# Education & Collection Facility GSHP Demonstration Project

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GSHP Deomstration Projects

# Mandatory Overview Slide - #1



- Project Timeline
  - Project start: 3/2010
  - Engineering Feasibility: 4/2010 – 5/2010 [complete]
  - Schematic Engineering: 5/2010 – 8/2010
  - Decision Point – Eng. Review: 8/2010
  - Final Engineering & CD: 8/2010 –11/2010
  - Purchase & Installation: 6/2012 – 9/2013
  - Commissioning: 6/2012 – 9/2013
  - Data Collection & Marketing: 2013 – 2015

- Percent Complete: < 5%

# Mandatory Overview Slide - #2



- Project Budget
  - Total Project Cost: $5,223,677
  - DOE Share: $2,611,832 (50%)
  - Awardee Share: $2,611,845 (50%)
  - DOE Funding for 2010 (yr.1): $155,665 (projected)

| | Years | DOE Funding | Awardee Share | TOTAL |
|---|---|---|---|---|
| Budget Period 1 | 2010-2011 | $ 185,138 | $ 254,138 | $ 439,276 |
| Budget Period 2 | 2011-2013 | $ 2,275,031 | $ 2,313,214 | $ 4,588,245 |
| Budget Period 3 | 2013-2015 | $ 151,663 | $ 44,493 | $ 196,156 |
| TOTAL | | $ 2,611,832 | $ 2,611,845 | $ 5,223,677 |

# Mandatory Overview Slide - #3



- Project Barriers (risks)
  - Municipal recycle water system's failure to deliver
  - Timeline may be impacted by ECF building construction schedule
- Collaboration Partners:
  - Denver Water (operator of recycle water system)
  - City and County of Denver
- Primary Contractors
  - Archectural Energy Corp (AEC)
  - GeoEnergy Services
  - Klipp Architects
  - Arup Engineering
  - BCER Engineering

## Project Objective

**Develop a commercial scale (100 Ton+) GSHP system that will meet the following goals**

- Reduce building energy consumption
- Require significantly less area than traditional ground-loop GSHP
- Reduce capital required for installation
- Replicatable in other urban areas of the US

## Proposed Solution

**Utilize water circulating within an underground municipal recycle water (non-potable) water system as the heat sink/source.**

## Proposed Solution

**Results in a high-performance, commercial-scale HVAC installation that consumes less power than a traditional HVAC, with a comparable capital investment.**

- Large footprint required for GSHP borehole field is eliminated
- Capital costs required for GSHP borehole field is eliminated
- Complex environmental & regulatory permitting is minimized
- Relative efficiency of the GSHP system may be increased
- Project can be replicated in other urban areas
  - Denver recycle water system: over 36 miles long (& expanding)
  - Currently 171 water districts in 11 states with recycled water systems

# Engineering /Technical Approach



- Major Go-No-Go Milestones
  - Recycle System Feasibility: completed – approved
  - Review during Schematic Design – August, 2010

- Engineering Design
  - Recycle system delivery modeling
  - Recycle system data collection (annual temp profile)
  - Thermal load model – to determine building requirements
  - System redundancy & control
  - Maximize  GSHP demo capabilities
  - Real-time energy monitoring within the building

# Accomplishments (to date)



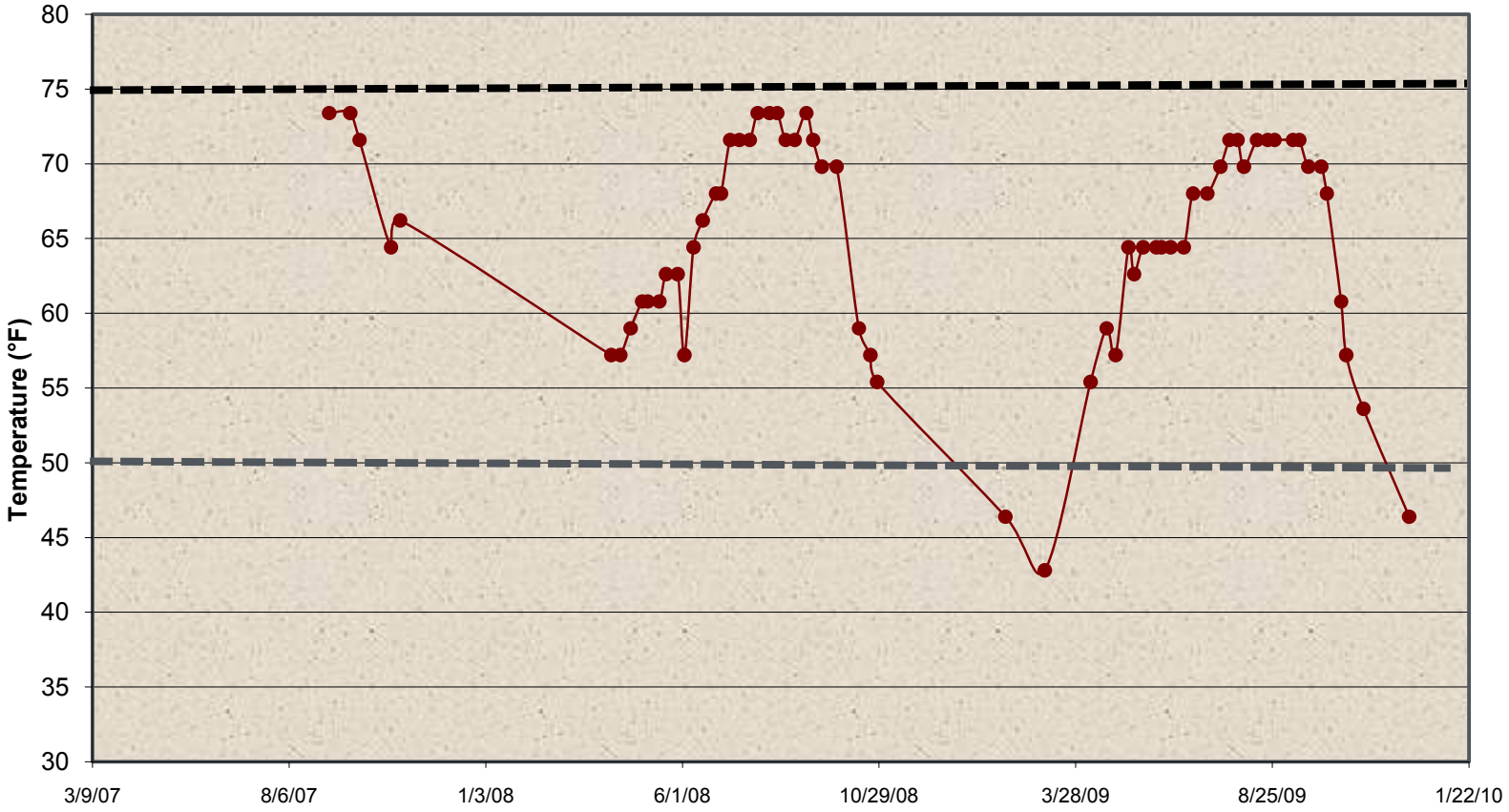
Initial Feasibility – focused on recycle water system

Conclusions:

- System can support project (year-around)
- Required water volume is adequate
- System cannot provide 100% availability
- Annual temperature profile is within range for HP
- Operational requirements are reasonable & implementable

## Initial Feasibility – temp profile of recycled water

Findings: system temp profile at delivery point is adequate, but not as stable as initially expected.



# Project Management Plan



- 2010: Major Tasks to Complete
  - Further modeling of recycle water system
  - ECF Schematic Engineering Design: integrate GSHP project
  - Complete final review
  - Begin Final Engineering Design
- 2011: Major Tasks to Complete
  - Complete Final Engineering Design
  - Complete permitting
- Data Collection for NGDS (2013)
  - Identify data items to collect & monitor
  - Identify data collection & management system
  - Prepare to deliver to NGDS

# Future Directions



- 2010: Recycle Water System
  - Model system/pipeline flow
    - Attempt to improve delivery water temp profile
    - Possibly introduce turbulent flow of some sort…
- 2010: ECF Schematic Engineering Design
  - Integrate GSHP into the ECF building design
  - Design GSHP system redundancy & maximize efficiency
    - Use of potable water when recycle water not available
    - Use of available evaporative water cooling to lower input temp
    - Continue to model use of thermal reservoir
- 2011: Complete Final Engineering Design

# Project Summary



Implementation of a commercial-scale GSHP system, integrated with an available recycle water system can:

a) Reduce building energy consumption by as much as 50%.

b) Significantly reduce the capital required for installation of a GSHP system, making the cost comparable to a traditional HVAC system

c) Eliminate the need for large surface area required to install a traditional ground-loop field.

d) Be economically replicated through-out the US where recycle water systems are available.