

Geothermal Technologies Office  
SMU Geothermal Conference  
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Doug Hollett, Director

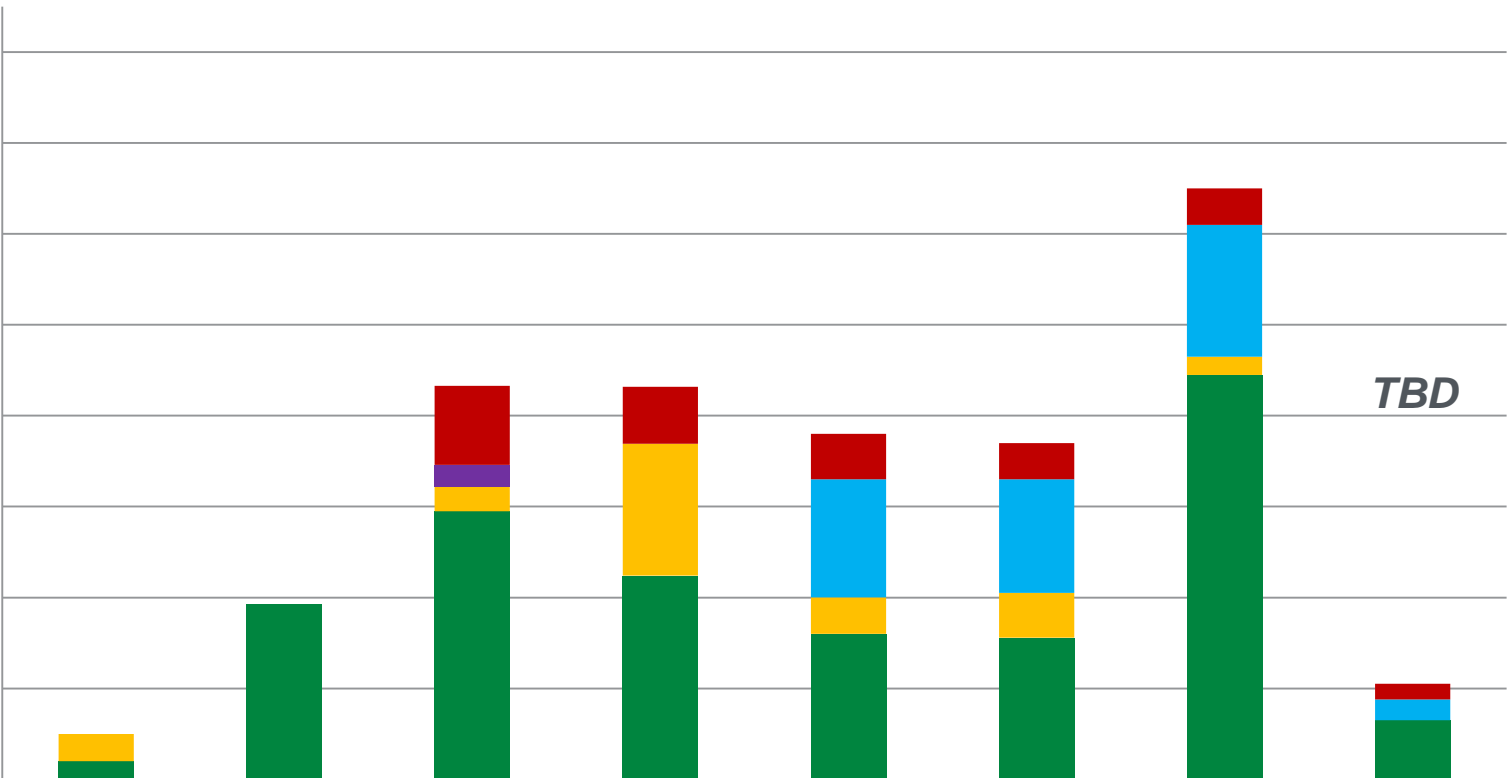
# Geothermal Program: Key Goals and Objectives





# Budget Overview

*Challenging but a good path forward*



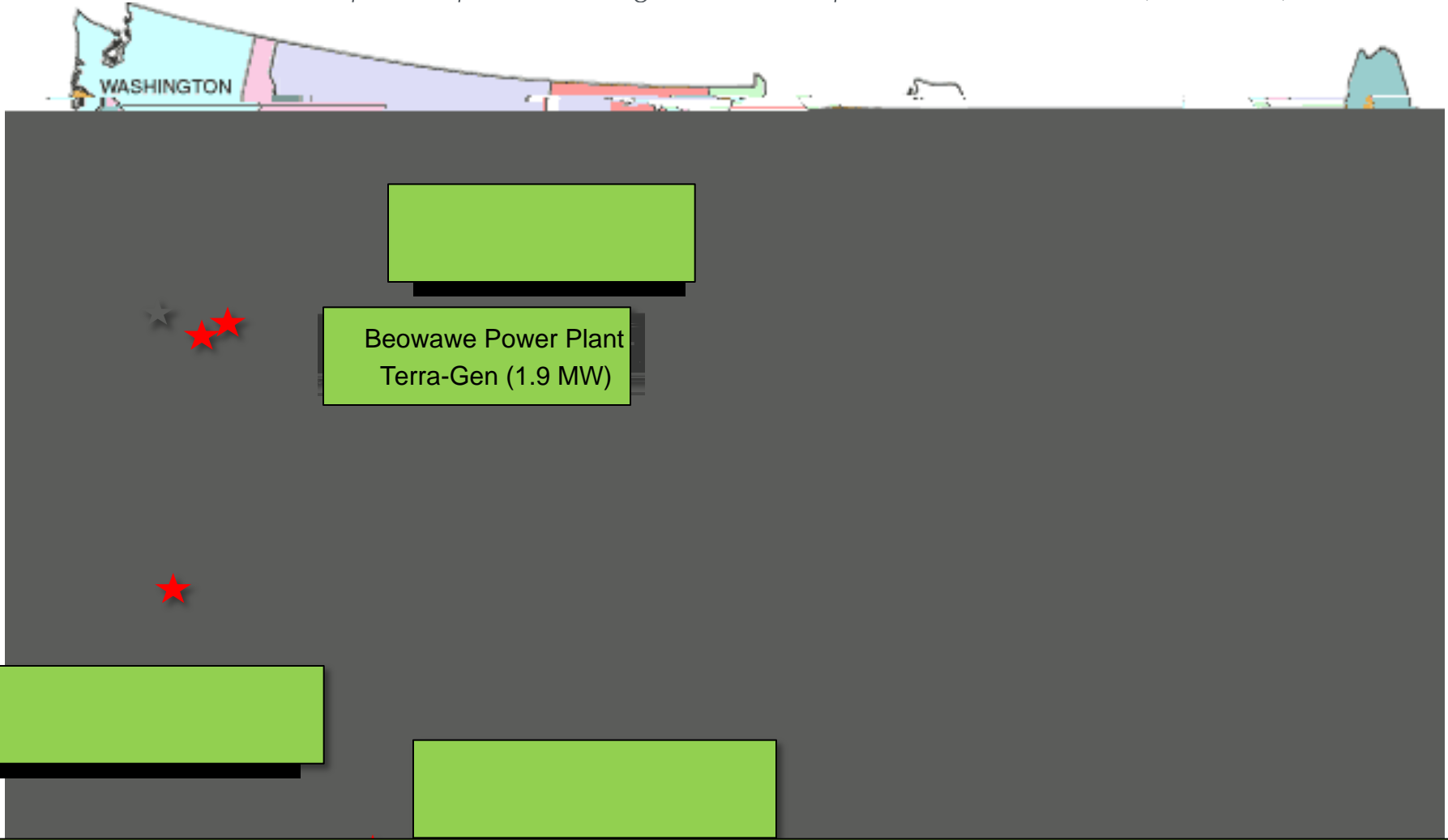
TBD



# Geothermal Power Plants

2011-2012

*Geothermal power plants brought online/expanded in 2012-13 (154 MW)*





# Technology as the Pathway to Growth

*Accomplishments in 2011-2012*

Low Temp

Co-Production

Blind Hydrothermal

In-Field EGS

Greenfield EGS

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

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

- ‡ **~150+ MW of new hydrothermal capacity**
- ‡ **26 wells drilled to date**

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

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

Baker Hughes

Polycrystalline Diamond  
Compact Drill Bit



# Recent Project Successes

*Low Temperature Portfolio*

## Beowawe Power, LLC

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# Low temp / co-production going forward

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what are the challenges to deployment?

- ‡ DOE investment is increasingly mature
- ‡ Technical risks? Technology?
- ‡ Upfront costs/capital requirements; opex?
- ‡ Regulatory or permitting uncertainty?
- ‡ Fundamental economics, or how communicated?
- ‡ Need for complementary revenue streams?
- ‡ Financing?
- ‡ Do we need more demonstration projects?

Do we have a clear understanding, or roadmap, of the costs, issues, barriers and best practices which industry can use to make informed decisions?

When can we expect broader adoption of low temp and co-production?







# Current EGS Demo Schedule

*Spring 2013 status*





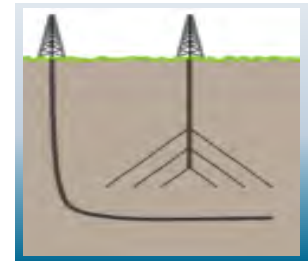


# EGS Field Observatory

*Vision and Objectives*

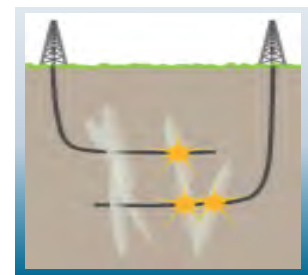
## WHY?

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Reservoir Access

±  
±



Reservoir Creation

‡



Productivity

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±

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Sustainability

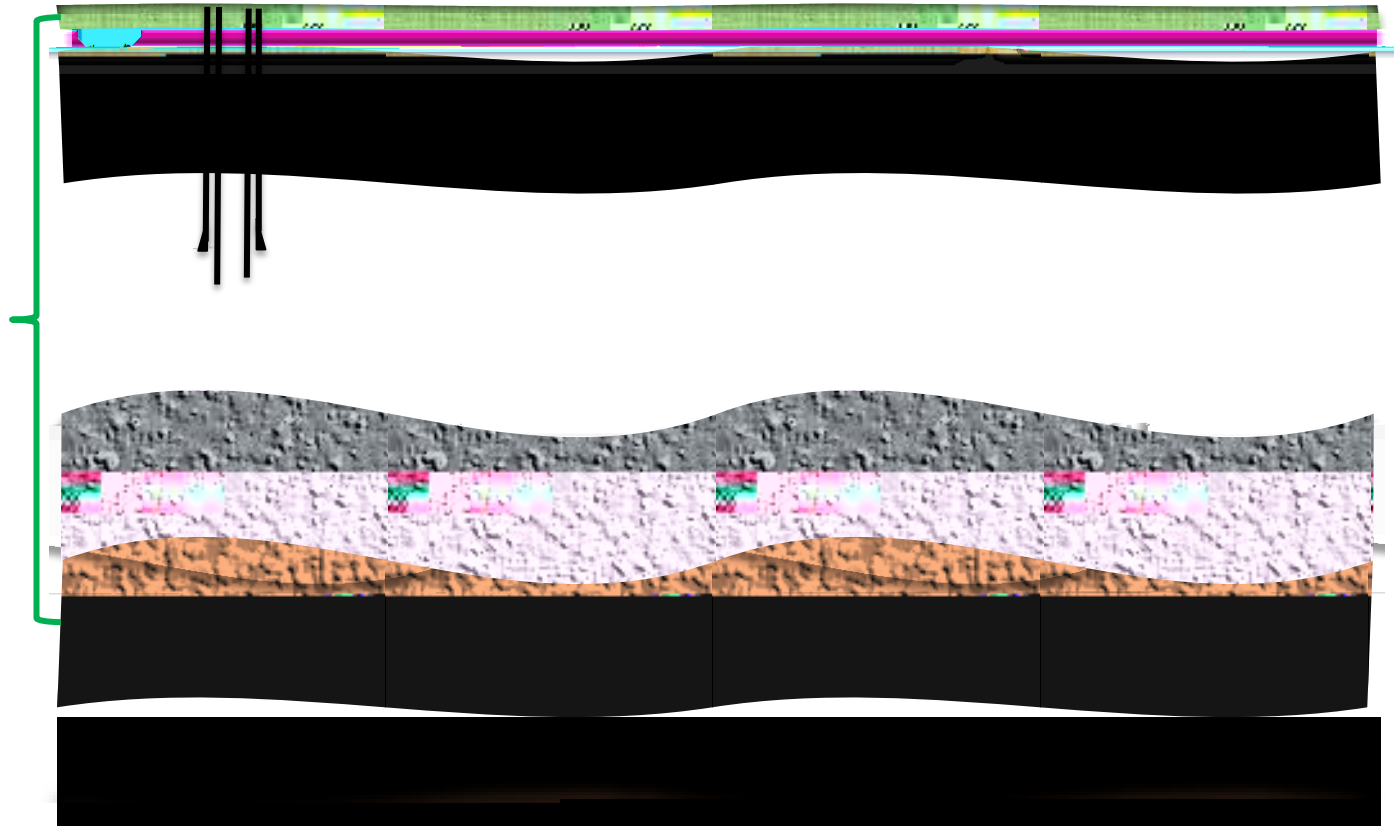
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Challenges

Innovative Solutions

## Barriers

1. High Cost of Drilling
2. Creating a Reservoir
3. Subsurface Characterization
4. Sustained Reservoir Production
5. Risk Management & Mitigation



# EGS Field Observatory Names?

What is descriptive, accurate, does not imply permanence, and is acceptable to a diverse constituency?

- ‡ Geothermal Experimental and Operational Development (~~SEEDS~~)
- ‡ Federal Observatory for Research in Geothermal Energy (~~FORGE~~)?
- ‡ Subsurface Research for Geothermal Energy (~~SURGE Lab~~)
- ‡ Underground Field Observatory (~~UFO~~)?

# What's next for EGS?

## *Growth sequence*

### Immediate / Primary Focus

- ‡ Progressive adoption based on demonstration successes
- ‡ Accelerated in-field use
- ‡ Advance into field extension applications

### Subsequent Focus

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- ‡
- ‡ Pathway to significant sector growth

### Future?

- ‡ Lower Temp EGS?
- ‡ Deployment into non-traditional basins/regions?
- ‡ mining?

# Possible game changers?

- ‡ Innovative exploration technologies: new imaging, measurement technologies for geothermal environments
- ‡ Radically new drilling technologies
- ‡ Innovative ways to map/identify prospective geothermal targets
- ‡ Determine how to fully advance larger-scale low temp, co-production and direct use deployment
- ‡ Exploring new rock systems geothermal in traditional sedimentary basins
- ‡ Horizontal drilling in geothermal systems; multi-stage stimulation, adapted for geothermal environment
- ‡ Integrated technologies: cascading systems; gas densification + geothermal coproduction; low temp + direct use; geothermal + solar

# Pathway to Transformative Change

Shale Gas: Technology Innovations  
Spawned Sector Transformation

Developed Resource



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

