Awardee: City of Klamath Falls, Oregon

Purchase and Installation of a Geothermal Power Plant to Generate Electricity Using Geothermal Water Resources

May 19, 2010

Brian Brown,
Brian Brown Engineering LLC
Steve Anderson,
Evergreen Energy

Mandatory Overview Slide

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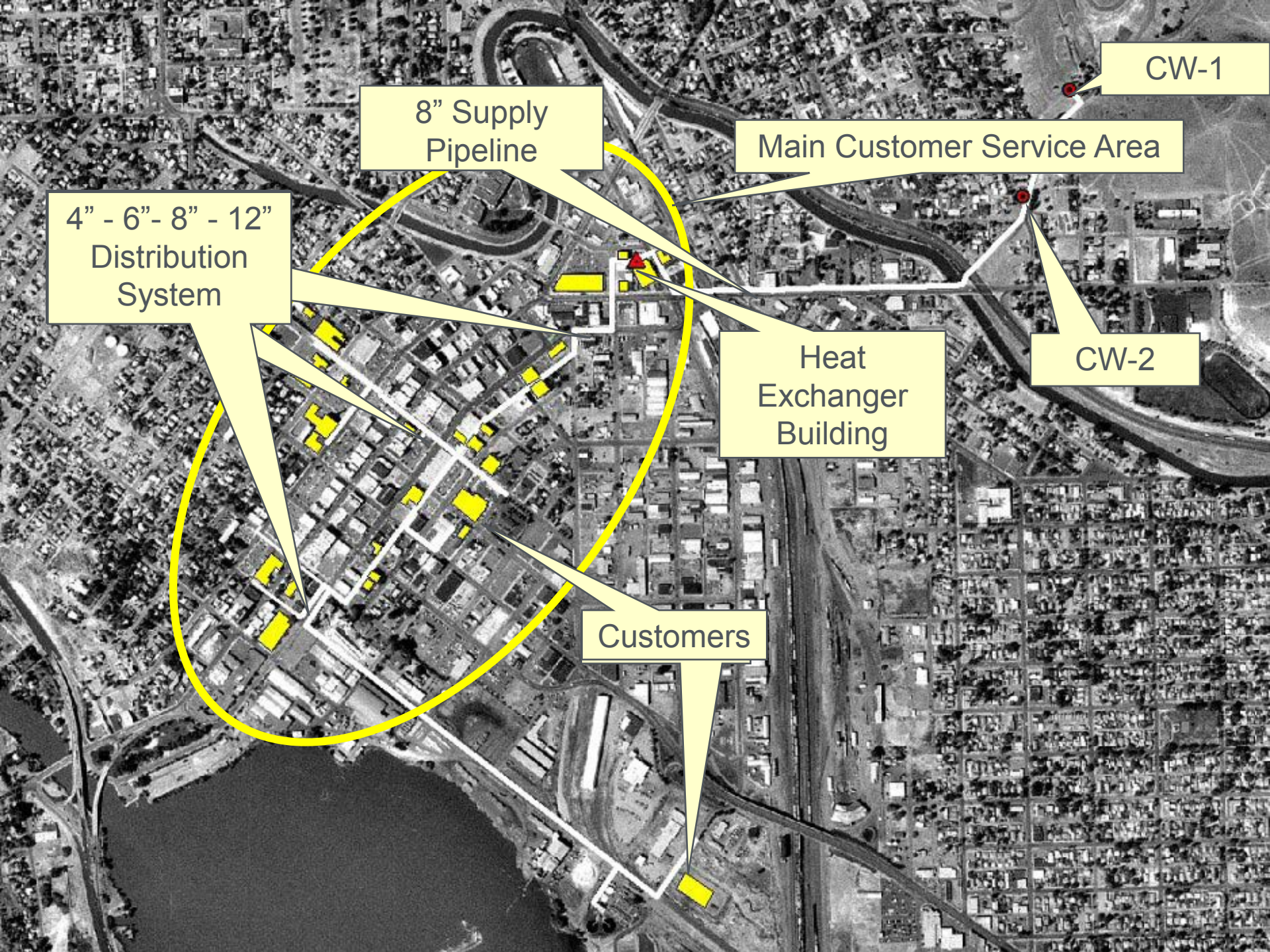
- Timeline
  - Project start date: 1/29/2010
  - Assistance Agreement Signed: 4/22/2010
  - Project end date: 3/28/2013
  - Percent complete: 1%
- Budget
  - Total project funding: $1,632,200
  - DOE share: $ 816,100
  - Awardee share: $ 816,100
  - Funding in FY09: $ 0
  - Funding for FY10: $ 80,000- 120,000
- Partners / Participants
  - Oregon Department of Energy
  - Energy Trust of Oregon
  - Pacific Power Blue Sky

Relevance/Impact of Research

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


CW-1
8” Supply Pipeline
Main Customer Service Area
4” - 6”- 8” - 12” Distribution System
CW-2
Heat Exchanger Building
Customers

District Heating System Photos

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District Heating System Schematic

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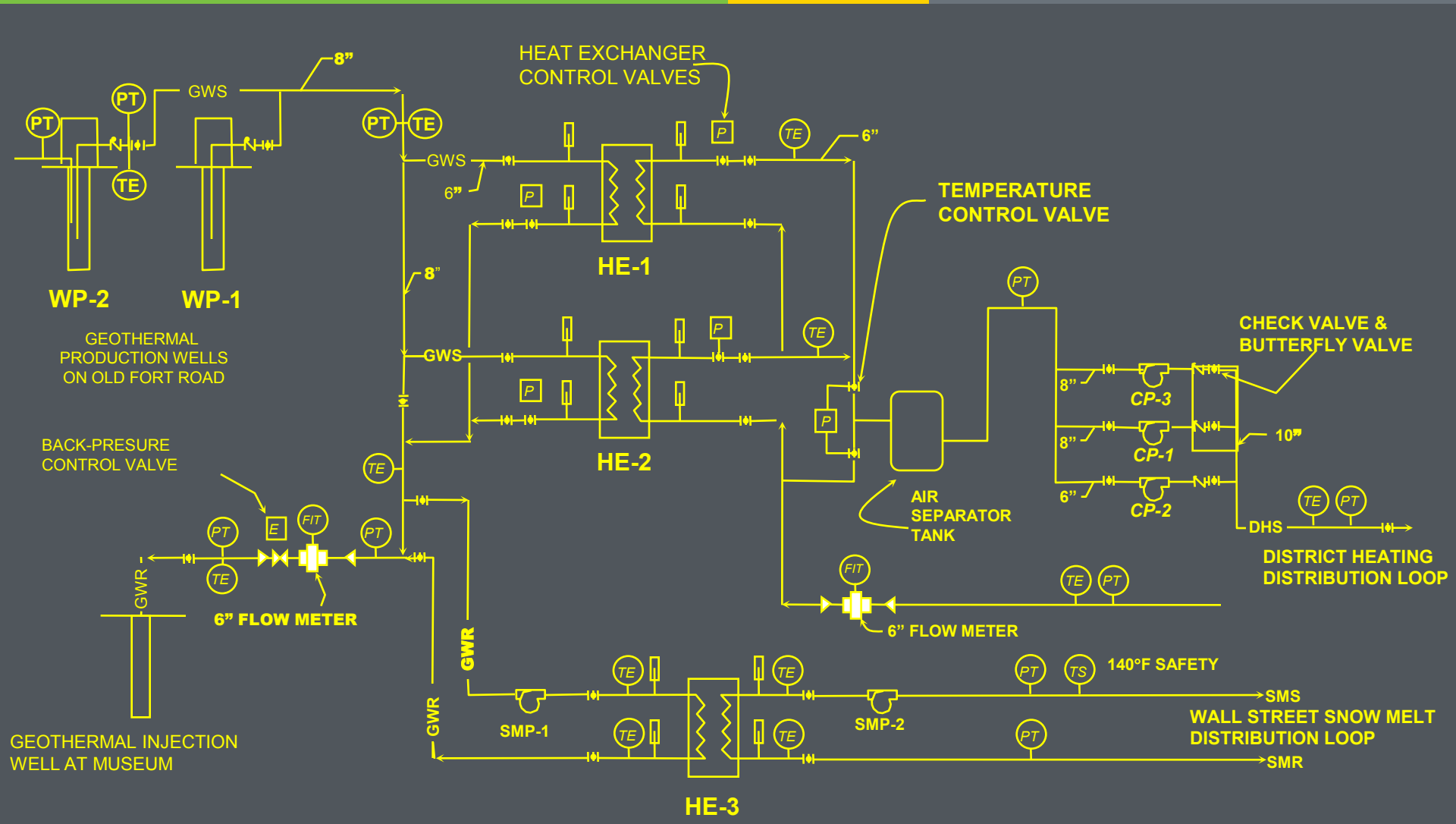

Scientific/Technical Approach

- 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 venders
- 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

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- 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, venders and ownership structure.
- A preliminary design, financial projection and recommendation to the City Council will be complete by November, 2010.

Mandatory Summary Slide

- 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.