Recovery Act: Development of Design and Simulation Tool for Hybrid Geothermal Heat Pump System

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Track Name

This presentation does not contain any proprietary confidential, or otherwise restricted information.
– Timeline
  • Conditional award was issued on 01/29/2010 and all conditions were lifted in the middle of April
  • Project kick-off meeting was held on 4/6/2010
  • Expected project end date is 03/31/2011
– Budget
  • Total project funding is $310,874, of which DOE share is $233,819 and awardees share is $77,055
  • Estimated funding for FY10 is $225,000
– Barriers
  • Lack of sufficient design and energy analysis tool for hybrid ground source heat pump (HGSHP) systems
– Partners
  • James J. Hirsch & Assoc.
  • Oak Ridge National Laboratory
Relevance/Impact of Research

- Expand eQUEST, a building energy analysis software with latest implementation of DOE-2, for simulations of HGSHP systems and improve its existing simulation capabilities for ordinary GSHP systems.

- With implementation of the proposed expansion and improvements, eQUEST will enable prospective customers to analyze the cost and performance of various HGSHP/GSHP systems.

- As such, it will serve as a powerful tool for use in making purchasing and design decisions for HGSHP/GSHP systems.
Based on existing simulation capabilities for vertical bore ground heat exchangers and water source heat pump systems, following new capabilities will be implemented into eQUEST/DOE-2:

- Simulation of common hybrid GSHP systems
  - Cooling tower/boiler is in parallel or series with vertical bore ground heat exchangers
  - Operation of cooling tower/boiler is controlled by schedule, supply fluid temperature of water source heat pump, or the difference between the supply fluid temperature and outdoor ambient temperature

- Improved multi-year simulations for HGSHP/GSHP systems

- Simulation of ground coupled water-to-water heat pump systems that use fan coils as heat/cool supply terminals
Accomplishments, Expected Outcomes and Progress

• Project was started a month ago and management/administration procedures have been in place.
• The detailed scope/plan for implementing the proposed new capabilities in eQUEST/DOE-2 is underdevelopment and will be finalized in this month.
• It is planned that all the proposed new capabilities will be implemented by the end of January 2011 and beta test of the implemented new capabilities will be performed then.
Project Management/Coordination

- Project management plans
  - Clear definition of the scope of work and detailed plan for implementation
  - Regular monthly progress meeting
  - Ad hoc technical meeting as needed
  - Progress report for DOE peer review
  - Internal test and quality control
  - Extensive beta test
Project Management/Coordination

• Schedule

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• Application of resources and leveraged funds/budget/spend plan
  • Funds from DOE
  • Cost share from ClimateMaster
  • Cost share from JJH
Future Directions

• Deployment strategy
  – Software launch event
  – Software training workshops
  – Validation/verification of software predicted results
  – Technical support for using eQUEST/DOE-2 in HGSHP/GSHP system design and energy analysis

• Future research, development or deployment needs
  – User friendly report customized for design engineers
  – New configurations and controls of hybrid GSHP systems that will further reduce the cost and/or improve the energy efficiency
• Simulation capability of eQUEST, a DOE-2 based software, will be expanded and improved to support the design and energy analysis of HGSHP/GSHP systems

• The proposed new capabilities include:
  – Simulation of common HGSHP systems
  – Improved multi-year simulations for HGSHP/GSHP systems
  – Simulation of ground coupled water-to-water heat pump systems that use fan coils as heat/cool supply terminals

• Upon success of this project, eQUEST will serve as a powerful tool for use in making purchasing and design decisions for HGSHP/GSHP systems