INVITATION TO SUBMIT A PROPOSAL ON AN ASHRAE PROJECT
Heat Pump and Application Guide

Attached is a Request-for-Proposal (RFP) for a project dealing with a subject in which you or your institution have either been recommended or have expressed interest. Should you decide not to submit a proposal, please circulate this information to any colleague who might have interest in this subject.

Title: Heat Pump Application, Design, and Operation Guide

Budget Range: Approximately $85,000 to $150,000 (may be more or less as determined by value of proposal and competing proposals.) Please indicate if the budget needs to be outside the range.

Scheduled Project Start Date: **May 4, 2023**

All proposals (hardcopy or electronic format) must be received at ASHRAE Headquarters **April 4, 2023.**
Electronic copies must be sent to sreiniche@ashrae.org

If you have questions concerning the Project, please contact:

Director of Technology
Stephanie Reiniche
ASHRAE, Inc.
180 Technology Parkway
Peachtree Corners, GA 30092
Phone: 678-539-1143
Fax: 404-321-5478
E-Mail: sreiniche@ashrae.org

Contractors intending to submit a proposal should so notify, by mail, fax or e-mail, the Director of Technology, by March 14, 2023 in order that any late or additional information on the RFP may be furnished to them prior to the bid due date.

Proposals may now be submitted electronically. Electronic submissions require a PDF file containing the complete proposal preceded by signed copies of the two forms listed below in the order listed below. **ONLY electronic proposals are to be sent to sreiniche@ashrae.org.**

All other correspondence must be sent to sreiniche@ashrae.org**.** Hardcopy submissions require 1-signed original in the same order. **In all cases, the proposal must be in the hands of the ASHRAE Director of Technology by 5 p.m. EST April 4, 2023.**

The following forms must accompany the proposal:

(1) ASHRAE Application for Grant of Funds (signed)
(2) Additional Information for Contractors (signed)

ASHRAE reserves the right to reject any or all bids or to not proceed with the project if circumstances dictate.

WORK STATEMENT
Heat Pump Application and Operation Guide

BACKGROUND AND VISION

OBJECTIVE

To develop a guide on the techniques and practices needed to incorporate various types of heat pump technologies in buildings across different climates to support building decarbonization.

SCOPE

Widespread deployment of heat pumps is expected to be a key strategy in on-going efforts to decarbonize building space conditioning and hot water loads. Proper application, design, and operation of heat pump systems will be critical to the success of this effort.

Targeted Audience:

The guide will be targeted at HVAC engineering professionals and building operators to provide a practical resource for design, deployment, and operation of heat pump technologies. It is also anticipated that the introduction sections of the guide will be targeted to a more general building professional audience to provide background and context on heat pump applications that would allow other building professionals, like architects and owners to have informed discussions with engineering professionals on heat pump application strategies.

Content:

The Heat Pump Application and Operation Guide will focus on how heat pumps should be designed, applied, and operated in commercial, institutional, and multi-family residential buildings to support decarbonization. The guide will provide guidance to design engineers on various heat pump-specific design elements including application and sizing in different climate zones, system configuration and refrigerants, electrical requirements, and control and operation strategies for space conditioning, water, and process heating applications. The Heat Pump Application and Operation Guide will represent a critical resource to building designers and operators to support rapid adoption of this building decarbonization strategy.

Proposed Outline:

It is suggested that the proposed content of the guide include, but not necessarily be limited to, the elements laid out in the outline in this section. This could form a rough draft of the table of contents, but the guide is not strictly fixed to this structure.

A. Introduction
    1. Decarbonization
    2. Energy Efficiency
    3. Relationship to other ASHRAE efforts
    4. Current state of the market and future trends (e.g. cold-climate product and high-temperature ones, new/future refrigerants, etc.)
    5. How to use this guide (intended audience, where to look for specific topics, etc.)

B. Heat Pump Basics
    1. Basic Functionality
    2. Refrigerant characteristics and impact
    3. COP/System COP/efficiency ratings

C. Technology Types
    1. Air to Air
    2. Air to Water
    3. Water to Air
    4. Water to Water
    5. VRF

6. High Temperature (European, Japanese progress, not available in North America yet)
7. Ground Source Heat Pumps - Common considerations (as a separate topic)

D. Functional Considerations
1. Space Heating/Cooling
2. Service Water Heat
3. Equipment Types
4. Building Types
5. Design Criteria
6. Heat Recovery
7. Process Loads
8. District systems

E. Design Considerations
1. Sizing/Capacity
2. Buffer Tanks and Thermal Storage
3. System Comparisons
4. Electrical requirements
5. Auxiliary heat/backup
6. Locating Equipment Spacing, layout, clearances
7. Defrost considerations
8. Controls
9. Cost Considerations (keep high level)
10. Backup and redundancy

F. Cold Climate Application
1. Recent market evolution and trends
2. Configurations conducive to cold climate applications.
3. Overview of equipment types and options on the market
4. Design considerations

G. System Applications
1. Simple (packaged air source)
2. Water Loop
3. Integrated (part of larger system)
4. Special Applications (thermal storage, high temp…)

H. Existing Building Considerations
1. Building thermal load
2. Electrical capacity
3. Required delivery temperature, heat transfer medium
4. Space Considerations.
5. Integration with Existing Systems
6. Safety considerations (in EB section or Design Considerations?)

I. Installation, Commissioning
1. Installation checklist and functional testing
2. Connection and control functionality
3. Adaptations for snow accumulation (Air-source especially)
4. Refrigerant piping
5. Charging practices
6. Water quality / treatment (Geothermal systems)

J. Operations and Maintenance Considerations
1. Maintenance, monitoring
2. Refrigerant maintenance and documentation requirements
3. Operations manuals and training

K. Resources

L. Case Studies (include case studies for various topics above; leverage ASHRAE technology awards and HPB). A minimum of four building case studies, plus additional examples are anticipated.

DELIVERABLES

Interim Deliverables:
Progress and Financial Reports shall be made to ASHRAE (the Society) through its Director of Technology (or designee) at monthly intervals.

During the course of this effort, the contractor shall provide the documents described below for review by the Project Monitoring Subcommittee (PMS). The PMS shall approve each deliverable listed below in a timely manner (as specified in the contract documents) prior to initiation of the succeeding deliverable. These documents shall be delivered to the PMS according to the final schedule specified in the contract.

1. An outline of the manual containing sufficient detail to allow the PMS to determine whether the scope of the manual will be adequate.
2. A preliminary working draft of the complete manual covering all sections of the guide (60% complete). This draft should include a proposed list and format of case studies to be included. (Case study format should be generally aligned with ASHRAE Technology Awards format.)
3. The final working draft of the complete manual (90% complete), incorporating changes recommended by the PMS on the preliminary working draft.

Electronic files of the working drafts shall be delivered to the Chair of the PMS and the Director of Technology (or designee) for each interim deliverable. Document delivery will be coordinated through the Director of Technology (or designee). The files shall clearly show the changes proposed. File formats shall be both Microsoft Word and Adobe Acrobat

Final Deliverables:

Microsoft Word File

1. Appropriate front matter, including an accurate table of contents with page numbers.
2. Text and appendices in an electronic format specified by ASHRAE Publications in the User Manual template documents. (Copy attached.)
3. Illustrations, tables, and all other artwork provided separately and/or in electronic format specified by ASHRAE Publications and as noted below.
4. All other materials necessary for a complete publication.
5. Reprint permission by owner of copyright for any material, illustrations, graphics, or photographs used from outside sources.

Format Specifications for MS Word File

1. All of the text (including front matter, table of contents, any back matter such as an index, etc) in Word. The Word file(s) must be free of conditional text, line numbers, track changes, and cross-references. The document must be in dual units (IP and SI).

2. Tables must be noted in the text (where they go) and numbered consecutively as they appear in the text. All tables must be Word or Excel tables; they CANNOT be unalterable images of tables. All table titles should be descriptive but concise, and each column should be labeled with a heading and include units of measurement and other necessary qualifying information; dual units must be provided for all measurements. In creating tables, the authors should use only 1 point (0.014 in. [0.355mm]) or thicker lines.

3. Figures must be noted in the text (where they go) and numbered consecutively as they appear in the text, but the actual figures themselves must be provided to ASHRAE as individual TIF or EPS files in Grayscale mode saved at high resolution (600 dpi or greater) and at least 4 in. size or greater. All figure files should be clearly labeled. In creating figures, the authors should use only 1 point (0.014 in. [0.35 mm]) or thicker lines—smaller lines will not reproduce well. The figures will be reproduced in black and white, so they should employ patterns or shapes to distinguish sections instead of coloring and shading. Each figure should have a brief legend or descriptive labels, as appropriate. Any text included in a figure (except the figure caption) should be embedded as part of the image file and not contained in a separate text box that is not part of the image file; captions should NOT be part of the image file. All figures should be provided in dual units, like the text. Providing two graphics for each figure – one in IP units and one in

SI units – is acceptable; such figures must be supplied as one TIF or EPS file with both graphics included in the one image file.

4. Works cited in the text must have reference list entries in a references section at the end of the document. ASHRAE uses the author-date citation method. Footnotes should be avoided in the document. Parentheticals are the preferred method for non-reference supplemental information.
5. The authors of the text need to obtain permission to reprint any images that they want to use from another source; ASHRAE will not obtain permissions for them.
6. The text and figures must comply with ASHRAE's commercialism policy (https://www.ashrae.org/about/governance/ashrae-commercialism-policy-and-guidelines).
7. Final submission of the completed book must include the manuscript in Word, separate TIF or EPS files for all illustrations and photos, and contact information for the authors in case of questions during any final editing or lay-out of the book.

CONTRACTOR REQUIREMENTS

The contractor's expertise must include familiarity with heat pump design and deployment in existing buildings and new construction. The contractor must have experience with multiple heat pump system types and technologies, across multiple building types and climate zones. The contractor should demonstrate familiarity with the full lifecycle of heat pump equipment, including commissioning, operation, and maintenance, and the deployment of heat pumps in cold climates.

The contractor must have demonstrated expertise in the development of design guides, manuals, or documents of like kind.

LEVEL OF EFFORT

The guide is expected to be approximately 150 to 200 pages in length. It is estimated that the project can be completed by the selected contractor within nine (9) months of the award of the contract. A total cost of approximately $85,000 to $130,000 is anticipated for the project (may be more or less as determined by value of proposal and competing proposals.)

SUGGESTED APPROACH

1. Prepare expanded/annotated outline for review by the Monitoring Committee. Include a brief narrative of how subsections of outline will be addressed.
2. Review the outline draft with the Monitoring Committee.
3. Address all review comments and reach agreement on the organization and content of the document.
4. Compile a list of relevant literature, available tools, organizations, regulations and standards, accepted engineering practices, and other resources that should be referenced in the guide. Review this with the Monitoring Committee.
5. Review with Monitoring Committee the heat pump technologies and applications including sizing processes and calculations to be included in the guide.
6. Review with Monitoring Committee the level of technical detail to be provided in Guide and provide initial section draft as example.
7. Prepare a draft of the manual for review by the Monitoring Committee.
8. Review the draft with the Monitoring Committee. Address all review comments and reach agreement on the substance of each change.
9. Develop formatting and graphics to produce the guide for publication by ASHRAE. Review a sample of key graphics with Monitoring Committee.
10. Develop the index and table of contents, composing each page, and providing consistent headers and footers.
11. Submit the document for final review and approval by ASHRAE to verify that changes have been accurately implemented.
12. Submit the project files, including source documents, for publication of the document by ASHRAE

ADDITIONAL INFORMATION FOR CONTRACTOR

General Information/Proposal Requirements

1. The proposal should specify a timeline with identified intervals for critical milestones including reviews and deliverables. Bidders should consider the time and costs necessary to provide for at least two (2) interim review cycles by the PMS for each of the working drafts (preliminary and final). Review cycles should include time for the PMS to review the document and provide feedback to the contractor.
2. While ASHRAE regularly updates its guidance documents, this is the first version of the guide, so the contractor will not have a previous version to work from. The proposal should provide an indication of the expected page count, content, and organization to effectively meet the stated objectives.
3. Bidders should propose topics and appropriate level of detail for the guide. Indicate resources, guidance, and standards that can be used to support topic discussions and strategy for providing guidance to building managers for evaluating less defined or rapidly evolving options.
4. Bidders should specify what actions time, and costs are necessary to include guidance in the guide to determine which control strategies are relevant in each climate zone.
5. Monthly conference calls with the Monitoring Committee will be scheduled to monitor progress and direction.
6. The proposal should describe bidder's relevant past experience. This could include a) developing guidance documents, especially for building operating. management or design professionals; b) training building professionals; c) work having to do with designing or evaluating advanced grid functions, customer-focused programs, facility-sited distributed energy resources; etc.
7. The proposal should identify the experience and qualifications of key team members that will cover the range of topics outlined in the proposal.
8. The proposal should include a list of previous published works (articles, manuals, papers, etc.) relevant to this project. An additional list of suggested reference materials will be provided to the successful bidder.
9. The following materials are attached to this RFP:
    a. Required Bid Forms:
        i. Additional information for Contractors
        ii. ASHRAE Application for Grant of Funds
10. All communications will be coordinated through the Manager of Standards (or designee), but the proposal should specify how the contractor plans to communicate with the PMS during the project. Communications may include virtual or in-person meetings (at the ASHRAE conferences).
11. Bidders who assisted in any work statement preparation or had knowledge of the contents of the work statement prior to the issuance of the RFP should identify themselves as such in the proposal. This is required in order to allow the PMS to satisfy themselves that these preparers did not gain an unfair advantage.
12. The following materials are available upon request:
    a. Electronic copy of ASHRAE Author's Manual
    b. Electronic copy of t ASHRAE Smart Grid Application Guide

Proposal Evaluation Criteria:

1. Contractor's understanding of the Work Statement and approach to complete the project, as demonstrated in the proposal. **(25%)**
2. Past performance writing user-oriented guidance. **(20%)**
3. Contractor's experience and expertise with deployment of multiple heat pump technologies across building types and climate zones, in new and existing buildings, and across the range of heat pump lifecycle from design and specification to operations and maintenance **(35%)**

4. Qualifications and experience of personnel for project. **(20%)**

In addition to these technical criteria, price will be a factor. Selection will be based on the best value for ASHRAE.

COPYRIGHT

This is a "Work for Hire." ASHRAE will be listed as the author of the Guide. ASHRAE will publish and hold the exclusive copyright to the Manual, including any associated software and source code. Only ASHRAE may license use of the Manual to third parties.

Reprint permission by owner of copyright must accompany any material, illustrations, graphics, or photographs used from outside sources.

All materials developed for this work will be treated as confidential material that cannot be disclosed to third parties without the written permission of ASHRAE.

REFERENCES

Additional reference material suggestions will be provided upon project kick off.

ADDITIONAL INFORMATION FOR CONTRACTORS

In preparing a response to this request-for-proposal, contractors should be aware of, and be agreeable to, the following ASHRAE policies, procedures, traditions and contractual requirements. Costs for meeting these should be considered when preparing research proposal budgets.

By submitting a proposal, the Principal Investigator is acknowledging he/she understands and agrees to comply with the policies listed below. The inability or unwillingness to comply should be pointed out in the transmittal letter accompanying any proposal or should result in no proposal being submitted.

1. It is the practice of ASHRAE to use fixed price contracts for special projetcts. Other contract forms, such as cost plus fixed fee, will be considered only in exceptional cases, and such proposals are discouraged. Unlike some other government or foundation research sponsors, ASHRAE does not approve cost extensions nor accept scope reductions except in the most unusual of cases. Such cases reflect unfavorably on the contractor with regard to future work.

2. All fiscal values should be stated in U.S. dollars.

3. Twenty five percent of the contracted sum will be paid upon signature of the contract, Twenty five percent of the contracted sum at the 60% draft, twenty five percent of the contracted sum at the 90% draft, fifteen percent of the contracted sum with submission of final electronic files. Ten percent of the contracted sum will be withheld pending publication of the work. Fifteen percent will be paid upon submission of the final report and the remaining ten percent upon completion and acceptance of all contract requirements. Notice: Open RFP and Intent to Submit is due by March 14, 2023 for the **Heat Pump Application, Design and Operation Guide.** ASHRAE seeks to solicit proposals for the development of the Guide from experienced Contractors. The final proposals are due by 5 P.M. EDT, Tuesday, April 4, 2023. The project is scheduled to begin May 4, 2023. The total sum is paid in equal payments upon acceptance of deliverables during the performance period. Except for the first payment, which is made within thirty days of contract initiation and the final payment for which 10 percent is held back pending publication. All payments are contingent upon receipt of deliverables.

4. The winning bidder is required to meet with the PMS via a site-visit or a conference call at the start of the project to review the project's scope. The results of this meeting shall be summarized by the contractor in the first progress report.

5. Any patentable inventions or copywritten computer programs developed as a result of this special project shall be made available to ASHRAE in recognition of their financial support of the work.

6. Proposers are encouraged to utilize undergraduate or graduate engineering students where appropriate in conducting this research in order to assist them professionally and financially in their education and in increasing their interest in the HVAC&R industry.

7. ASHRAE's proposal evaluation committee will make the primary recommendation regarding

the selection of a contractor. While bidders may be given some information on their and competitors' scores, ASHRAE is not obligated to do so and will not become involved in negotiating, explaining or defending the decisions made.

8. The signed original of this document should be enclosed with the proposal's letter of transmittal. Multiple copies are not desired.

The above conditions are acceptable:

_____

Principal Investigator (date)

_____

Institution Authority (date)

ASHRAE APPLICATION FOR GRANT OF FUNDS

(to be completed by Applicant)

1.0 Title:

2.0 Principal Investigator (P.I.):

3.0 Name of Contracting Institution:
Mailing Address of P.I.:

E-mail address of P.I.:
Phone No. of P.I.:
Fax No. of P.I.:

Other Key Personnel:

4.0 Any subcontractors:

5.0 Objective & Scope:*

6.0 Project Start Date:_____ Total Project Length:_____

7.0 Total Cost: US$_____ ASHRAE Funding Requested: US$_____

8.0 Details of Financial Support:

a) Professional Salaries	$_____	Person Months_____
b) Research Assistants	_____	
c) Fringe Benefits (%)	_____	
d) Equipment	_____	
e) Supplies & Materials	_____	
f) Computer Costs	_____	
g) Travel & Communications	_____	
h) _____	_____	
i) Total Direct Costs	_____	
j) Indirect Costs (%)	_____	
k) TOTAL	$_____	

9.0 Qualifications of Principal Investigator:*

10.0 Signature of Project Manager or P.I.:_____

Title:_____ Date:_____

Signature of Executive Officer of Institution:_____

Title:_____ Date:_____

Key personnel were ( ) were not ( ) involved in writing the ASHRAE request for proposal for this project.

* All sections must be completed. Use of terms such as " See Attached Proposal" may result in rejection of proposal.