Flathead Electric Cooperative
Facility Geothermal Heat Pump System Upgrade
May 19, 2010
Project Timeline

• Feasibility Study & Design - February 1, 2010
• Permit Acquisitions - May 10, 2010
• Construction Start - May 17, 2010
• Construction End - August 31, 2010
• Data Acquisition & Dissemination to DOE - September 1, 2010 – September 2012

Project Budget

• Total Budget - $319,600
• DOE Share - $155,270
• Cost Share - $164,330
  • FEC - $116,330
  • Bonneville Power Administration - $48,000
• FY09 - $0
• FY10 - $155,270

Barriers

• Water Rights Authorities
  • Water Rights Application complicated, involved, & time intense (180 Days to Review)

Partners

• Jackola Engineering & Architecture
  • Extensive Ground Source Heat Pump System Design Experience
Relevance/Impact of Project

- **Project Will Take Advantage of Abundant Water in Shallow Aquifer**
  - 15’ Static Water Level
  - Low Pumping Power
  - Reduced Installation Costs
  - Good Quality Water

- **Demonstrate Low Temperature GSHP System Design**
  - Modular heat pumps with variable water temperature output (90° F - 140° F)
  - Maximum System Efficiency, 5.0+ COPs
  - Extreme climate conditions, i.e. outdoor design temp of -19° F
  - System to serve radiant floors, hydronic unit heaters, and outdoor ventilation air tempering

- **Provides a Baseline for Local Industrial Geothermal Project Costs and Benefits**
  - As a utility company, Flathead Electric Cooperative is uniquely positioned to provide marketing of ground source heat pump systems
  - $ Incentives to GSHP customers
  - Real-time public display of energy saved and emissions avoided
  - GSHP technical support
  - Energy data analysis
Technical Approach

• (4) 20 Ton Heat Pump Modules = 1,000,000 Btuh of Heating Only

• Ground Water Source – Open Loop Design
  • 15’ Static Water Level
  • Clean & Viable Ground Water
  • VFD Submersible Well Pump

• Low Temperature Applications
  • Variable Flow, Modular Heat Pump System w/Variable Temperature Output Up to 140° F
  • Radiant Floors
  • Unit Heaters Capable of Heat Delivery w/Low Water Temperature Source (90° -140°)
  • Heat Recovery Ventilators Water Coils Capable of Heat Delivery w/Low Water Temperature Source (90° -140°)

• Outdoor Reset Control: Heat Delivered = Heat Lost
  • Controls Supply Water Temperature Based on Outdoor Air Temperature
  • Maximizes Heat Pump COP’s
  • Minimal Equipment Cycling

• Completes Facility Wide HVAC Transition to GSHP Heating & Cooling
Scientific/Technical Approach (continued)

Project Milestones

• Feasibility Study
  • Complete
  • Provided Favorable Results to both Technical and Economic Viability of Proposed System

• System Concept Development to Final Design
  • Complete

• Well Drilling & Water Rights Certificate
  • Well Drilling to be Complete by May 20, 2010
  • Water Rights Certificates
    • FY10 Go/No Go Decision Point

• System Commissioning
  • September 1, 2010
Accomplishments, Expected Outcomes and Progress

• **Feasibility Study**
  - Payback Period is Approximately 16 Years

• **System Concept Development to Final Design**
  - Complete

• **Construction Permits & Water Rights Certificate**
  - Permits Obtained by May 10, 2010
  - Water Rights Certificates Expected to be Acquired without Problems

• **System Commissioning**
  - September 1, 2010
  - Will Include Heat Pump Manufacturer Representative
  - Adjustments to Source & Load Water Flowrates to Maximize Performance

• **Data Acquisition & Analysis**
  - BTU Meter, Flowmeter, & Temperature Sensors will Measure Energy Delivered to Space While Electric Meter will Measure Power Consumed by Heat Pump Modules
Accomplishments, Expected Outcomes and Progress (continued)

• **Data Acquisition & Analysis (continued)**
  • Data and Analysis Results will be Provided to the DOE through the use of the Geothermal Desktop Software or Other Means Required by the DOE.

• **Equipment**
  • **Heat Pump**
    • Modules can be Combined to Provide *Variable* Output and Allow for Future Expansion (Up to 600 Tons)
    • Can be Piped and Controlled to Produce the desired Evaporator or Condenser Temperature

• **Team Qualifications**
  • **Flathead Electric Cooperative**
    • At Forefront of Renewable Energy in the Region
    • Facility Wide GSHP Systems
  • **Jackola Engineering & Architecture**
    • 50+ Combined Years of GSHP System Design
Project Management/Coordination

- **Phase 1** (February 1, 2010 – June 30, 2010)
  - Feasibility Study, Engineering Design – Jackola Engineering & Architecture
  - Well Drilling & Development – Certified Well Driller
  - Well Testing, Data Analysis, & Water Rights Application to DNRC – Jackola Engineering & Architecture
  - Go/No Go Point – Contingent on Water Rights Certificate from DNRC

- **Phase 2** (May 17, 2010 – September 1, 2010)
  - Project Coordination – Principal Investigator, Director of Facilities Maintenance and Jackola Engineering & Architecture
  - Construction and Equipment Installation – Contractor w/experience in GSHP system installation
  - Weekly site meetings and Project Inspection – Jackola Engineering & Architecture
  - Project Cost Accounting – Flathead Electric Co-Op – Principal Investigator, Support Services Manager & Staff, Contractor
  - System Commissioning – Jackola Engineering & Architecture, Contractor

- **Phase 3** (September 1, 2010 – September 1, 2012)
  - Equipment Operation – Director of Facilities Maintenance
  - Data Collection & Analysis – Flathead Electric Co-Op Energy Services Group
  - Business & Technical Marketing – Flathead Electric Co-Op Marketing Team
• Budget & Cost Share Overview

- Bonneville Power Administration
- Flathead Electric Co-Op
- DOE Funding

• National Geothermal Data System
  • Data and Analysis Results will be Provided to the DOE through the use of the Geothermal Desktop Software or Other Means Required by the DOE.
Future Directions

• Flathead Electric Co-Op Facility HVAC Upgrade Project to Showcase Feasibility of Commercial and/or Industrial GSHP System in Region
  • Public Access to Project Feasibility, Costs, Implementation, and Performance
  • Published on Flathead Electric Co-op’s Website, in Monthly Newsletter, and National Utility Industry Magazines
  • Highlights Commitment to Renewable Energy Initiative
  • Highly Publicized as 1 of 2 DOE GTP Funded Projects in Montana
  • Interest From other Regional Utility Companies

• Sharing of Project Success Factors as Opportunities Arise

• Potential Increase in Ground Source Heat Pump Commercialization based on Proven Feasibility and Performance
Flathead Electric Co-Op Presents Unique and Innovative GSHP Demonstration Project

Predicted to validate Technical & Economic Feasibility of Commercial-Scaled GSHP System in Region

- Instrumental in Keeping the Northwest as the lowest carbon-emitting Region in the U.S.

Utilize Abundant & Clean Natural Resource – Shallow Aquifer

Use of Modern & Highly Efficient System Equipment & Components
- Modular Heat Pump
- Use of Low Temperature Heating Water
- Technically Advanced Pumps – VFD & ECM