

Final Research Performance Progress Report

Federal Agency and Organization: DOE EERE – Building Technologies Program

Recipient Organization: Cedarville School District 44

DUNS Number: 800 159 829

Recipient Address: 9500 Pirates Pt, Cedarville, AR 72932-9565

Award Number: DE-EE0002968

Project Title: Cedarville School District Retrofit of Heating and Cooling Systems with
Geothermal Heat Pumps and Ground Source Water Loops

Project Period: 1/29/2010 to 9/30/2013

Principal Investigator: Dr. Dan Foreman
Superintendent, Cedarville School District
dforeman@cedarvilleschools.org
479-474-7220

Report Submitted by: Mark Jarrell
(If other than PI)
Engineer/Analyst
mjarrell@ldl.net
678-575-9009

Date of Report Submission: October 2, 2013

Reporting Period: January 29, 2010 to September 30, 2013

Report Frequency: Final

Project Partners: Cedarville School District

DOE Project Team: DOE Contracting Officer – Genevieve Wozniak
DOE Project Officer – Leon Fabick
Project Monitor – Andrew Kobusch

There is no distribution limitation for this Report. The Report is not believed to contain any patentable material or protected data.

EXECUTIVE SUMMARY

Cedarville School District retrofitted the heating and cooling systems in three campus areas (High School, Middle School, and Upper Elementary School) with geothermal heat pumps and ground source water loops, as a demonstration project for the implementation of geothermal heat pump systems and other energy efficiency and air quality improvements. The project was funded as a result of the American Recovery and Reinvestment Act of 2009 (ARRA), and supported the intent of that Act by creating jobs, and investing in infrastructure, education, health and renewable energy.

New high efficiency geothermal heat pumps and ground loops were installed to replace various older heating and cooling systems in each of the three existing campus areas, as well as in new building expansion areas constructed during the project period, resulting in more energy efficient operation of heating and cooling for the entire campus and lower maintenance costs. Air quality was improved in all retrofitted campus areas by use of new equipment and automated controls. Overall campus energy efficiency was optimized by installation of measures such as increased insulation and weather sealing, in coordination with the design and installation of the new geothermal heat pump systems.

The new systems are monitored and controlled by a central computer system which collects operation data on each heat pump unit and system wide performance. This data is transferred automatically to a DOE contractor, CDH Energy Corp, for study and inclusion in a national data system. CDH Energy has also gathered installation and historical cost data for use in analysis of the new geothermal systems. The new systems have been utilized in educational activities within the schools and in outreach activities to the community. The new systems have been available to support marketing efforts for cost effective installation and operation of energy efficient geothermal heat pumps with ground source water loops.

SUMMARY OF PROJECT ACTIVITIES

Project Status Summary:

All goals and tasks set out for this project have been met.

Equipment Installation Phase - High School, Middle School, and Upper Elementary School buildings:

High School geothermal heat pumps are working in all areas using circulation water to and from the High School geothermal well field.

Middle School geothermal heat pumps are working in all areas using circulation water to and from the Middle School geothermal well field.

Upper Elementary School geothermal heat pumps are working in all areas using circulation water to and from the Upper Elementary School geothermal well field.

Work is completed on the equipment installation Phase of this Demonstration Project.

Data Reporting Phase

A data collection protocol has been specified by DOE for inclusion of data into the National Geothermal Data System (NGDS). We received this protocol in June 2011, and are currently sending data to the DOE's contractor, CDH Energy Corp.

We have provided data submittal with full support through the end of the project as of Sep-2013. After Sep-2013, data will continue to be transmitted, with limited support provided. As data analysis continues, we will respond to requests.

Work is completed on the data reporting Phase of this Demonstration Project.

Cedarville School District coordinated with DOE to market the installation of energy efficient geothermal heat pumps with ground source water loops, and the project continues to be available for marketing efforts.

Work is completed on the marketing Phase of this Demonstration Project.

Accomplishments with Specific Project Goals:

In this section each task, as defined by the Statement of Project Objectives (SOP), is discussed. The discussion for each task includes subtasks. Milestones, deliverables, and decision points may be discussed in more detail in portions of this section.

Task number and title: Phase 1, Task 1

1. **Planned Activities:** Feasibility study and engineering – Audit and design confirmation.
2. **Actual Accomplishments:** Completed on schedule.
3. **Explanation of Variance:** Test wells confirmed conductivity assumptions, and engineering design assumptions were confirmed.
4. **Plans for Next Quarter:** Already completed, no plans for next quarter.

Task number and title: Phase 1, Task 2

1. **Planned Activities:** Feasibility study and engineering – Utilizing innovative financing.
2. **Actual Accomplishments:** No innovative financing was required.
3. **Explanation of Variance:** This task was contingent on the financial needs of the Cedarville School District. The District was able to supply all funds needed for their 50% share of this project without the need for outside financing.
4. **Plans for Next Quarter:** Already completed, no plans for next quarter.

Task number and title: Phase 1, Task 3

1. **Planned Activities:** Feasibility study and engineering – Specifying innovative technology.
2. **Actual Accomplishments:** Completed on schedule.
3. **Explanation of Variance:** Engineering specifications for equipment and installation were confirmed and delivered to the Project Management team.
4. **Plans for Next Quarter:** Already completed, no plans for next quarter.

Task number and title: Phase 2, Task 1

1. **Planned Activities:** Installation and commissioning of equipment and systems – Equipment procurement and preparation for installation.
2. **Actual Accomplishments:** Completed on schedule.
3. **Explanation of Variance:** Proposals were requested from vendors, vetted and accepted under Arkansas Dept. of Education guidelines.
4. **Plans for Next Quarter:** Already completed, no plans for next quarter.

Task number and title: Phase 2, Task 2

1. **Planned Activities:** Installation and commissioning of equipment and systems – Installation.
2. **Actual Accomplishments:** Completed on schedule between May, 2010 and October, 2011.

3. **Explanation of Variance:** Proposals were requested from vendors, vetted and accepted under Arkansas Dept. of Education guidelines.
4. **Plans for Next Quarter:** Already completed, no plans for next quarter..

Task number and title: Phase 2, Task 3

1. **Planned Activities:** Installation and commissioning of equipment and systems – Commissioning and training.
2. **Actual Accomplishments:** Completed on schedule.
3. **Explanation of Variance:** All equipment installed and School District operators and administrators trained.
4. **Plans for Next Quarter:** Already completed, no plans for next quarter.

Task number and title: Phase 3, Task 1 – Q2-2013

1. **Planned Activities:** Operation, data collection and marketing – Data collection and availability.
2. **Actual Accomplishments:** Operation has been ongoing since completion of installation for each campus area. Data collecting instrumentation and data transmission formats were specified by the DOE contractor, CDH Energy Corp., who is responsible for data collection, based on the specific equipment at this project.
Have supplied reports and data on project performance to CDH Energy, and other DOE contractors as requested.
3. **Explanation of Variance:** No variance.

Plans for Next Quarter: Task completed. Data transmission and reporting began during Q2-2012, and continued with support through Sep-2013. After Sep-2013 the project will be closed. Data will continue to be transmitted, but no support provided.

Task number and title: Phase 3, Task 2 – Q2-2013

1. **Planned Activities:** Operation, data collection and marketing – Marketing.
2. **Actual Accomplishments:** Cedarville School District has actively engaged the local and state community in awareness of this demonstration project. Tours have been given.
Students have participated in public relations activities regarding this project. Our team has offered to cooperate with any DOE events or marketing efforts.
3. **Explanation of Variance:** No variance.

4. **Plans for Next Quarter:** Task completed. Project closed after Sep-2013.

Task number and title: Phase 3, Task 3 – Q2-2013

1. **Planned Activities:** Operation, data collection and marketing – Project management and reporting.
2. **Actual Accomplishments:** Professional outside project management will continue until the end of the project, and they are responsible for continued reporting to DOE and others as necessary.
3. **Explanation of Variance:** No variance.
4. **Plans for Next Quarter:** Task completed. Project closed after Sep-2013.

Problems: None reported for this project.

DOE has requested that the project spending be completed by Sep-2013. We have met this objective and complied with our required submittal of data over at least a one year period. Data will continue to be transmitted, with limited support provided.

PRODUCTS / DELIVERABLES

Training and Professional Development: School District personnel have been trained in operation and maintenance of the equipment and the Alerton control system. School District and Project Management personnel have been trained in operation and maintenance of the monitoring/data-collection process.

Publications, Conference Papers, and Presentations: In the first project year, we participated in a Peer Review with a published presentation. No subsequent Peer Reviews have been scheduled.

Patents and IP: No patents or proprietary developments were anticipated or have resulted from this demonstration project.

Other Products / Deliverables: Data is being supplied to the National Geothermal Data System via the responsible DOE contractor for data collection, CDH Energy Corp.