

# Geothermal Technologies Office Current Outlook



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# Geothermal Technologies – Focus & Budget Summary

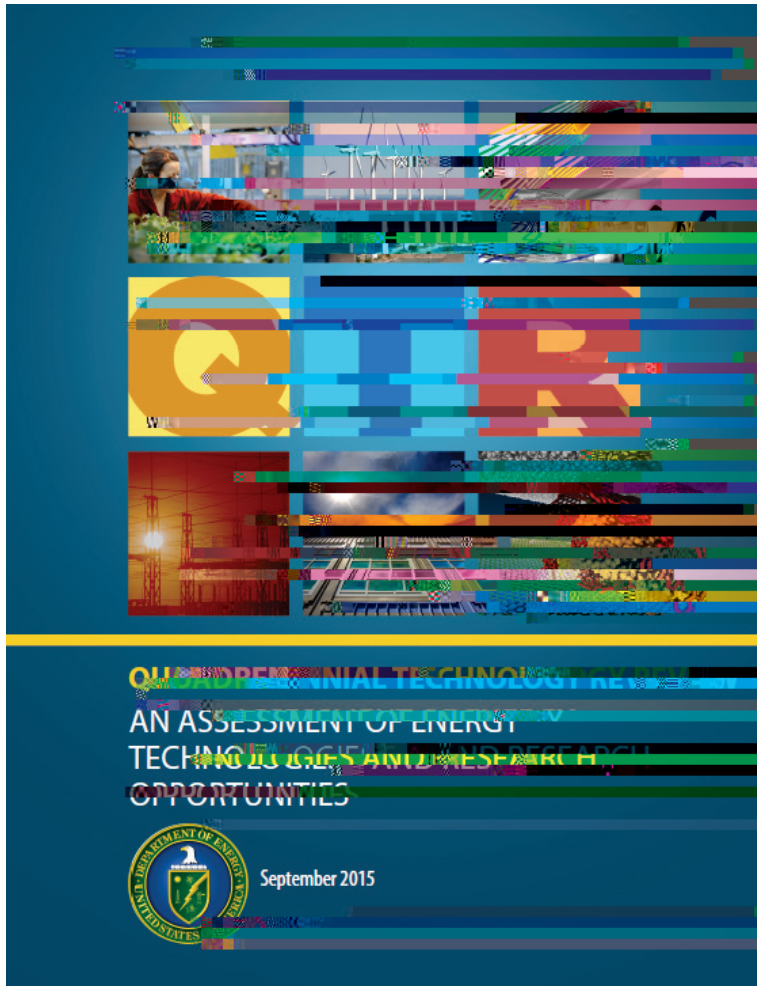
## Motivation/Focus

The Geothermal Technologies Program accelerates the deployment of domestic energy

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Enhanced Geothermal Systems	32,100	45,000	45,000	0
Hydrothermal	12,500	13,800	40,500	+26,700
Low Temperature and Coproduced Resources	6,000	8,000	10,000	+2,000
Systems Analysis	3,900	3,700	4,000	+300
NREL Site-Wide Facility Support	500	500	0	-500
<b>Total, Geothermal Technologies</b>	<b>55,000</b>	<b>71,000</b>	<b>99,500</b>	<b>+28,500</b>



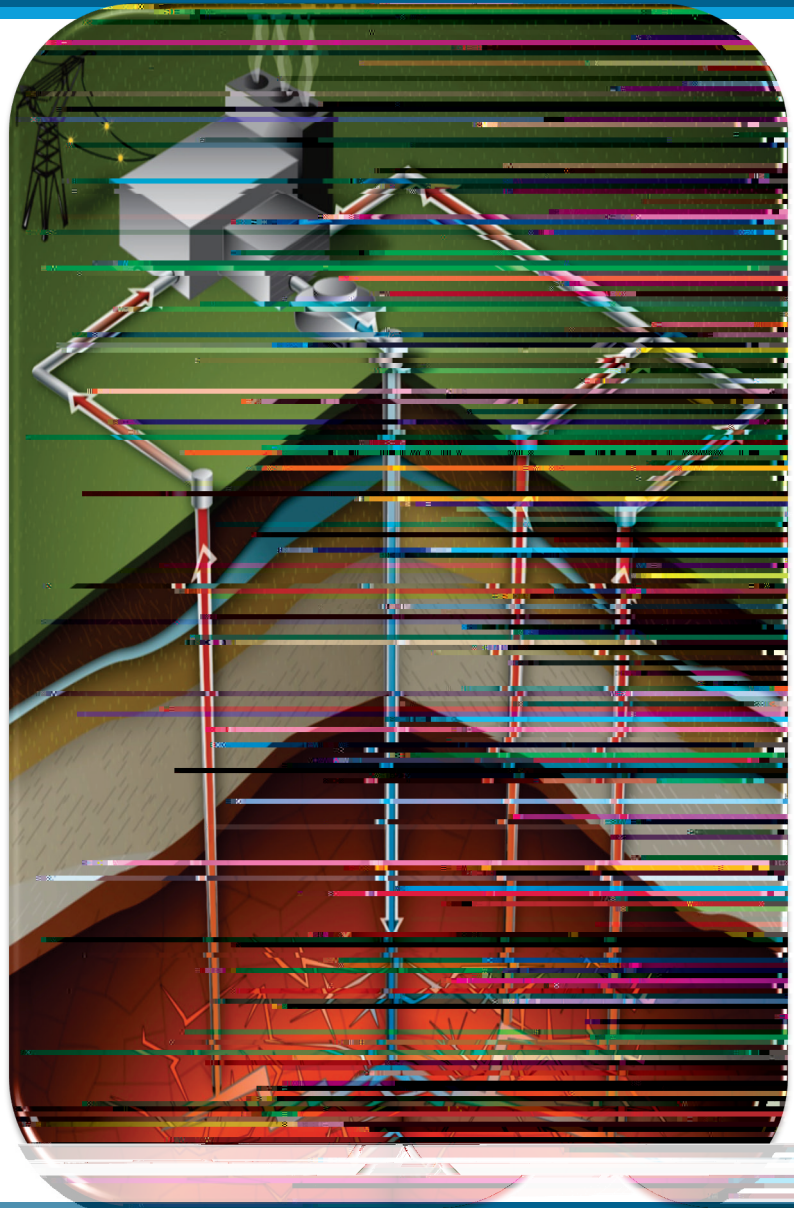
# QTR: Opportunities for Geothermal Technology Development



- Develop advanced remote resource characterization tools to identify geothermal opportunities without surface expression
- Purposeful control of subsurface fracturing and flow
- Improve and lower \$/MW subsurface access technologies
- Develop mineral recovery and hybrid systems to provide second stream of value

<http://www.energy.gov/qtr>

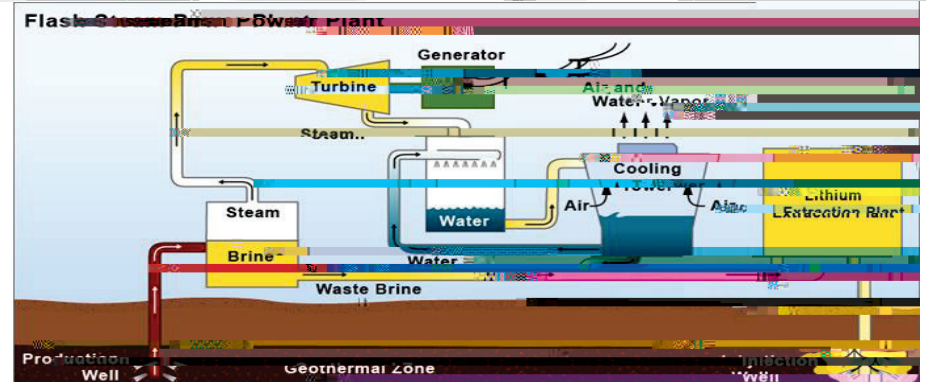
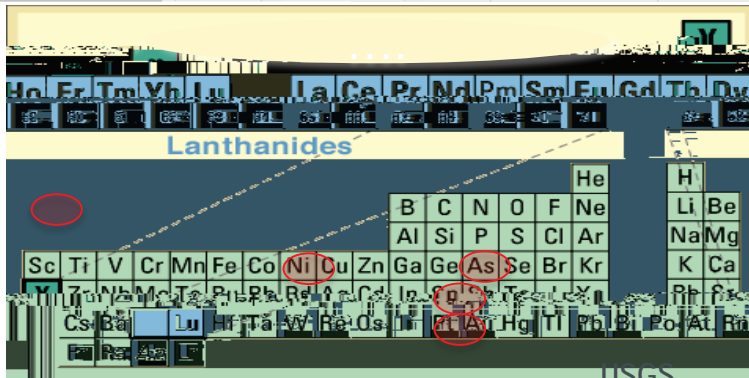
# Geothermal Technologies – FY16 & FY17 Major Initiatives



- **Low-Temperature Mineral Extraction** - Resource assessment and feasibility (ongoing)
- Large-scale **Direct Use**: where does it make technical and commercial sense?
- Use geothermal hot fluids for heating and cooling
- Potential displacement of traditional baseload generation on site-by-site basis
- Targeted RD&D on innovative energy conversion, additional **revenue-stream creation** (

## DOE is interested in:

- Determining the **technical** feasibility and **economic** viability of mineral extraction technology(s)
- Assessments of the **current rare earth and near-critical metal resource base**
- **Geochemical modeling** and **leaching**



## Current Activities

### Phase I (Initiated FY2014)

- Technical feasibility and economic viability of proposed mineral extraction technology(s) combined with geothermal power production at a new or existing geothermal resource
- Assess current Rare Earth Element (REE) and near-critical metal resource base; potential extraction volumes with techno-economic analysis

### Phase II (Initiated FY2016)

- Competitive Funding Opportunity Announcement released.
- Up to \$4M to be awarded under select Topic Areas
  - Topic Area 1, Subtopic 1A: Leveraging Methods from Other Extractive Industries for Surface Operations
  - Topic Area 1, Subtopic 1B: Leveraging Methods From Other Extractive Industries to Enhance Subsurface Materials Recovery
  - Topic Area 2: U.S. Regional or Nationwide





## Objective

- Continue to dedicate targeted RD&D to innovative energy conversion and additional revenue-stream creation with the goal of steadily increasing the value of geothermal resources.

## Why it Matters

- Geothermal resources can be utilized in hybrid sw 164.192570 m(e.6)-73(c)(th )hen 1.6(c)-

- Use hot fluid—a by-product of oil, gas, and other material harvesting processes—to generate electricity
- Has the potential to extend the economic life of oil and gas fields

## Value Proposition

The GTO is exploring opportunities to partner with Industry to deploy binary systems in operating commercial oil and gas (O&G) fields.

### GTO Provides:

- Units at low/nominal cost (subject to final contract)
- Funds for minimally invasive and fast installation
- Necessary O&M of the unit

### Industry Partner Provides:

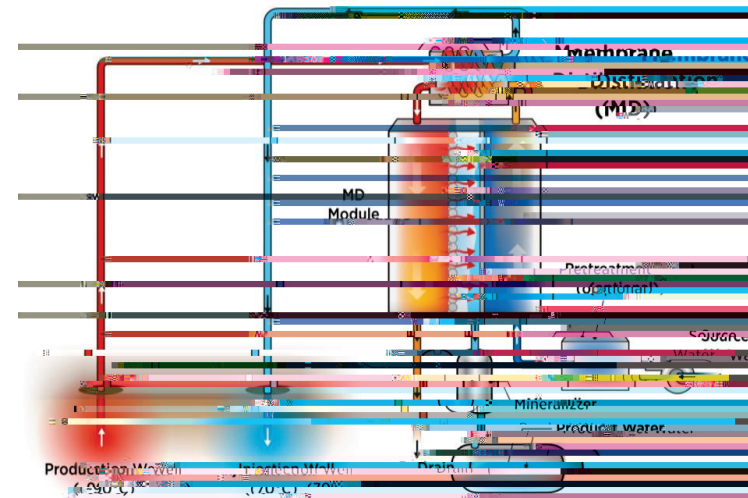
- Site access for installation and contingency operations
- Shared information on coproduced water volumes, temperature, flow rate, fluid chemistry, and power production and operability
- Design and engineering of the field (for cost estimate)
- Clearly defined site ownership/control

- Utilize geothermal alongside another energy source, with innovative power cycles, or through cascaded uses of the resource
- Can expand the geographic range of geothermal use, decrease production costs and increase the resource base
- First-its-of-kind plants:
  - Triple hybrid power plant commissioned in March 2016

Stillwater triple hybrid power plant combines Geothermal, CSP, and PV.



- Opportunity to use co-produced geothermal resources to treat produced waters
- Offset disposal costs and adverse environmental effects – induced seismicity
- Two thermal desalination projects:
  - Switchable Polarity Solvent – Forward Osmosis at INL
  - Membrane Distillation at NREL



Source: Idaho National Laboratory

Source: National Renewable Energy Laboratory

