Awardee: City of Klamath Falls, Oregon
Purchase and Installation of a Geothermal Power Plant to Generate Electricity Using Geothermal Water Resources
May 19, 2010

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Mandatory Overview Slide

• Timeline
  – Project start date: 1/29/2010
  – Assistance Agreement Signed: 4/22/2010
  – Project end date: 3/28/2013
  – Percent complete: 1%

• Budget
  – Total project funding: $1,632,200
  – DOE share: $ 816,100
  – Awardee share: $ 816,100
  – Funding in FY09: $ 0
  – Funding for FY10: $ 80,000-120,000

• Partners / Participants
  – Oregon Department of Energy
  – Energy Trust of Oregon
  – Pacific Power Blue Sky
Klamath Falls Geothermal Power Project Objectives

- Demonstrate technical and financial feasibility of the use of an existing low-temperature geothermal resource for combined heat and power
  - Two existing production wells 210° - 220° F
  - 800 gpm capacity per well
  - Existing injection well

- Maintain and enhance existing geothermal district heating operation
  - Currently serves 350,000 sq.ft. buildings, 160,000 sq.ft. greenhouses, and 135,000 sq.ft. sidewalk snowmelt systems.

- Renewable power generation with modular equipment
  - Goal is 400-500 kW gross / 250 kW net

- Positive cash flow

- Technology transfer
District Heating System Photos
District Heating System Schematic

- **GEOTHERMAL PRODUCTION WELLS ON OLD FORT ROAD**
  - WP-1
  - WP-2

- **GEOTHERMAL INJECTION WELL AT MUSEUM**
  - GWR

- **HEAT EXCHANGER CONTROL VALVES**
  - HE-1
  - HE-2
  - HE-3

- **TEMPERATURE CONTROL VALVE**
  - CP-1
  - CP-2
  - CP-3

- **DISTRICT HEATING DISTRIBUTION LOOP**
  - SMS
  - SMR

- **6" FLOW METER**
  - GWR

- **AIR SEPARATOR TANK**

- **CHECK VALVE & BUTTERFLY VALVE**

- **140°F SAFETY**

- **DISTRIBUTION LOOP WALL STREET SNOW MELT**
Scientific/Technical Approach

• **Phase 1A: Feasibility Study and Preliminary Design**
  – Evaluate district heating system loads and surplus capacity available for power generation
  – Evaluate available modular or field-erected power generation equipment for
    • Power production
    • Construction cost
    • Operation and maintenance costs
    • Compatibility with district heating system operation
  – Evaluate heat rejection options
    • Open cooling tower
    • Hybrid/dry condenser
  – Schematic-level design of power plant and installation
Scientific/Technical Approach

• Phase 1A: Feasibility Study and Preliminary Design
  – Initiate electrical interconnection study with utility
  – Initiate power purchase negotiations with utility
  – Prepare applications for funding assistance from State and local sources
  – Apply for permits
    • Oregon Water Resources: Modify water rights for increased production
    • Oregon DEQ: Injection permit modification for power production
    • FERC
  – Prepare economic analysis
  – Prepare feasibility study report
• Go/no-go decision by City and DOE
Scientific/Technical Approach

• Phase 1B: Detailed Construction Design
  – Completion of power plant and installation construction drawings
  – Finalize power purchase agreement with utility
  – Finalize electrical interconnection study with utility
  – Finalize funding plans
  – Finalize permits

• Phase 2: Procurement, Installation, and Startup
  – Contract for purchase and installation of power plant equipment
  – Manage construction
  – Manage startup

• Phase 3: Operations and Reporting
  – Report Experience and Results
Scientific/Technical Approach

• Technical Accomplishments:
  – Identified key issues to address
  – Identified potential equipment vendors

• Progress to Date:
  – Obtained Go Ahead for the Feasibility Study from the City Council.
  – Prepared application for State DOE funding

• Our Team’s Qualifications:
  – More than 20 years experience in geothermal energy and power project development
  – Just completed design, installation and start-up of a 275 kW facility that is similar to the unit now planned for the City of Klamath Falls.
Project Management/Coordination

- **Project Organization**
  - Grantee: City of Klamath Falls, OR
    - Rick Witlock, City manager
  - Technical analysis and design
    - Brian Brown, Brian Brown Engineering LLC, Fort Klamath, OR
  - Financial analysis, utility interconnect, and permitting
    - Steve Anderson, Evergreen Energy, Wilsonville, OR
  - DOE grant administration
    - Betty Riley, South Central Oregon Economic Development
Project Management/Coordination

• Schedule
  – Phase 1A, Feasibility study: May 2010 – November 2010
  – Phase 1B, Detail design: November 2010 – May 2011
  – Phase 2, Construction: May 2011 – February 2012
  – Startup: February 2012
  – Phase 3, Operation: February 2012 – February 2013
  – Final Report: March 2013
Future Directions

• We plan to implement this project on a very limited budget, recognizing that financial hurdles must be overcome in order to obtain approval of the city council. We recognize that smaller power projects have difficulty reaching financial goals.

• The coming months will be focused on identifying the most cost-effective installation arrangement, vendors and ownership structure.

• A preliminary design, financial projection and recommendation to the City Council will be complete by November, 2010.
• Recognizing the challenges of completing an economically viable small project, our focus will be on high efficiency and simplicity of design.

• The Klamath Falls project benefits from established thermal energy customers. Adding electric power production to an existing system should be cost-effective for the City.