

Analysis of Energy, Environmental and Life Cycle Cost Reduction Potential of Ground Source Heat Pump (GSHP) in Hot and Humid Climate

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Ground Source Heat Pumps >
Data Gathering and Analysis

- Timeline
 - Project start date: April 1, 2010
 - project end date: March 31, 2011
 - percent complete: <5%
- Budget
 - Total project funding: \$312,500
 - DOE share: \$250,000
 - Awardee share: \$62,500
 - Funding received in FY09: \$250,000
 - Funding for FY10:
- Barriers: Data sources
- Partners: ClimateMaster, Inc., Florida Power and Lights, Oak Ridge National Laboratory

Objectives

- Gather and analyze independently the available technical, cost, financial incentive data on installed GSHP/HGSHP applications in residential, commercial and schools in hot and humid climate regions, and develop a calibrated baseline and performance period model of new construction and retrofitted buildings in conjunction with the energy simulation program.
- Develop a cost/benefit model and tool including life cycle cost (LCC) analysis of GSHP and HGSHP system based on data collected and correlate the data with identified parameters.
- Present a comprehensive report outline the findings and recommendations addressing the goal of the project by providing the easy-to-follow guidelines

Impact

- The analysis results will provide a basis for decision on wider adoption or identification of barriers of GHP systems. It will also provide feedback to technical design of loop and systems, reliability and performance associated with cost structure in hot/humid regions.
- The potential for wide applications of GSHP especially HGSHP in hot and humid climate is significant, especially towards building zero energy homes where the combined energy efficient GSHP and abundant solar energy production in hot climate could be an optimal solution.

Tasks

1. Data Gathering and Analyzing
2. Cost Modeling
3. Baseline Model Development and Calibration
4. LCC Analysis
5. Reporting

Approach

- Focus on initial 50-60 projects and categorize them by residential, commercial and school buildings;
- Collect or derive historical system performance data (such as temperature, humidity, electricity consumption, flow rate, etc.) and cost and incentive data. May include published data.
- Select about nine sites for in-field performance data validation using portable monitoring units (spot check)
- Will run simulation for 12 cases (3 building types x 3 different loop types + 3 benchmark cases with conventional non-GSHP systems).
- Compare the collected data, field data with simulation data.

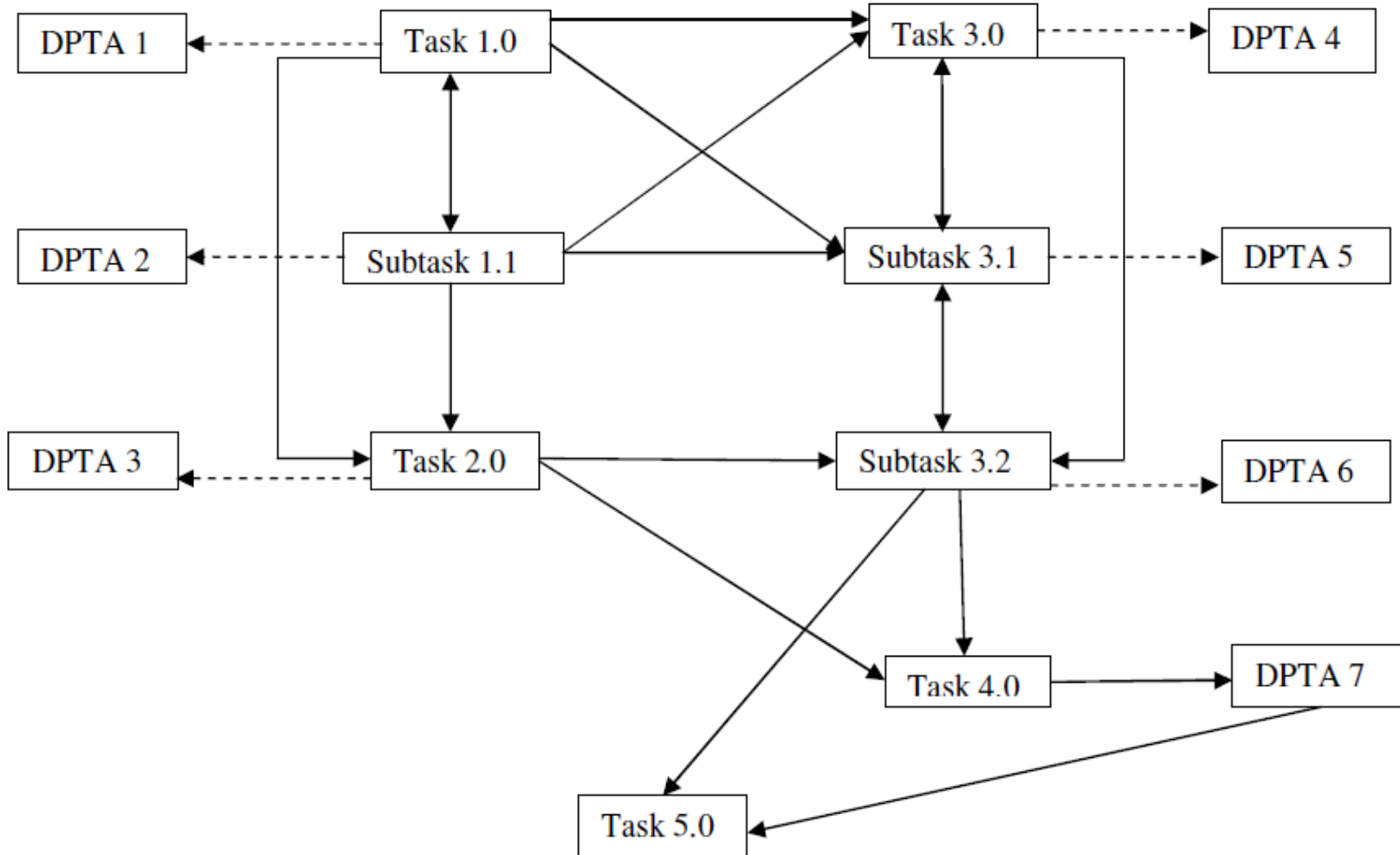
Planned Milestones

Tasks	Phase 1						Phase 2					
	2010						2011					
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Data Gathering and Analysis												
Walk-through Survey												
Cost Modeling												
Baseline Model Development and Calibration												
Performance Period Model Development												
Energy Saving Calculation												
LCC Analysis												
Deliverables	Report 1			Report 2			Report 3			Draft Final Report Design Guideline		
Key Milestones	Completion of data source and field data visit identification			Completion of data analysis results			Completion of analysis tools			Completion of analysis results		

Decisions Point Task Alternatives (DPTA)

DPTA	Original Tasks	Decision Points	Task Alternatives
1	Task 1.0: Data Gathering and Analysis	If there is no sufficient data	Use the data as a validation tool for the model simulation rather than generate models purely from the empirical historic data
2	Subtask 1.1: Walk-through Survey	If there is no sufficient field data available because of lack of monitoring instruments	Apply the FIU energy monitoring system for selected data point validation
3	Task 2.0: Cost Modeling	For the regions with no significant GSHP installation	Model will take into account a proposed scenario using extrapolated data from other regions
4	Task 3.0: Baseline Model Compilation and Calibration	For the regions there lacks the meaningful baseline data, or FPL does not serve that region	Additional criteria and assumptions will be established to allow the reasonable extrapolation of data from other regions. Alternatively, other utility companies in those regions will be contacted
5	Subtask 3.1: Performance Period Model Analysis	If the performance data from the data collection and manufacturers and limited could not generate meaningful correlative results	Theoretical models will be sought to enhance the analysis
6	Subtask 3.2: Energy Saving Calculation	If the field data alone cannot provide sufficient correlative results	Physics-based simulation model will be used and validated by the limited field data
7	Task 4.0: LCC Analysis	If the whole-process LCC yields results that may not be practically implementable	The scope of LCC analysis will be modified to include the short and mid-term economic interests.

Go/No-Go Decisions



Progress to date

- Contacted 40 owners, designers and contractors of GSHP
- 6 participant parties responded. An approximately 50-60 project sites could be evaluated.
- Prepared questionnaire and agreements sent to participants
- Portable data monitoring units identified and to be ordered
- Site visits are in the planning stage.
- Contacted various data sources

Management:

- PI and Co-PI (Leading and design analysis algorithms)
- Project Manager (Post-Doc: Coordinating with participants)
- Simulation researchers and field engineers (Graduate students)
- LCC analyzer (Graduate student)
- Consultant (ORNL Scientist: Liaison with industries)
- DOE technical support (Jonathan Cross)

Plan to work with the National Geothermal Data System:

- Will be in contact with them soon.

- Execute the plan
 - FY10: Data collection and site visits
 - FY11: Simulation and analysis
 - Evaluation of deflection points quarterly according to the plan

- Contact and funding are now in place. April 1, 2010, is the actual project starting date due to the delay in finalizing the agreement.
- Project is well on the way.
- Initial progress (first month) is on schedule.
- The critical evaluation will be given in a month to review the deflection points for Task 1.