Geothermal Resources and Transmission Planning
May 18, 2010

This presentation does not contain any proprietary confidential, or otherwise restricted information.
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• Organization: National Renewable Energy Laboratory
• Track: Analysis, Data System and Education

This presentation does not contain any proprietary, confidential, or otherwise restricted information.
This project addresses transmission-related barriers to utility-scale deployment of geothermal electric generation technologies.

It is comprised of three tasks: assessment of the technologies’ capacity and reliability value; engagement in planning; and an analysis of available transmission capability in geothermal-rich areas of the Western Interconnection.

Start – May 2010
End date – October 2010
Budget - $300,000
Relevance/Impact of Research

• If geothermal resources are to play a role in transmission planning, transmission planners need to know what geothermal brings to the table

• Transmission costs are non-trivial; ultimately have to be justified to regulators and ratepayers on basis of cost effectiveness
  – Small line (230 kV single, 400 MW capability) = $1 million per mile
  – Large line (500 kV double, 3,000 MW capability) = $3 million per mile

• Results will help developers and transmission owners address “used and useful” regulatory criteria for siting and funding new lines to geothermal resource areas
• Timing of project is crucial
  – Western Governors’ Association will soon begin next phases of Western Renewable Energy Zone Initiative
    • Load-serving entities (LSEs) will identify renewable energy zones of mutual interest to multiple LSEs
  – WECC stakeholders currently formulating high-penetration renewable energy scenarios for interconnection-wide modeling
    • Project will engage GTP in that work
Scientific/Technical Approach

• Task 1: Capacity and reliability value
  – Categorize different geothermal technologies by their reliance on the transmission system (distance from load, need to interconnect at 67kV or higher)
  – Summarize generator capabilities required by grid operators to maintain reliability
  – Assess ability of utility-scale geothermal plants to perform to requirements
Scientific/Technical Approach (continued)

- Task 2: Planning in the Western Interconnection
  - Provide objective, credible input on geothermal resources to WGA WREZ development, especially through technical support provided by national labs
  - Provide input to WECC subregional planning groups
Task 3: Capability on existing lines

- Begin with current WECC analysis on line congestion and available transmission capability (ATC)
- Assess ATC on existing lines near WGA renewable energy zones with significant geothermal resource potential
- Analyze general costs and benefits of line upgrades, including the value of base load capacity
Accomplishments, Expected Outcomes and Progress

• Funding finalized in April 2010
• Detailed project scoping in May 2010
  – Staffing will include experts from NREL’s Systems Integration Group, Strategic Energy Analysis Policy Group, and NREL geothermal specialists
• Final reports for Tasks 1 and 3 expected by October 2010
• Outcomes for Task 2 will be in the context of broader WREZ work being conducted by Western Governors; will be summarized in a management memorandum
## Project Management/Coordination

<table>
<thead>
<tr>
<th>Task</th>
<th>Milestone</th>
<th>Status</th>
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<tbody>
<tr>
<td>Funding</td>
<td>12/28/2009</td>
<td>Complete</td>
</tr>
<tr>
<td>Detailed work plan</td>
<td>5/31/2010</td>
<td>In progress</td>
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<tr>
<td>Final report, Task 1</td>
<td>10/31/2010</td>
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<tr>
<td>Management memorandum, Task 2</td>
<td>10/31/2010</td>
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<td>Final report, Task 3</td>
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### Synergies with other GTP programs

- Analysis tasks (resource assessment, policy analysis, exploration success rate)
- Low Temperature Geothermal, Unconventional Exploration resource assessment and exploration
Future Directions

• As geothermal resource assessment methodologies improve, outcomes will be used to guide utility resource planning

• Geothermal resources will be analyzed as part of the resource portfolio, not in isolation from other grid issues
Summary

• This project will provide an objective assessment of the value geothermal resources can bring to the grid, from the perspective of transmission planners and grid operators.

• Project tasks will engage current interconnection-wide planning activities in the West to ensure accurate evaluation of geothermal resources.