, Texas.	Progressing
Geothermal Demo	University of North Dakota	Electric Power Generation from Coproduced Fluids from Oil and Gas Wells	1MW air-cooled modular binary plant that proposes to demo a 1MW binary organic Rankine cycle unit from co-produced oil and gas fluids with wellhead temps of 210 °F. Will use air as condensing medium.	Progressing
Geothermal Demo	Louisiana Tank, Inc.	Demonstrating the Commercial Feasibility of Geopressured – Geothermal Power Development at Sweet Lake Field Cameron Parish, Louisiana	Louisiana Tank, Inc. will demonstrate the feasibility of a geopressured power plant in Cameron Parish, Louisiana.	In process of returning federal funds

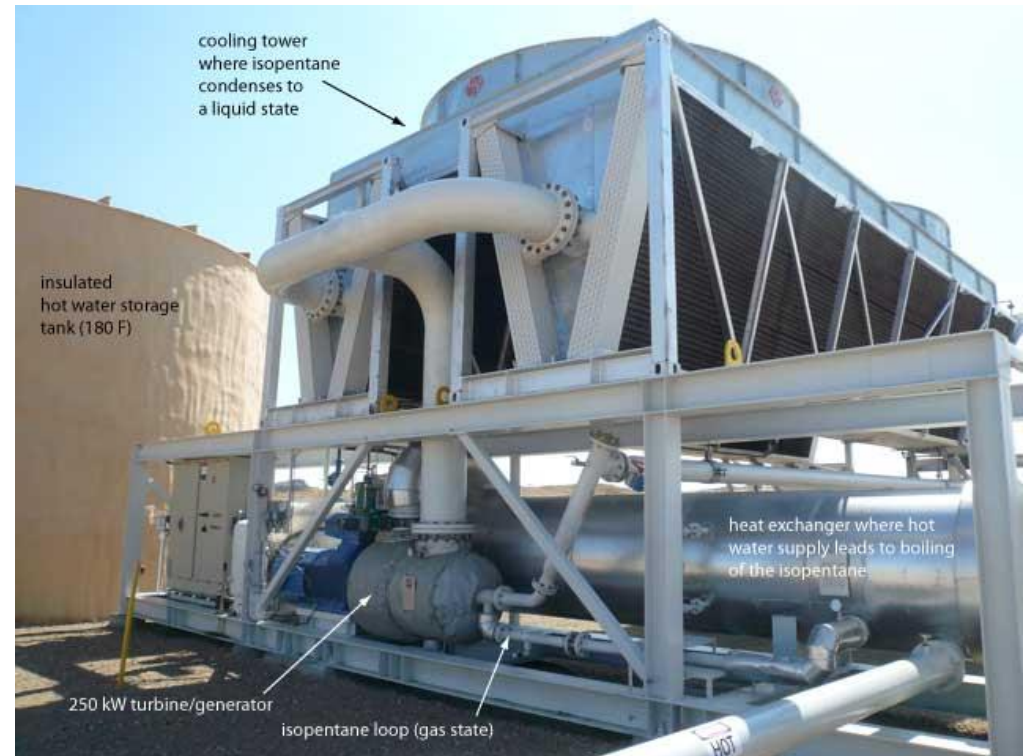
**MEMORANDUM OF UNDERSTANDING
BETWEEN
THE DEPARTMENT OF ENERGY'S GEOTHERMAL TECHNOLOGIES PROGRAM
AND OFFICE OF FOSSIL ENERGY'S ROCKY MOUNTAIN OILFIELD TESTING CENTER (RMOTC)
REGARDING THE DEVELOPMENT OF GEOTHERMAL PROJECTS AT THE ROCKY MOUNTAIN OILFIELD
TESTING CENTER**

Products and Deliverables;

RMOTC Site Visit: July 27-28, 2010

Draft MOU Agreement: August 6, 2010

Final MOU Agreement: August 31, 2010



Fifteen geothermal experts identified the obstacles to geothermal energy growth, discussed the appropriate role of DOE, and recommended priority R&D areas for the Program.

Recommendation—Narrow the focus of the Program and invest in critical need areas, targeting high-quality near-term resources to help the industry grow and long-term resources to tap the huge geothermal potential.

Accelerate Near-Term Market Growth—Hydrothermal

- Develop an inventory of high-quality prospects using existing technology
- Advance exploration technologies to reduce the cost and risk of drilling
- Develop technologies that reduce O&M cost

Secure the Future—Enhanced Geothermal Systems

- Define the optimal conditions for EGS and identify the best prospects
- Model the feasibility of reservoir creation using existing technology
- Develop tools to optimize power production and reduce costs
- Demonstrate the ability to create and maintain a reservoir in multiple geologic conditions

Financing and permitting were identified as major challenges for the industry. Panel members noted that policy in the form of a cost-shared drilling program and streamlined permitting would help overcome those challenges.

Data Collection and Model Validation

- To ensure Program cost analyses are representative and relevant
- To determine baseline cost and performance and track progress toward goals



Input to Strategic Planning and Roadmapping Efforts

- Blue Ribbon Panel Recommendations
- Exploration Roadmap
- EGS Roadmap
- Induced Seismicity Protocol
- Induced Seismicity Roadmap

Merit and Peer Reviews

- Proposal Evaluations
- Stage-Gate and Go/No-Go Reviews
- In-Progress Reviews

Upcoming Funding Opportunity Announcements (FOAs) will focus on exploration and EGS R&D and Systems Analysis.

Geothermal R&D FOA

Anticipated Release: this week

Anticipated Total Funding: \$70 million over 3 years

Potential topics:

- Advanced Exploratory Drilling Technologies
- Advanced Well Completion Technologies
- Zonal Isolation
- Observation Tools and Data Collection System for Reservoir Stimulation
- Geophysical Exploration Technologies
- Geochemistry/Rock-Fluid Interactions

**For a link to the Notice of Intent go to:
geothermal.energy.gov**

You can sign up to receive notifications
when FOAs are released:

www.geothermal.energy.gov

Systems Analysis FOA

Anticipated Release: July 2011

Anticipated Total Funding: \$3M over 2 years

Potential topics:

- Techno-Economic Impact of Federally Funded Geothermal Technologies
- Identification of Regional Geothermal Data Needs for Mapping New Geothermal Prospects
- Establishing High Quality Geothermal Data Sets
- Technology Assessment of Logging Techniques

Innovative Heat Recovery FOA

- Released in FY 2010, the objective of this FOA is to demonstrate innovative approaches to recovering heat from geothermal reservoirs.
- Selected projects will be announced in June 2011

Geothermal Technology Advancement for Rapid Development of Resources in the U.S.

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

Funding Opportunity Announcement (FOA) Number: DE-FOA-0000522

Issue Date: June 8, 2011

Application Due Date: July 15, 2011



**U.S. Department of Energy
Golden Field Office**

The complete Funding Opportunity Announcement can be viewed on FedConnect:
www.fedconnect.net/FedConnect/PublicPages/PublicSearch/Public_Opportunities.aspx

DOE's Geothermal Technologies Program works in partnership with U.S. industry to establish geothermal energy as an economically competitive contributor to the domestic energy supply.

For more information on these awards, please visit:
<http://eere.energy.gov/financing/exchange>.

Funding was made available in the following topic areas:

Topic 1: Advanced Exploratory Drilling Technologies

Topic 2: Advanced Well Completion Technologies

Topic 3: Zonal Isolation

Topic 4: Observation Tools and Data Collection System for Reservoir Stimulation

Topic 5: Geophysical Exploration Technologies

Topic 6: Geochemistry/Rock-Fluid Interactions



Thank you!

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