



Flathead Electric Cooperative Facility Geothermal Heat Pump System Upgrade

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Ground Source Heat Pumps Demonstration
Projects

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

- **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**

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

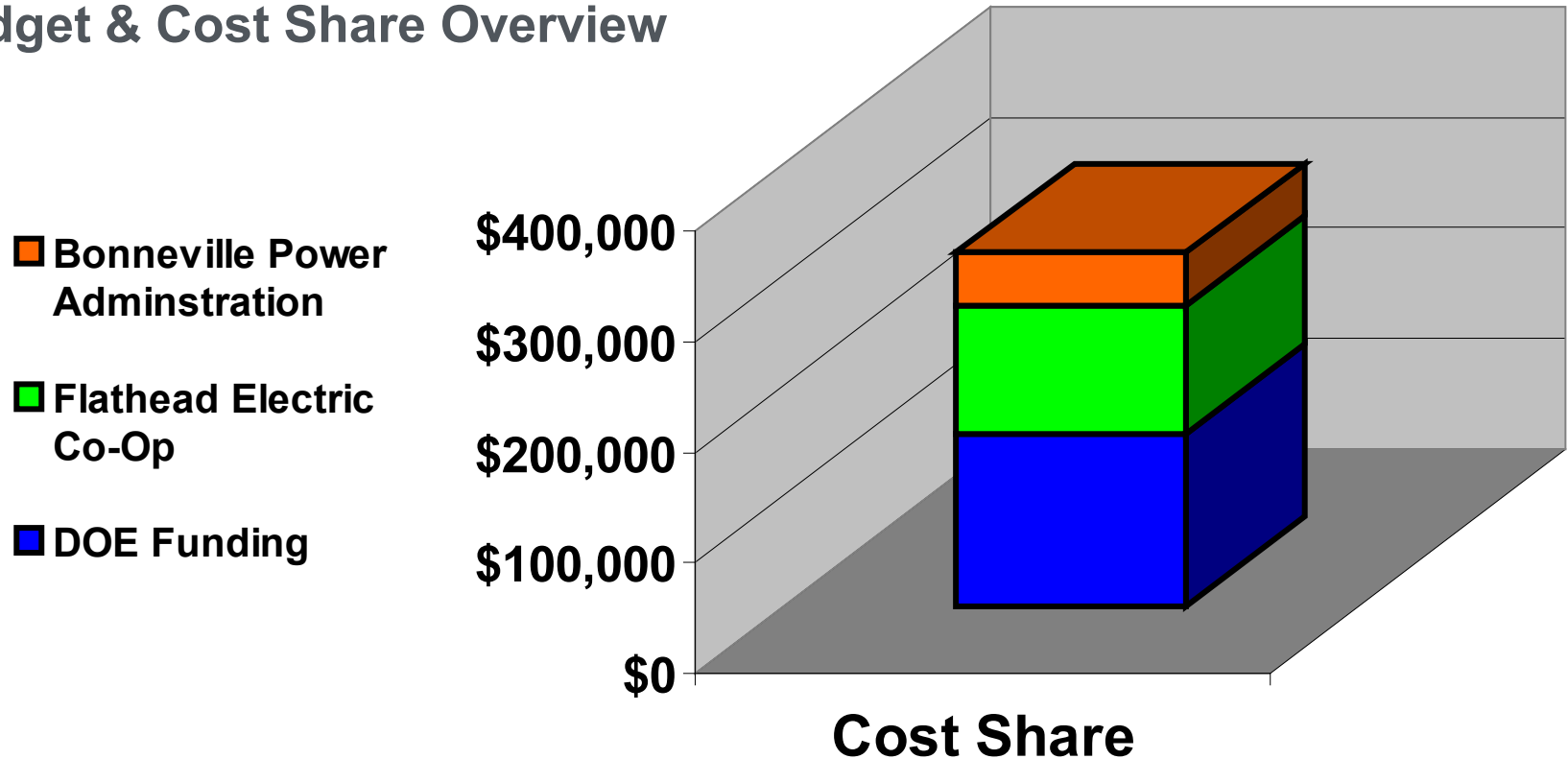
- **Feasibility Study**
 - Payback Period is Approximately 16 Years
- **System Concept Development to Final Design**
 - Complete
- **Construction Permits & Water Rights Certificate**
 - Permits Obtained by May 10, 2010
 - Water Rights Certificates Expected to be Acquired without Problems
- **System Commissioning**
 - 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

- **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



- **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**



- **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.

- **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**
- **Strengthen Flathead Electric Co-Op's Renewable Energy Commitment & Platform**
 - 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