

**ASHRAE TC 6.9 – Thermal Storage  
General Meeting Minutes  
Monday, February 6, 2023  
4:00 – 6:00 PM EST  
Hybrid – Omni CNN Center, Grand Ballroom C (M4-North)  
and MS Teams Meeting**

**Attendees**

Attendees included:

Alisson Mahvi	G	
Ana Amoral	G	
Andy Poslinski	G	
Aritra Sur	G	
Blake Ellis	CM	Standards Subcommittee Chair
Brent Kovash	CM	
Bruce Lindsay	CM	Program Subcommittee Chair
Casey Troxler	G	
Casey Troxler	G	
Charles Booten	VM	
Chi Lui	PCM	
Claus Daniel	G	
Daniel Pacellar	CM	
Daniel Pywell	VM	Vice Chair/ Webmaster
Deba Maita	G	
Emishaw Iffa	CM	Secretary
Eric Kozubal	G	
Farzin Rad	VM	Chair
Geoff Bares	CM	
Guy Frank	VM	
Ian O'Connor	G	
Ivan Thomas	CM	
Jack Danley	G	
Jason wood	CM	
Jhon Nix	VM	
John Dunlap	CM	
Jyothis Ahmad	G	
Keitz Pointz	CM	
Ken Fulk	VM	
Kyle Gluesenkamp	CM	
Lingnan Lin	G	
Michael Kazmierczak	CM	
Mike Filler	CM	
Navin Kumar	CM	Handbook Subcommittee Chair
Paul Staffers	CM	
Paulo Tabares	CM	Research Subcommittee Chair
Ransisi Huang	PCM	
Richard Brooks	CM	
Richard Kooy	CM	
Sandra Boetcher	CM	

Shang Cui	G	
Shaun Turner	G	
Som Shrestha	CM	
Sven Mumme	G	
Tae Kwon	G	
Todd Mayer	G	
Tugba Turnaoglu	PCM	
Xiaobing Liu	G	
Zhening Li	CM	
Zihao Yang	G	

### **Preliminaries**

- i. Meeting called to order at 4:03PM by Chairperson, Farzin Rad.
- ii. Housekeeping – for virtual meeting the Zoom link was not working. Farzin sent out a Teams meeting invitation.
- iii. The TC 6.9 Purpose Statement and Code of Ethics Commitment was read by Farzin Rad.
- iv. Voting Member Roll Call – Six voting members were present: Farzin Rad, Guy Frankenfield, Daniel Pyewell, John Nix, Ken Fulk, and Charles Booten. The following voting members were not present: Henry Becker and Scott Shaffer. Based on the six voting members present, a quorum was determined.
- v. All attendants were given the opportunity to introduce themselves.
- vi. 24 guests were in attendance.

### **Approval of Minutes**

- i. Toronto summer Hybrid T.C. 6.9 meeting minutes: John Nix made a motion to approve the minutes, seconded by Farzin Rad. The present six voting members approved; thus, the minutes were approved unanimously.

### **Liaison Reports**

- i. John Nix mentioned the planned Training and Education program. There will be a course in Thermal storage by Doug Randall to offer course in Chicago. Any additional ideas to put additional course are requested.

### **Standards – Blake Ellis**

- i. ANSI/ASHRAE Standard 150-2000 (RA 2019) – Method of Testing the Performance of Cool Storage Systems
  - a. Background:
    - i. First meeting in 2022 in Las Vegas
    - ii. Meeting monthly
    - iii. Title, Purpose and Scope have been changed
    - iv. Adding two methods of test to the existing standards.

1. Method 1 – Latent
  2. Method 2 – Sensible
  3. Method 3 – Existing Standard 150 test method
- v. Met on Saturday (February 4, 2023) in Atlanta.
- b. Activities:
- i. Voted to recommend a change to the Title Purpose and Scope.
  - ii. Looking to add two methods of test. A sensible test and a latent test.
- ii. SPC 233P – Testing, Evaluating, and Reporting of Phase Change Materials Performance
- a. Proposed Standard authorized November 2021.
  - b. The committee met on Saturday (Feb. 6, 2023) and is looking to add members to the project committee.
  - c. Current plan for release of the standard is in 24 months.
  - d. PURPOSE:
    - i. To provide a test method to evaluate the performance of Phase Change Materials (PCMs). This standard also provides a method of reporting the performance of different phase change materials in a standardized way based on laboratory testing.
  - e. SCOPE:
    - i. This standard covers the testing and evaluation of Phase Change Materials (PCM) thermal and life-cycle performance.
    - ii. This standard includes:
      1. Uniform method of testing
      2. Identification of testing equipment for performing such testing.
      3. Identification of data required and calculations to be used.
      4. Identification of reporting method to be used.
      5. Criteria for determining the life cycle performance.
      6. Definitions and Terminology
    - iii. This standard does not cover thermal energy storage system-level evaluation.
    - iv. Contact:
      1. Navin Kumar, Chair
      2. [nkumar@gti.energy](mailto:nkumar@gti.energy)
- iii. Other Standards (of Interest to T.C. 6.9):
- a. ANSI/AHRI 900 (I-P)-2014 & ANSI/AHRI 901 (SI)-2014, Performance Rating of Thermal Storage Equipment Used for Cooling – ANSI Approved in 2015; reaffirmed in 2020.
    - i. Status: No Change since it was reaffirmed in 2020 with no changes.
    - ii. Contact:
 

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507 E. Craighill Channel Dr.  
Perryville, MD 21903  
667-228-9626  
[shamamcioglu@ahrinet.org](mailto:shamamcioglu@ahrinet.org)
  - b. Proposed ASME (American Society of Mechanical Engineers) TES-2-200X, Safety Standard for Thermal Energy Storage (TES) System Requirements for Solid State and Other TES Systems is being monitored.
    - i. Tentative Scope: Safety requirements for high temperature TES systems
    - ii. Status: In development
    - iii. Contact:

Nicole Gomez  
S&C Project Engineer, Safety Codes & Standards  
ASME  
2 Park Avenue, 6th Floor  
New York, NY 10016-5990  
Tel 1.212.591.8720  
Fax 1.212.591.8501  
[gomezn@asme.org](mailto:gomezn@asme.org)

### **Programs –Bruce Lindsay**

- i. ASHRAE-Atlanta Presentations: TC 6.9 has 7 presentations in this conference.
  - Feb 5, 8:00 AM – 9:00 AM EST  
Seminar 3: Cutting-Edge Japanese Technologies on Grid Resilience and Thermal Storage: SHASE Annual Award Winners  
Georgia World Congress Center, A402
    - Hirotaka Kubo, Nikken Sekkei LTD
    - Shunichi Nakamoto, Shimizu
    - Jun Yoshida, Takenaka Corporation
  - Feb 5, 9:45 AM – 10:45 AM EST  
Seminar 11: Optimizing Thermal Energy Storage Integrated with HVAC  
Georgia World Congress Center, A408
    - Zhenning Li, ORNL
    - Li Song, PhD, University of Oklahoma
    - Zhiyao Yang, PhD, Texas A&M University
  - Feb 5, 11:00 AM – 12:30 PM EST  
Seminar 15: The Evolution of Thermal Energy Storage for Cooling Applications: The Past, Current and Future  
Georgia World Congress Center, A402
    - Bruce Lindsay, PE, Trane Technologies
    - Paul Catanzaro, McDermott
    - Mark MacCracken, PE, Trane Technologies
  - 1:30 PM – 3:00 PM EST  
Seminar 21: Optimizing Design and Controls for Thermal Energy Storage at the Building and Community Scale  
Georgia World Congress Center, A405  
Chair: wood
    - Karl Heine, Embry Riddle Aeronautical University
    - Nelson Janes, NREL
    - Wale Odukomaiya, NREL
  - Feb 6, 8:00 AM – 9:30 AM EST  
Seminar 25: Decarbonizing Campuses Utilizing Heat Pumps and Thermal Energy Storage  
Georgia World Congress Center, A404
    - Blake Ellis, PE, Burns & McDonnell
    - Jeff Urlab, PE, Salas O'Brien
  - Feb 6, 4:00 PM – 5:00 PM  
AHRI Session, Innovation in Thermal Energy Storage and the Inflation Reduction Act of 2022  
AHR Expo
    - Samantha Slater, AHRI
    - Wei-Tai Kwok, Thule Energy Storage
    - Guy Frankenfield, PE, DN Tanks

- Boaz Ur, Nostromo
  - Mike Filler, PE, Trane Technologies
- Feb 7, 8:00 AM – 9:30 AM EST  
Seminar 41: Supporting Grid Resilience with CHP and TES  
Georgia World Congress Center, A402
  - Mike Filler, PE, Trane Technologies
  - Gearoid Foley, Integrated CHP Systems
  - Richard Sweetser, Exergy Partners Corp
- ii. ASHRAE-Tampa Presentations, June 24-28, 2023. The following presentations are proposed for Tampa summer conference
  - Inflation Reduction Act of 2022 and Provisions for Tax Credits Using Thermal Energy Storage---Steffes
    - Overview of IRA, Mike Filler, Trane Technologies
    - Ice Storage
    - Chilled Water Storage
    - Hot Water Storage
    - Residential thermal storage
  - Retrofit of Existing Air-Cooled Chillers with Ice Storage
    - City of Melbourne Police Headquarters, Bruce Lindsay, Trane Technologies
    - City of Melbourne City Hall, Mason Green, Florida Institute of Technology
    -
  - ASHRAE & DOE Partnership for K12—Thermal Storage
    - Overview of the ASHRAE & DOE Partnership for K12, John Constantinide, PE, US Space Force
    - Brevard County Public Schools in Disadvantaged Communities, Energy Audits, and Ice Storage Retrofit, Hamid Najafi, PhD, Florida Institute of Technology
    - National lab.
    -
- ASHRAE-Chicago Presentations and Tour, January 20-24, 2024 & Jeoff to co-sponsor
  - 30 Years of Thermal Energy Storage and District Cooling in Chicago
    - Update on McCormick Place Tri-Energy Plant, TBD
    - Update on Northwind (Centrio Energy) Plant, Geoff Bares, Centrio
    - Update on the Latest District Cooling Plant Using Thermal Energy Storage, TBD
  - Tour of Centrio Energy Plant

### **Handbook – Navin Kumar**

- i. Handbook review schedule is in the 2nd year. The planned draft submission date is August 8, 2023
- ii. The first draft will be available by the end of May 2023.
- iii. Bruce Lindsay, Geoff Bares and Farzin Rad volunteered to review the draft.
- iv. Farzin asked members to contribute their inputs on the draft.

### **Research –Paulo Cesar Tabares Velasco**

Paulo Tabares presented the RTAR progress and potential new research topics.

- i. RTAR:
  - Evaluation of ground source heat pumps (GSHP) with thermal energy storage (TES) for residential and commercial buildings

- TC 6.8 Xiaobing Liu and Harrison Skye. *Status: Approved by 5 voting members.*
  - Hot water storage. Why people are not doing more often? Why not spread usage? Still need to define scope.
    - Joe Rendall, Amy Van Asselt (*Status: still looking for collaborators*)
    - Armada Power (OH), 3<sup>rd</sup> party aggregator
  - Optimal HX design with Phase-change Material for advanced manufacturing (3D printing HX): *Status: in progress*
    - Sandra Boetcher
  - Quantify broad Benefits of TES using energy modeling
    - Mark and Chuck (NREL). *Status: Ongoing*
  - Identifying synergies between behind-the-meter battery and thermal energy storage (min battery cycling, TES can leverage diurnal temps)
    - Jason Wood and Paulo Tabares. *Status: ongoing*
- ii. Other topics discussed
- ORNL has requested the feedback of the TC on enhancing the capabilities of EnergyPlus to improve TES modeling. The following points were discussed:
    - The Current usage of E+ (or a similar engine) for TES-related simulation
    - Barriers to usage of E+ (or a similar engine) for TES-related simulation
- iii. New Ideas: (collected by Paulo Tabares)
- Seasonal energy storage
  - Unearthing and quantifying the benefits of TES beyond \$\$\$
  - Comments from DOE TES workshop???
  - TES and EV??
  - Potential cost savings maps for cool storage (Paulo Tabares, Mikael Salonvaara)
  - Potential for value TES for vegetable/fruits preservation.
  - Renewable energy generation + energy storage (heating purposes)
- iv. Additional Ideas: (collected by Paulo Tabares)
- Optimal Design and Control of Distributed Cool Thermal Energy Storage for the Interactive Grid (Amy Van Asselt and Karl Heine)
  - Convective heat transfer role in PCMs effectiveness
  - TES control to maximize mix of renewable energy generation
  - Control strategies with a stochastic (not deterministic) data
  - Renewable energy generation for heating purposes or for mix storage sources
  - PCM Plenum Storage
  - Methods to Address High Flow Requirements When Using TES for Emergency Cooling
  - Secondary Coolants, Refrigerants Efficiency Improvements to TES
  - Small plate diffusers. Characterization. Design vs figure of merit. Varies way to design diffusers.

## **Honors and Awards – Blake Ellis**

### **TC 6.9 Members Receiving Awards at this Meeting:**

- None.

### **Update ASHRAE Bio**

- Blake indicated that an updated ASHRAE bio is important as it is reviewed with any award submission and Blake encouraged people to keep their bios updated.

### **Hightower Award**

- Given to people about service the last four years on technical activities.
- TC chair and members of TAC & Tech Council are not eligible.
- TC chair submits the form to the TC section head by September 1.

### **Other Awards Application Dates**

#### May 1 Due Dates:

- Louise and Bill Holladay Distinguished Fellow Award: This award honors Fellows of the Society for continuing preeminence in engineering or research work.
- Andrew T. Boggs Service Award: This award, named after Andrew T. Boggs, former ASHRAE Executive Vice President, recognizes past recipients of the Exceptional Service Award for continuing, unselfish, dedicated and distinguished service to the Society.
- Distinguished Fifty-Year Member Award: This award recognizes individuals who have been ASHRAE members for a minimum of fifty years, and were a past Society President, a Fellow, recipient of the Distinguished Service Award, or otherwise performed outstanding service for the Society.
- Exceptional Service Award: This award recognizes members who have served the Society faithfully and with exemplary effort, far in excess (45 service points) of that required for the Distinguished Service Award (15 service points). The individual must have been a full grade Member for a minimum of ten years and be a past recipient of the Distinguished Service Award.
- Distinguished Service Award: This award recognizes members of ASHRAE who have served the Society faithfully and with distinction on committees or otherwise given freely of their time and talent on behalf of the Society (15 service points are required).

#### December 1 Due Dates

- ASHRAE Hall of Fame: This award honors deceased members who have made milestone contributions to the growth of ASHRAE-related technology. Individuals inducted into the Hall of Fame must have been an ASHRAE member (any grade) or a member of a predecessor Society and must have shown evidence of distinction in the Society, either technically or academically.
- ASHRAE Pioneers of the Industry Award: This award honors deceased individuals who have made milestone contributions to the growth of air conditioning, heating, refrigeration and ventilation. Individuals inducted into the Pioneers of the Industry must have shown evidence of distinction, either technically or academically.
- F. Paul Anderson Award: This award, named in honor of F. Paul Anderson, 1927-28 President of the American Society of Heating and Ventilating Engineers, is the Society's highest award. This award honors members for notable achievement, outstanding work or service in any field of the Society. Accomplishments should include exceptional leadership in the HVAC&R industry, ASHRAE, and society. Broad-based activities of

outstanding value in consulting, contracting, engineering, design, and related activity within ASHRAE are desired. Previous recipients of this award include Willis Carrier, Sam Lewis, Carl Ashley and Donald Kroecker.

- *Fellow Nominations:* ASHRAE members who have attained distinction in the fields of heating, refrigeration, air conditioning, ventilation or the allied arts and sciences through invention, research, teaching, design, original work, or as an engineering executive on projects of unusual or important scope. The individual must have made substantial contributions and have been a full grade member in good standing for at least ten years prior to the date of their election.
- *ASHRAE Award for Distinguished Public Service:* This award recognizes ASHRAE members who have performed outstanding public service in their community, and in doing so, have helped to improve the public image of the engineer.
- *Honorary Member:* Honorary Member status is granted to individuals in recognition of preeminent professional distinction without regard to whether the individual is or has been a member of the Society. Previous recipients include Milton Eisenhower and President Herbert Hoover.

#### **Old Business**

- Training & Education: a ~3 hour on course on thermal storage is proposed for spring 2023.

#### **New Business**

- Daniel Pywell will prepare a Basecamp for the TC prior to the summer meeting.
- John Dunlap has become Standards subcommittee chair.
- Emishaw Iffa & Geoff Bares become voting members.
- New guests are asked to join through online.
- To enhance the TC 6.9's visibility an additional online information is proposed. LinkedIn is mentioned as a potential platform.
- How can The TC tie itself to the decarbonization effort is discussed.

#### **Adjourn**

Farzin Rad adjourned the meeting at 5:29 p.m.