Summary of Responses to Surveys on Experience with GHP Installations in Federal Facilities and Minimum Qualifications of GHP-related Professionals

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Contents

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• Design of the survey
• Timeline
• Results
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Background and Goals of the ongoing ORNL GHP Surveys

• The 1st national certification standard for all disciplines involved in GHP projects is needed to increase customer confidence in geothermal heat pump (GHP), reduce potential for improperly installed systems, and assure GHP system quality and performance

• Federal buildings compose the largest single potential market for GHP installations

• This surveys is designed to collect information on:
  – Experience with GHP installations in federal facilities
  – A consensus on minimum qualification of all GHP disciplines
Design of the ORNL GHP Surveys

For federal employees or private sector employees who have worked on GHP projects in federal facilities

Experience on GHP systems (from both customers and suppliers)

Required qualifications of GHP disciplines

Opinions on the classification of GHP disciplines and qualifications of each disciplines

For GHP industry stakeholder
Access to the ORNL GHP Surveys

http://www.ghpnics.org/

Surveys on Federal experience with GHP systems

Survey of GHP Systems at Federal Facilities

This survey focuses on the characteristics and actual performance of GHP systems installed at federal facilities. It is designed for federal employees at agency or facility level, or private sector employees, who have worked on GHP projects in federal facilities.

Survey of Qualifications and Requirements for GHP Disciplines in Federal Facilities

This survey focuses on the qualifications and requirements of each of the GHP Disciplines. It is designed for federal employees at agency or facility level, or private sector employees, who have worked on GHP projects in federal facilities.

GHP Industry Stakeholder Survey

Industry Stakeholder Survey of Qualifications and Requirements for GHP Disciplines

This survey focuses on the qualifications and requirements of each of the GHP Disciplines. It is designed for all GHP industry stakeholders including those not named in GHP Discipline Classifications.
Timeline

Developed the survey by June 2011

Conducted a pilot survey from 7/17/2011 through 8/16/2011

Revised the survey and released it to public on 9/16/2011

Closed the survey by the end of March, 2012

Analyzed the survey results and developed a final draft report by the end of July, 2012

The survey was delivered to potential participants through GHPC, IGSHPA, NGWA, and ASHRAE TC 6.8. The survey invitations were also extended to various federal agencies, including the US Army, Air Force, Navy, Coast Guard, Army Corps of Engineers, and the General Services Administration.
Experience with GHP installations in Federal Facilities—Surveyed Facilities

- Survey participants include federal employees from various agencies (including Army, Air Force, Navy, Coast Guard, Army Corps of Engineers, and GSA) and private-sector employees who have worked on GHP projects in federal facilities.

- Over 12 million ft² GHP systems implemented in the surveyed federal facilities:
  - Located in 21 cities
  - Across 16 states
  - 46.4% in new construction
  - 53.6% in retrofit
Experience with GHP Installations in Federal Facilities—Consumer Satisfaction

- 72% of the surveyed federal facility energy managers are satisfied with their GHP systems
- 86% of the surveyed federal facilities have plans to expand installations of GHP systems in the next 5 years
Experience with GHP Installations in Federal Facilities—System Configurations

- Vertical closed-loop GHX is the most popularly used GHX (61%)
- Small packaged water source heat pump units are used more often (85.7%) than large central heat pump chillers (33.3%)
- 23% of GHP systems were used to either preheat water or provide full hot water service

<table>
<thead>
<tr>
<th>GHX Types</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical closed loop</td>
<td>61.0%</td>
</tr>
<tr>
<td>Horizontal closed loop</td>
<td>7.0%</td>
</tr>
<tr>
<td>Standing column well</td>
<td>24.0%</td>
</tr>
<tr>
<td>Groundwater open loop</td>
<td>5.9%</td>
</tr>
<tr>
<td>Surface water open loop</td>
<td>0.0%</td>
</tr>
<tr>
<td>Surface water closed loop</td>
<td>0.4%</td>
</tr>
<tr>
<td>Other</td>
<td>2.0%</td>
</tr>
</tbody>
</table>
Experience with GHP Installations in Federal Facilities—Best Practices

• Hire qualified professionals
• Get required design and installation information
• Use appropriate design tools
• Specify good-quality equipment and materials
• Ensure enough budget/time
• Use a holistic approach that involves all stakeholders in the design to optimize energy savings and minimize life-cycle cost
• Calculate accurately both the peak and annual cumulative heating and cooling loads
• Avoid oversizing equipment (especially pumps) and the use of dry fluid coolers
Experience with GHP Installations in Federal Facilities—Needed Improvements

Common causes to malfunctioning GHP systems

Improvements needed in each phase of a GHP project

Unqualified designer & installer

Poor design tool

Quality of design

Quality of commissioning

Unqualified designer & installer
Insufficient design info
Unqualified installer
Poor design tool
Malfunctioning equip
Low-quality materials
Not enough info
Opportunity

Votes on Which Areas Improvement is Need [%]

Time Frame
Quality
Cost
Other

Experience with GHP Installations in Federal Facilities—Needed Improvements

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Low-quality materials
Not enough info
Opportunity

Votes on Which Areas Improvement is Need [%]

Time Frame
Quality
Cost
Other
Experience with GHP Installations in Federal Facilities—Key Barriers

• Lack of experienced designers & installers, high initial cost, and lack of awareness of GHP technology are major barriers

• Other barriers include:
  - Lack of accurate heating & cooling loads
  - Insistence upon expensive closed-loops
  - Poor geological conditions
  - Lack of an overall HVAC system package
  - Army procurement regulations
Minimum Qualifications of GHP-related Professionals—Profile of Survey Respondents
Minimum Qualifications of GHP-related Professionals—Education

![Bar chart showing the number of votes for different GHP-related professions grouped by educational level. The chart indicates that higher education levels generally receive more votes, with high school/GED being the most common educational level across various professions.]
Minimum Qualifications of GHP-related Professionals—Experience

[Bar chart showing the number of votes for different job roles and experience levels.]

- 0-1 years
- 1-2 years
- 2-3 years
- 3-4 years
- Greater than 4 years
Minimum Qualifications of GHP-related Professionals—Lic./Cert. Requirement

<table>
<thead>
<tr>
<th>License/Certification</th>
<th>Percentage [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCA certified HVAC technician</td>
<td></td>
</tr>
<tr>
<td>Certified Geoexchange Designer</td>
<td></td>
</tr>
<tr>
<td>IGSHPA Accredited Driller</td>
<td></td>
</tr>
<tr>
<td>NGWA Certified Ground Water Professional</td>
<td></td>
</tr>
<tr>
<td>Professional Engineer</td>
<td></td>
</tr>
<tr>
<td>NGWA Certified Well Driller</td>
<td></td>
</tr>
<tr>
<td>BCxA certified Building Commissioner</td>
<td></td>
</tr>
<tr>
<td>DOT certified fusion technician</td>
<td></td>
</tr>
<tr>
<td>IGSHPA Accredited Installer</td>
<td></td>
</tr>
<tr>
<td>NGWA Certified Vertical Closed Loop Driller</td>
<td></td>
</tr>
</tbody>
</table>
Recommendations

• To deliver high quality GSHP systems and further improve consumer satisfaction, improvements are needed mostly in:
  – Quality of designers and installers
  – Quality of design (tool)
    • Accurate load calculations (not only peak but also cumulative load)
    • Holistic approach to maximize system cost effectiveness
    • Proper integration with other ground sources and conventional equipment
  – Quality of commissioning

• Disciplines require high minimum qualification are:
  – GHP system design engineer and ground heat transfer designer
  – GHP system trainer
  – GHP system commissioning agent and regulator
For more information on this topic, please contact:

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The summery report of the survey results is available at:
http://www.ghpnecs.org