

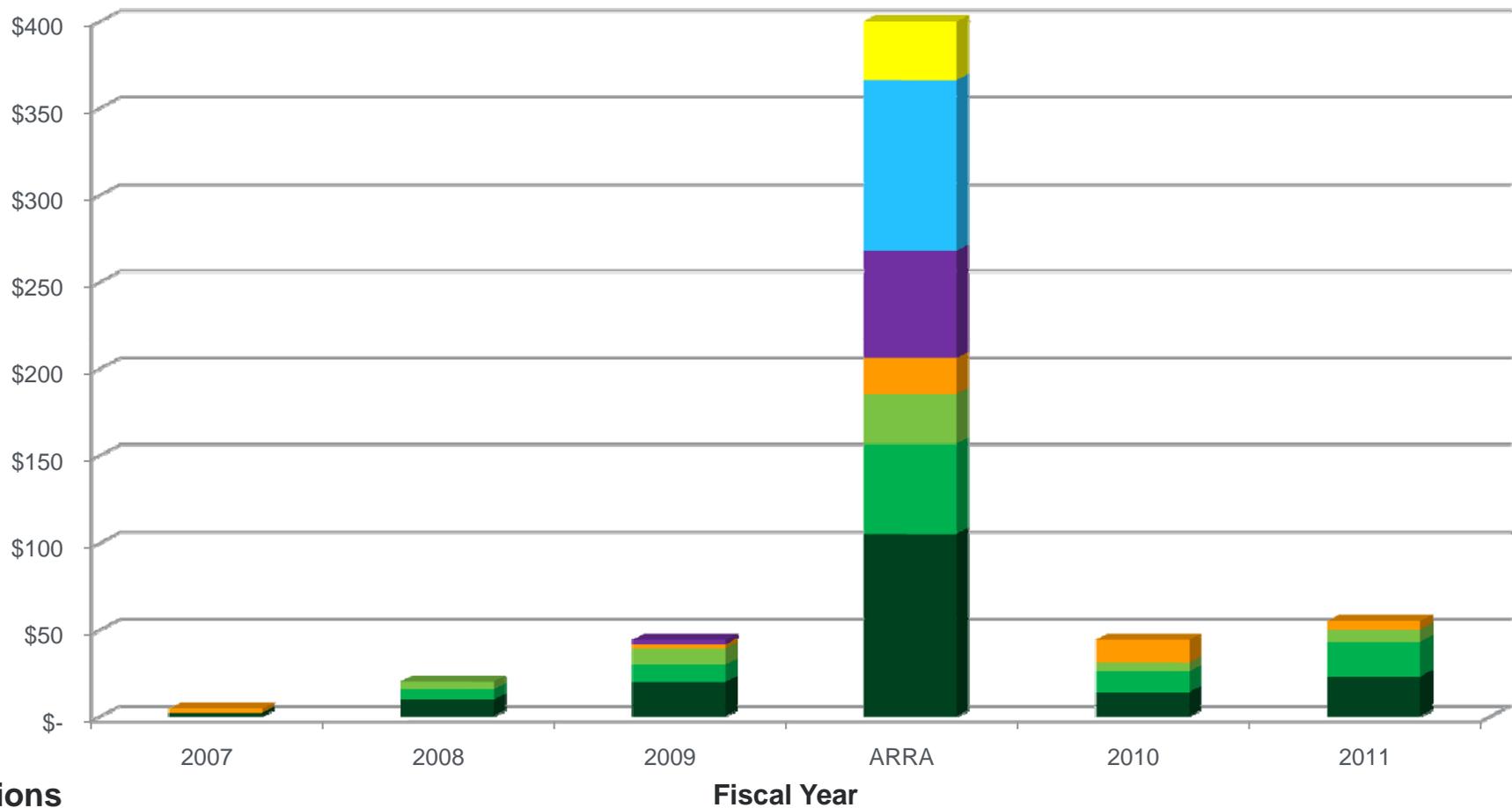


# *Geothermal Technologies Program 2010* First Annual RMOTC Symposium

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- **Geothermal Technologies Program Overview**
  - Technology Portfolio Budget and Highlights
    - Innovative Exploration Technologies
    - Enhanced Geothermal Systems
    - Component R&D
    - National Geothermal Data System
- **Low-Temperature, Coproduced & Geopressured Geothermal Activities**
  - ARRA Low Temperature Geothermal Demonstrations
  - Low Temperature, Coproduced & Geopressured FY10 FOA
  - Low Temperature Roadmap
  - RMOTC MOU
- **Coming Soon: Innovative Geothermal Heat Recovery Methods and Technologies FOA**

# GTP Budget Trend



Millions

- Enhanced Geothermal System Component R&D
- Enhanced Geothermal System Demonstration
- Induced Seismicity, Planning, Analysis, Int'l and other
- Coproduction and other Low Temperature
- Ground Source Heat Pump
- Innovative Exploration Technology
- Geothermal Data Development, Collection Maintenance

## Issue:

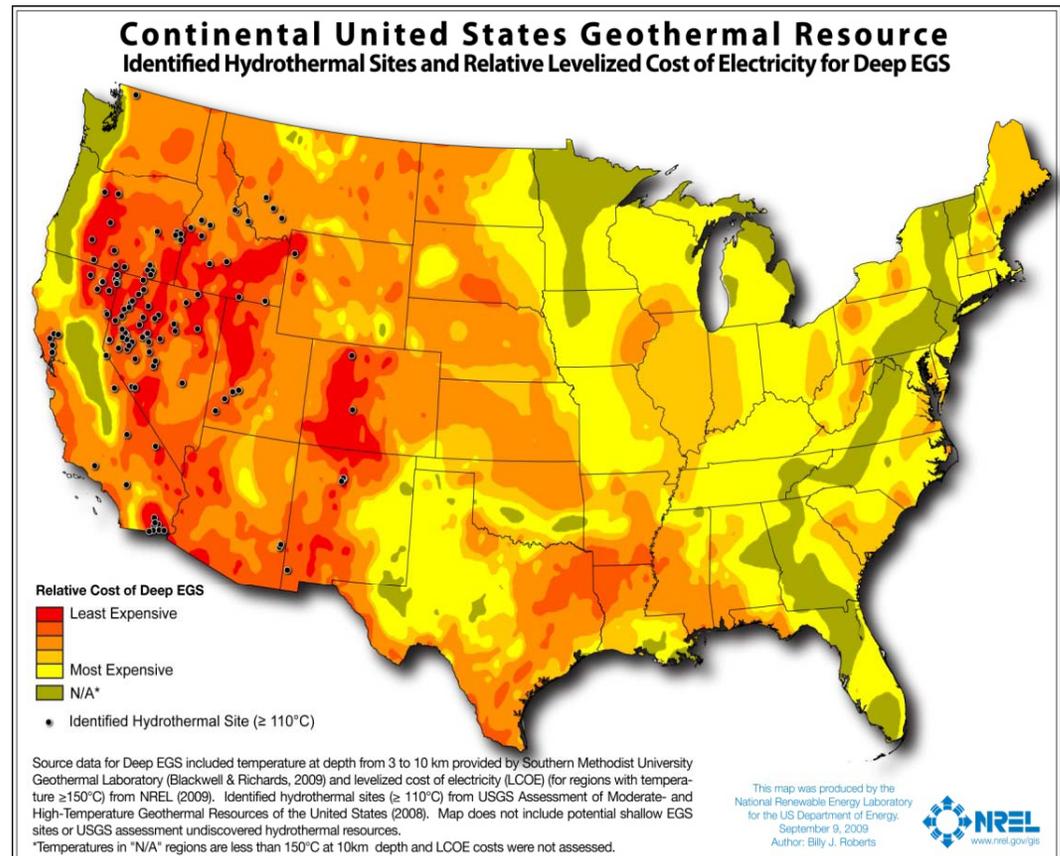
- Upfront costs for early development and associated risk are prohibitively high.
- According to the USGS, there is a mean of 30GWe of undiscovered hydrothermal in 13 western states.

## 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 (EGS)

## Issue:

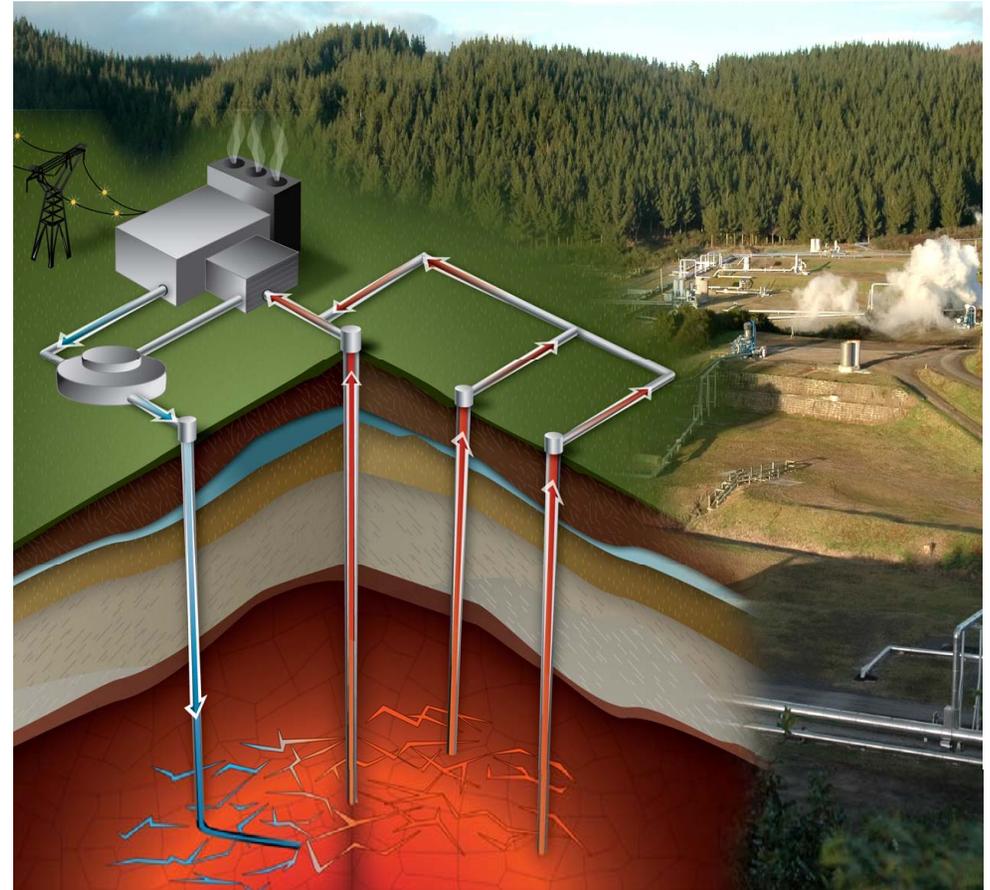
- EGS has the highest potential payback, but is the highest risk technology in GTP portfolio.

## 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.
- Prove that EGS can be scaled up to produce power economically.

## Action:

- 7 projects underway in 5 states: CA, OR, UT, NV, AK. ARRA EGS project total is \$44 million.



## 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<sub>2</sub> as heat mining fluid
  - Modeling and predicting induced seismicity
  - Measurement While Drilling tools for directional drilling.



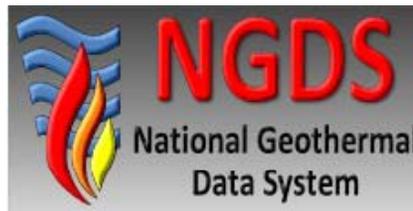
# National Geothermal Data System, Resource Assessment & Classification

## Issue:

- Upfront exploration costs for and associated risk are extremely high.
- There is a need to standardize and centralize geothermal information.
- Classification standards require updating.

## Objectives:

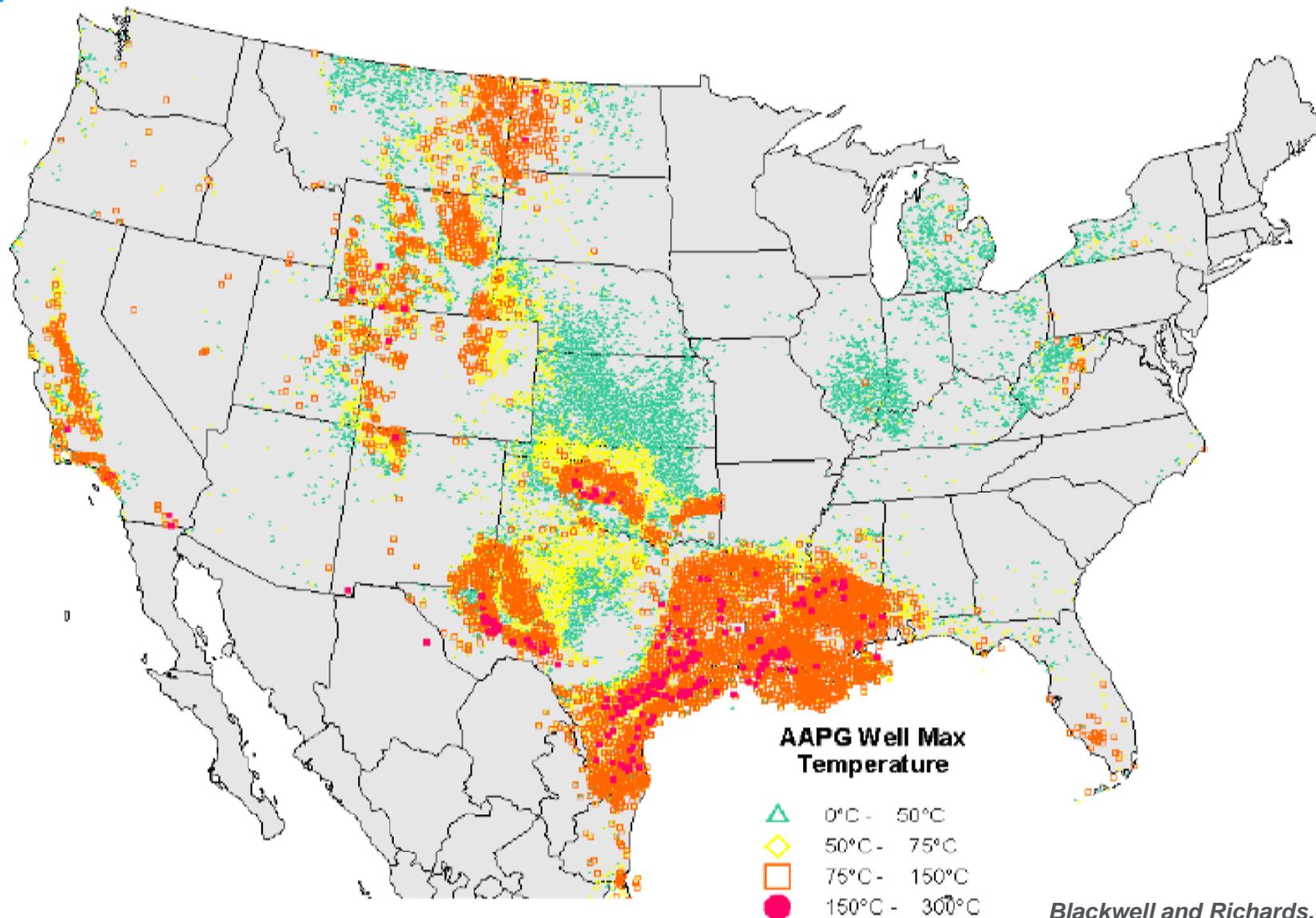
- Reduce exploration costs and risk!
- Expand geothermal resource assessments including:
  - High/moderate/low temp resources
  - EGS, coproduced fluids, geopressured
  - Entire U.S., including AK and HI
- Develop new geothermal resource classification standards.



## Action:

- Up to \$ 30M in ARRA funds
- Implement three step strategy:
  - **Step 1: System Design, Development and Testing:** Distributed web-based system design by Boise State University.
  - **Step 2: Data Development, Collection & Maintenance:** Populate NGDS by linking to data sets in partnership with 46 state geological surveys and other geothermal data providers including Southern Methodist University and GTP technology partners.
  - **Step 3: National Resource Assessment and Classification:** Inter-Agency Agreement with U.S. Geological Survey.

# Low Temperature, Coproduced & Geopressured



# ARRA Low Temperature Geothermal Demonstrations

## Objective:

- Demonstrate geothermal energy production from oil and gas fields, geopressured fields, and low temperature resources throughout the United States.

## Deployment Strategy:

- Funding opportunity announcement opened on May 27, 2009 to seek applications from consortia of industry, academia and Federal Labs.

**Funding:** Up to \$18.9M in Recovery Act funds to rapidly commercialize technologies and reduce upfront risk

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

### PureCycle® Development Funding

- DOE- \$1.5M/UTC \$1.5M
- Alaska Energy Authority & Denali Commission - \$246K
- 
- Chena Hot Springs Resort Infrastructure ~ \$2M

### Facts:

Diesel based electric ~ 30¢/kWhr in 2006  
Seasonal loads 180kW – 380kW  
1<sup>st</sup> unit commissioned July 2006  
2<sup>nd</sup> unit commissioned December 2006  
< 165°F hot water resource  
37 – 50°F cooling water available



# Low Temperature, Coproduced & Geopressured FY10 FOA

## FINANCIAL ASSISTANCE FUNDING OPPORTUNITY ANNOUNCEMENT



**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](http://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://www1.eere.energy.gov/geothermal/low\\_temperature\\_resources.html](http://www1.eere.energy.gov/geothermal/low_temperature_resources.html)

Funding was made available in the following topic areas:

- A. Low-temperature geothermal fluids at temperatures up to 300°Fahrenheit (F) or approximately 150°Celsius (C)
- B. Geothermal fluids produced from productive, unproductive, or marginal oil and gas wells, mining operations or other hydrocarbon or mineral extraction processes.
- C. Highly pressurized or "geopressured" fluid resources that show potential for cost-effective recovery of heat, kinetic energy, and gas.

# Low Temperature Roadmap

**Sub-Program/Technology Area Mission :**  
Support DOE's goals of energy security and diversity by providing reliable, clean, base-load power to a variety of sectors.

## Roadmap Draft Vision

Our vision is to provide the geothermal community with the means to achieve development and widespread deployment of economically viable, innovative, and scalable technologies—including those involving coproducts—that will capture a significant portion of the low-temperature geothermal resource base over the next two decades.



## Products and Deliverables:

Vision Workshop Game Plan:	January 15, 2010
Vision Workshop:	February 5, 2010
Draft Vision Summary Report:	February 28, 2010
Roadmap Workshop Game Plan:	March 31, 2010
Roadmap Workshop:	July 13-14, 2010
Roadmap Workshop Summary Report:	July 29, 2010
<b>Technology Roadmap Draft :</b>	<b>August 15, 2010</b>
<b>Roadmap Review:</b>	<b>August 18, 2010</b>
<b>Final Technology Roadmap:</b>	<b>September 30, 2010</b>

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



# Coming Soon: Innovative Geothermal Heat Recovery Methods and Technologies FOA

U.S. DEPARTMENT OF  
**ENERGY**

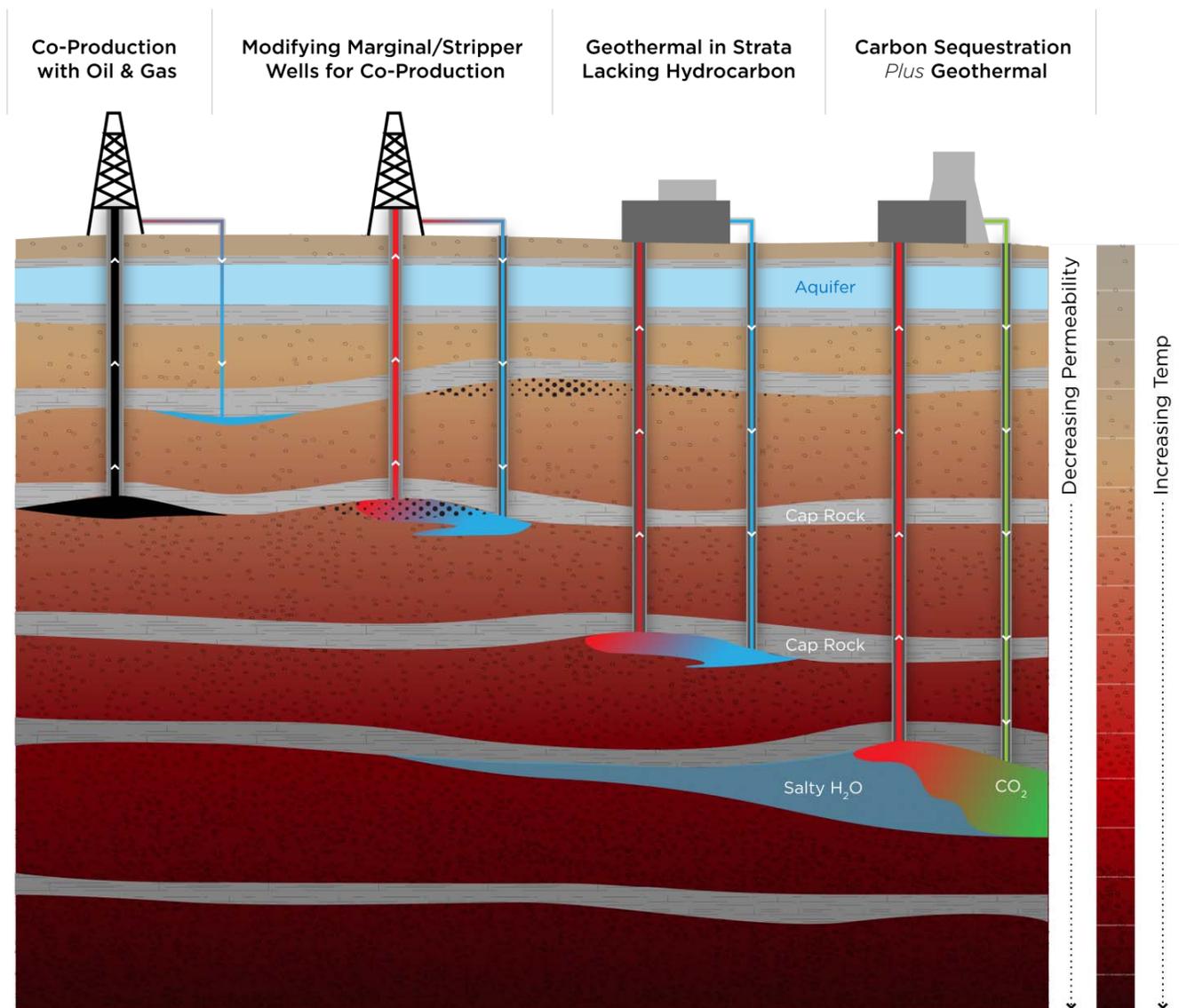
Energy Efficiency &  
Renewable Energy



U.S. Department of Energy  
Golden Field Office

Check GTP's Web site  
for FOA details:

[eere.energy.gov/geothermal/  
current\\_opportunities.html](http://eere.energy.gov/geothermal/current_opportunities.html)





*Thank you!*

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