



Desert Peak (Source: Ormat Nevada, Inc)

Geothermal Technologies Office

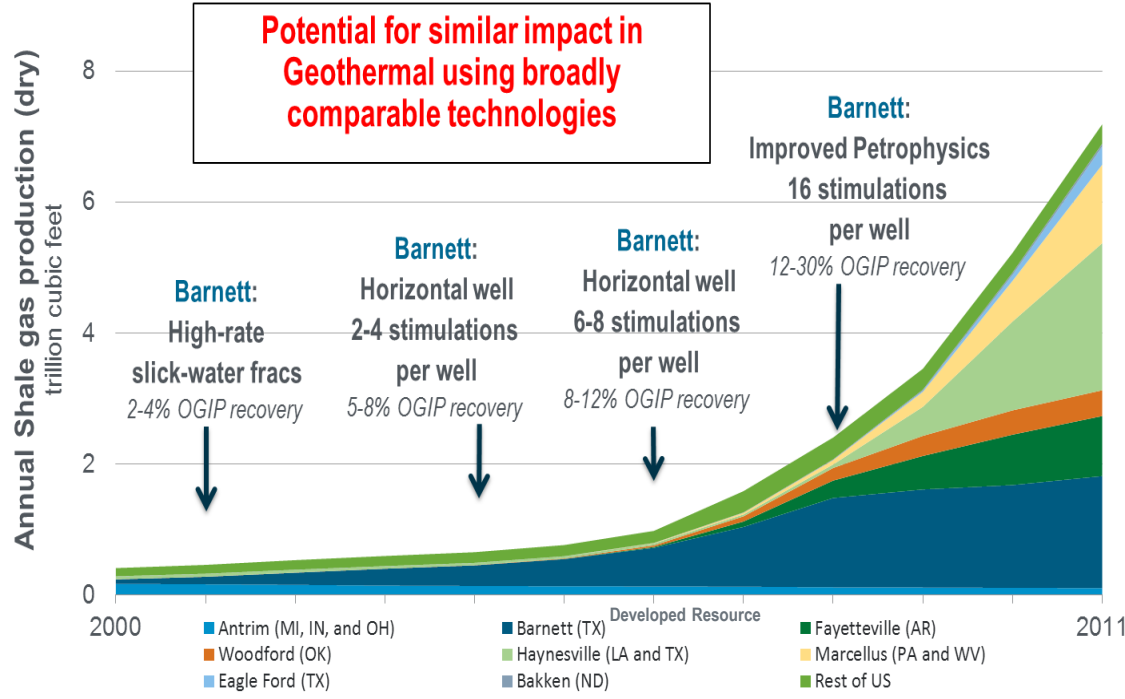
GEA Geothermal Summit
February 26, 2013

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Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

Pathway to Transformative Change

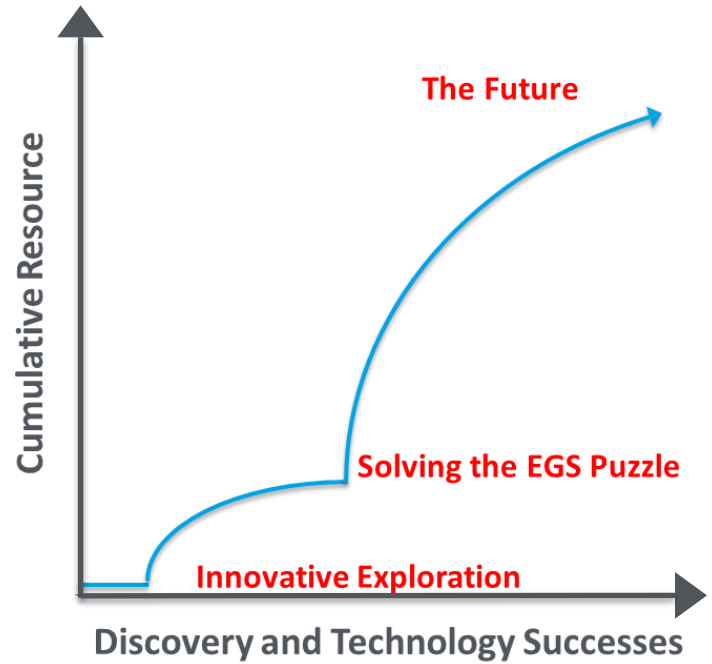
Shale Gas – Geothermal

Shale Gas: Technology Innovations Spawned Sector Transformation



Sources: Lippman Consulting, Inc. 2011. Technology advances from King, 2012 (SPE 152596)

Geothermal Development Potential



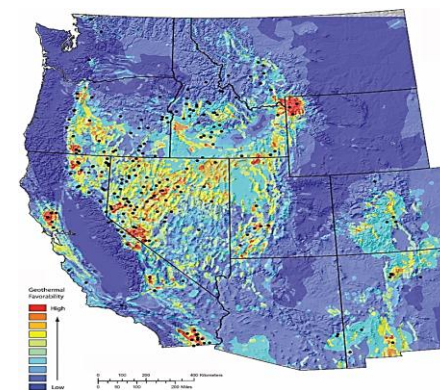
Geothermal Program Balance

Transition from Near to Long Term

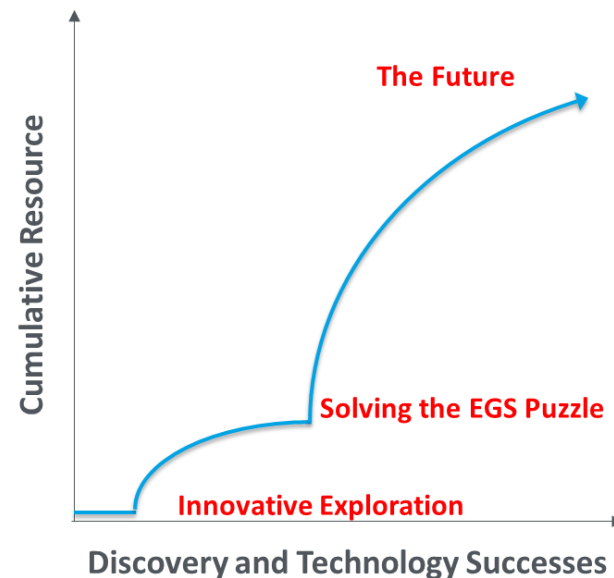
	Low Temp	Co-Production	Blind Hydrothermal	Near-Field EGS	Greenfield EGS
<i>Timeline</i>	Near Term	Near Term	Near to Intermediate	Near to Intermediate	Long Term
<i>Strategy</i>	Utilize waste-heat / promote distributed energy	Leverage O&G infrastructure	Promote Sector Growth	Maintain /expand existing fields	Develop replicable model for commercial scale-up
<i>Scale</i>	10's-100's MW	100's KW to MW scale- aggregate to GW potential	10's GW additional potential	10-100's GW potential- low risk	10's - 100's GW potential -high risk
<i>Constituency</i>	Local or Rural, Direct Use	Growing Interest, New Potential Sector	Private Sector	Private Sector	Fewer Players

GTO Operational Space

- ***Establish EGS Field Observatory***
 - Temporary, collaborative subsurface lab
 - New techniques and technologies
- ***Identify new hydrothermal opportunities***
 - Lowered risk and cost through “play fairway mapping”
 - New prospecting workflow
- ***Reduce Risk Through Project Synergies***
 - Co-Production and Distributed Power
 - Strategic Resources
- ***Address Non-Technical Barriers***
 - Regulatory Roadmaps and Optimization
 - Data Access- NGDS



**Geothermal
Development Potential**



Technology as the Pathway to Growth

Accomplishments in 2011-2012

Low Temp

Co-Production

Blind Hydrothermal

In-Field EGS

Greenfield EGS

Low-temperature:

- **Beowawe Power:** Beowawe, NV – 2.5 MW added
- **TerraGen Sierra Holdings:** Dixie Valley, NV – 6 MW online

Co-Production:

- **Simbol Materials:** Lithium extraction plant groundbreaking expected 2013
- **O&G:** Deploying two binary systems in operating O&G fields.

Hydrothermal:

- ~100+ MW of new hydrothermal capacity
- 26 wells drilled to date

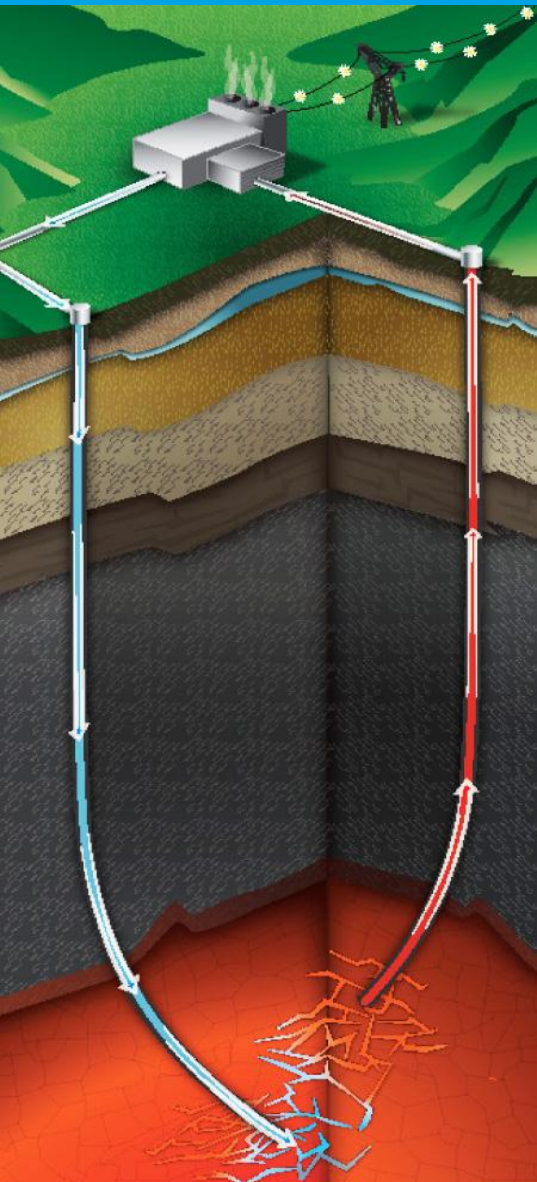
EGS Demonstrations:

- **IN-FIELD:** **Ormat:** Desert Peak, NV
- **NEAR-FIELD:** **Calpine:** The Geysers, CA - 5 MW
- **GREENFIELD:** **AltaRock:** Newberry, OR

Cross-Cutting Research & Development:

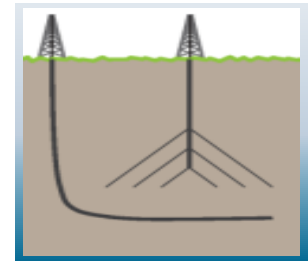
- **CSI Technologies /AltaRock-** Diverters
- **Baker Hughes** – Ultrasonic Fracture Imager
- **Sandia National Lab** – PDC Bits



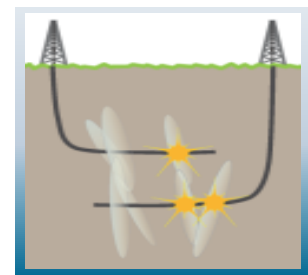


WHY?

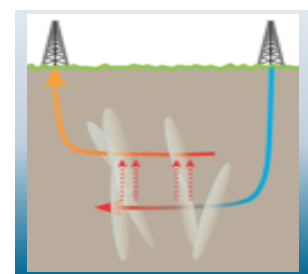
- Promote transformative science and engineering to:
 - Address key barriers
 - Validate and optimize EGS technology
 - Capture high fidelity data
 - Ensure deep understanding and reproducibility for commercial scale-up
- Federal Role:
 - Test technologies/take technical risks not possible in private sector
 - Work under aggressive timeframe
 - Gather and disseminate comprehensive data sets
- Direct benefits to all areas of research in the geothermal space



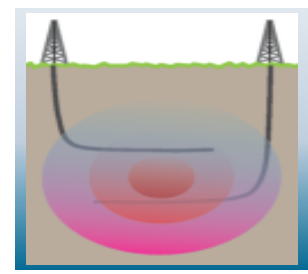
Reservoir Access
New well geometries and concepts, optimized drilling



Reservoir Creation
Characterize local stress, zonal isolation, novel fracturing methods, increase fractured volume per well



Productivity
Increase flow rates without excessive pressure needs or flow localization



Sustainability
Maintain productivity with minimal thermal drawdown and water losses

Position all major initiatives for initiation and execution over next 2 years

- ***EGS Field Observatory:***
 - Competitive Solicitation early FY14
- ***Play Fairway mapping***
 - 1st go-by completed 2013
- ***Oil and Gas Co-Production deployment***
 - Equipment in the field Q3, first data by year end
- ***Regulatory Roadmap***
 - Completion Q2 and support optimization
 - 5 of 10 white papers on key topics
- ***Interagency Collaboration:***
 - ***DOE-DOD collaboration***
 - Identify and pursue activities where missions align
 - ***Strategic Materials***
 - Project kickoff with key agency stakeholders