January 31, 2011

TC 8.3 RESEARCH SUBCOMMITTEE MINUTES OF MEETING IN LAS VEGAS, NV

TC 8.3 Research Subcommittee met on January 31, 2011 in Las Vegas, NV. A list of minute recipients and attendees is attached (Attachment 1).

1. Review of Minutes from June 28, 2010 Meeting in Albuquerque, NM.

The minutes were reviewed and no changes were requested by the subcommittee members.

2. WS 1462 *"Active Mechanisms for Enhancing Heat and Mass Transfer in Sorption Applications."*

Uwe Rockenfeller reported that 1462-TRPC has been put on the ASHRAE "Potential Projects for Bid in Spring 2011" list. It currently holds the number 6 spot by project seniority.

No action is required until proposals are received.

3. RTAR Development *"Absorption Refrigeration Cycle Training Simulator for Sustainable Resource Use."*

Vikas Patnaik submitted the RTAR to ASHRAE in December, 2010. The RTAR has been included into the RTAR review during the Las Vegas Winter Meeting.

A copy of the RTAR submission is attached as Attachment 2.

The RTAR has been returned to TC 8.3 for modification. Vikas Patnaik and Ebrahim Al-Hajri will review comments and make adjustments.

4. New RTAR Development *"Absorption Cycle Computer Simulator."*

Paul Sarkisian and Jay Kohler are the authors of this RTAR. A copy of the RTAR in its current status is attached as Attachment 3.

Paul Sarkisian and Jay Kohler agreed to finalize the RTAR.

RTAR approved vote by full committee: 7-0-0

5. New RTAR Development *"Actual Field Experience with Solar Driven Absorption Chillers"*

The effort has been tabled for two years due to lack of RTAR author volunteers.

The research subcommittee decided to abandon the effort due to lack of interest at this time.

6. Other Business

None

Attachment 1

LIST OF ATTENDEES
And
MINUTES RECIPIENTS

Present at TC 8.3
Research Subcommittee Meeting
January 31, 2011

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Unique Tracking Number Assigned by MORTS _____

RESEARCH TOPIC ACCEPTANCE REQUEST (RTAR) FORM

(Generally 2 to 6 pages, with 10 pt Times New Roman font)

Sponsoring TC/TG/SSPC: _____8.3_____

Title:
Absorption Refrigeration Cycle Training Simulator for Sustainable Resource Use

Applicability to ASHRAE Research Strategic Plan:
The Absorption Refrigeration Cycle Training Simulator would meet the ASHRAE Strategic Plan for education. The training unit would enable a better understanding of the absorption refrigeration cycle, which is deemed by industry experts to be a sustainable technology using zero-ODP, zero-GWP refrigerants and improving overall energy utilization rates. Further education and understanding of this technology would lead to further development and deployment of the absorption cycle, replacing systems using harmful ozone depleting substances and higher grades of energy. In addition, with further development, refrigeration / air-conditioning could be introduced to areas of the world where availability of this higher grade of energy (electric power) is limited.

Research Classification:
Technology Transfer

TC/TG/SSPC Vote:
6-0-0-6

Reasons for Negative Votes and Abstentions:
N/A

Estimated Cost:
$75,000

Estimated Duration:
15 months

RTAR Lead Author
Vikas Patnaik, vpatnaik@trane.com

Expected Work Statement Lead Author
Ebrahim Al-Hajri, ealhajri@pi.ac.ae

Co-sponsoring TC/TG/SSPCs and votes:
N/A

Possible Co-funding Organizations:
N/A

Application of Results:
Software program available for purchase from ASHRAE, ASHRAE Green Guide, Handbook chapters 1 and 41.

State-of-the-Art (Background):
A few absorption cycle simulation programs have been developed and released in the past, the most notable of which is ABSIM (2002), from Oak Ridge National Laboratory. ABSIM is a modular computer code for simulation of absorption systems, based on unit subroutines containing the governing equations for the system's components and on property subroutines containing the thermodynamic properties of the working fluids.

Advancement to the State-of-the-Art:
Previous similar tools have been more equipment-focused, rather than application- or solution-oriented, and do not generally serve the purpose of training the HVAC&R practitioner. The deployment of the proposed simulator will result in a better understanding and awareness of how absorption systems can reduce overall energy utilization via integrated energy systems that avail of renewable sources of energy such as waste heat and solar.

Justification and Value to ASHRAE:
The commercial, industrial and retail HVAC&R consulting/contracting communities looking to reduce overall energy consumption rates will benefit from the proposed work. This directly supports the sustainability goals ASHRAE has set forth for itself. Last but not least, this work will result in increased revenues for ASHRAE through the sale of the simulator tool.

Objectives:

1. Survey the open literature for simulation efforts on absorption technology to build upon.
2. Develop simulator that includes a library of energy sources and their characteristics, including renewables, a library of proven (in-practice) working fluids and their characteristics, and finally a library of proven (in-practice) sub-systems (components) and systems and their characteristics.
3. Allow for plug-&-play simulation with components (dynamically linked libraries) from other sources.
4. Use state-of-the-art software platforms such as Windows 7 and the .NET framework while preserving backward compatibility with older systems.

Key References:

Grossman, Gershon, and Zaltash, Abdi, 2001, "ABSIM — modular simulation of advanced absorption systems," *International Journal of Refrigeration*, Volume 24, Issue 6, pp. 531-543.

ATTACHMENT 3

RESEARCH TOPIC ACCEPTANCE REQUEST (RTAR) FORM

TC/TG: TC 8.3

Title: Absorption Cycle Computer Simulator

Applicability to ASHRAE Research Strategic Plan:
The absorption cycle computer simulator would meet the ASHRAE research strategic plan. Specifically, it would apply to Goal 7 of the 2010 – 2015 Strategic Plan, Support of tools, procedures and methods suitable for designing low-energy buildings. Secondarily, it applies to Goal 1 of the plan in that it would enhance the understanding of equipment operators and technicians, which would positively impact actual energy performance.

The proposed Absorption Cycle Computer Simulator would be useful as a technician or operator training tool or for the education of HVAC engineering students. In addition, the Simulator would become an online interactive educational asset for ASHRAE or could be included in the Handbook or sold as a separate Bookstore CD.

Research Classification:
Basic/Applied

TC/TG Priority:

TC Vote:
To Be Completed

Reasons for Negative Votes and Abstentions:
To Be Completed

Estimated Cost:
$150,000

Other Interested TC/TG's
None to date

Possible Co-Funding Organizations:
None to date

Application of Results:
Handbook CD or CD for Purchase at ASHRAE Bookstore. Could also be used as an online ASHRAE software resource.

State-of-the-Art (Background):

The present state-of-the-art modeling software is suitable for absorption simulation is ABSIM. While a good tool for detailed analysis of a wide variety of absorption and absorption/vapor compression cycles, the program requires considerable training time to use and lacks the type of user friendly graphical user interface that would be suitable for use as an educational or training tool.

Advancement to the State-of-the-Art:

Efforts under this project would result in an educational and training tool for students, technicians and operators interested in LiBr-H_20 absorption technology. No such tool presently exists.

Justification and Value to ASHRAE:

The proposed Absorption Cycle Computer Simulator would have an impact on absorption chiller technicians, operators and students studying absorption cycle thermodynamics. Lack of ability to simulate absorption cycles is cited as an impediment to the evaluation of such systems. When powered by waste heat, absorption equipment can significantly reduce energy consumption in HVAC systems. ASHRAE could provide the Simulator as a part of the Handbook CD or as a separate CD to be purchased at the bookstore. Inclusion in the handbook would offer widespread distribution to all ASHRAE members. The software would be exclusively owned by ASHRAE and subject to its requirements for distribution.

Objective:

The objective of the Absorption Cycle Computer Simulator project is to develop an educational tool that would allow a user interactive analysis of a variety of LiBr-H_2O absorption thermodynamic cycles. The simulator would have a graphical user interface (GUI) for simple interaction by the user. Included in the simulator would be the capability of modeling single and double effect chillers fired by hot water, steam or natural gas combustion.

The GUI interface would allow components such as the generator, absorber, evaporator, condenser, solution heat exchanger and solution and pump to be input into the model by the user. Different solution circuiting possibilities would be possible, such as those used in various types of double effect chiller cycles. The model will allow heat exchanger and pump parameters to be input by the user and would also allow the possibility of water or air cooling of the absorber and condenser. Default parameters would be set so that novice users could obtain useful results.

Operating condition parametric studies would be possible using the model. Entering source and sink fluid flows and temperatures along with variation of these parameters

would be allowed using a simple GUI interface. Variation of heat exchanger UA values or effectiveness would also be allowed. Solution flow rate parameters could be input as relative pumping rates or mass flow rates and flow splits and mixing capabilities would also be possible. Both full and part load performance would be modeled.

Outputs from the model, which would be viewable using the GUI, would include all thermodynamic state points, including their temperature, concentration, enthalpy, entropy in tabular form as well as a Duhring plot representation of the cycle. The Duhring plot would include the crystallization line and would allow multiple cycles to be plotted at the same time for parametric studies. In addition, the output would allow plots of capacity, COP, or other state point information to be plotted as a function of an input parameter for the parametric study.

The model would include simplified baseline absorption cycle models for single effect (steam and hot water fired) and double effect cycles (steam and direct fired) that are representative of generic commercial products. These baseline cycles would be useful in the training of absorption technicians and operators to further their understanding of the effects of such variables as cooling tower water inlet temperature and flow rate, chilled water inlet and flow rate, hot water temperature and flow rate, steam pressure and firing rate on chiller capacity and COP.

The software would be compatible with the Handbook CD or as a standalone CD. It would also be available for inclusion into ASHRAE's TC 8.3 website.

Key Reference:

Grossman, G., Zaltash, A., "ABSIM : Modular Simulation of Advanced Absorption Systems," International Journal of Refrigeration 24, 531-543 2001