U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

CLIMATEMASTER®
Geothermal Heat Pump Systems

An LSB Industries. Inc. Company (NYSE : LXU)

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

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Track Name

Mandatory Overview Slide

- 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

- 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 planed 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

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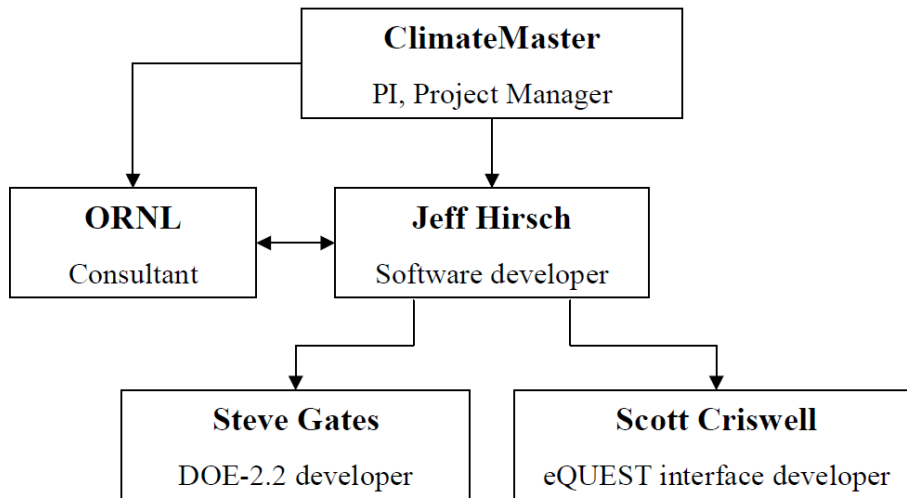
Project Team Organization Chart

- 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

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- Schedule

Task \ Month	1	2	3	4	5	6	7	8	9	10	11	12
Task 1 Ground coupled WWHP systems	X	X	X									
Task 2 Multi-year simulation			X	X	X	X	X					
Task 3 Hybrid GHP systems	X	X	X	X	X	X	X	X	X	X	X	
Task 4 Software launch and training											X	X

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

- 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

Mandatory Summary Slide

- 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