

# Meeting Minutes



## TC 7.6 Building Energy Performance Research Subcommittee – Hybrid

Sunday January 21, 2024, 1:00 PM–2:00 PM (CST)

Location/Room: Marriott Marquis Chicago, Culture (2)

Virtual Meeting Link: <https://njit.webex.com/njit/j.php?MTID=mdf94fe336d7fc5ce64a3f7fbaf370f9a>

TC 7.6 is concerned with the estimation, measurement, analysis, benchmarking, and management of whole building and building systems energy and water performance.

### 1. Sign-in / Introduction

- ASHRAE Research Process: [Flowchart](#)
- 19 Attendees

	Name	Email	Affiliation	Voting Status (VM, CM, Guest)	YEA (Yes, No)	International (Yes, No)	Virtual / In Person
1	Hyojin Kim	hyojin.kim@njit.edu	New Jersey Institute of Technology	VM	No	No	In Person
2	Niraj Kunwar	kunwarn1@ornl.gov	Oak Ridge National Laboratory	CM	Yes		Virtual
3	Kartik Tiwari	kartik.tiwari@cloudkitchens.com	CloudKitchens	Pro CM	Yes	No	Virtual
4	Annie Smith	smithannelise314@gmail.com	Introba	VM	Yes	No	In Person
5	Brittany Wilkins	brittany.wilkins@carrier.com	Carrier Corporation	CM	No	No	In Person
6	Joshua Vasudevan	joshuavasudevan2011@gmail.com	Chord Consult	CM	Yes	No	In Person
7	Hashani De Silva	desilvhm@mail.uc.edu	University of Cincinnati	CM	Yes	No	In Person
8	Josie Cline	josie.cline13@gmail.com	University of Cincinnati	Guest	Yes	No	In Person
9	Bre Devillier	breanadevillier@gmail.com	University of Cincinnati	Guest	Yes	No	In Person
10	Abby Hans	hansay@mail.uc.edu	University of Cincinnati	Guest	Yes	No	In Person
11	Jessica Burke	burke3gl@mail.uc.edu	University of Cincinnati	Guest	Yes	No	In Person
12	Nicholas Long	nicholas.long@nrel.gov	NREL	VM	No	No	In Person
13	Scott West	scott.west@hfa-ae.com	HFA	VM	No	No	In Person
14	Raj Setty	rsetty@setty.com	Setty	Guest	No	No	In Person
15	Amanda Webb	amanda.webb@uc.edu	University of Cincinnati	VM	No	No	In Person
16	Joe Hofstetter	jhofstetter@karpinskieng.com	Karpinski Engineering	VM	No	No	In Person
17	Ali Shirazi	ali.shirazi.salim@gmail.com	WMS/AT	VM	No	No	In Person
18	Quinn Graessle	graessqp@mail.uc.edu	University of Cincinnati	Guest	Yes	No	In Person
19	Michael Deru	michael.deru@nrel.gov	NREL	Guest	No	No	In Person

### 2. Recently-Completed Projects: The abstracts of the Final Reports are available at the end of the minutes.

- 1836-RP Developing a Standardized Categorization System for Energy Efficiency Measures (Final report published on February 2022; Revised on February 2023) [Amanda Webb \(PI\) is planning to submit a manuscript to the ASHRAE Journal.](#)
- 1771-RP Energy Modeling of Typical Commercial Buildings in Support of ASHRAE bEQ Energy Rating Program (Final report published on May 2022)
- 1814-RP Actual Energy Performance of Secondary Schools Designed to Comply with ASHRAE Standard 90.1-2010 (Final report published on January 2023)

### 3. Status of Current Research Projects

No	Project	Contributors	Status
1	<b>1815-RP</b> Integrating Occupant Behavior Data with Building Information Modeling for Performance Simulation	(RC) MTG.OBB (Co-Sponsor) TC 7.6 PES/PMS Jeff Haberl, TC 4.7, MTG.BIM, TC 1.5	(2022 Annual, after meeting) No updates - approved by ASHRAE for bid at the next cycle.  (2023 Winter) RP 1815 Contractor was Stephen Roth. Project just getting started. PMS meeting follows TC 7.6 meeting.  (2023 Annual) PMS meeting on 6/25 at 2 PM – 6/25 progress report posted on <a href="#">Basecamp</a> . Working on Task 1 (i.e., research on existing occupancy behavior schemas/stakeholder interviews) and Task 2 (i.e.,

			analysis of how the occupant behavior data is represented in existing BIM schemas – gbXML, IFC4.3 schema).  (2024 Winter) Making good progress. Requested a 6 month no-cost extension through June 2024.
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4. WS and RTAR In-Progress

No	Project	Contributors	Status
1	<b>1861-WS</b> Thermal Comfort in U.S. and Canadian Residences: Indoor Conditions, Occupant Behavior and Energy Consumption	Hyojin Kim  (RC) TC 2.1 (Co-Sponsor) TC 7.6	(2020 Winter) WS submitted to the subcommittee basecamp. Ready for review. Due by Feb. 16.  (2021 Winter) The team received feedback from RAC. There were concerns with data collection and a large scope proposed. Feedback from TC 2.1 includes to remove the field work and consider a meta-analysis instead. The team agreed to work on the revision in summer 2021.  (2021 Annual) The team plans to work on the revision this summer.  (2022 Winter) The team still works on the revision of this WS.  (2022 Annual, after meeting) The team met and agreed to re-scope this WS and aim to complete it by the end of August.  (2023 Winter) Still working on WS revision.  (2023 Annual/2024 Winter) On hold until the release of G45P in 2024.
2	<b>1822-RTAR</b> Supplemental Normalization Parameters for Alternate/Enhanced Expression of Energy Performance	Dennis Landsberg, Jeff Haberl  (RC) TC 7.6 (Co-Sponsor) SSPC 100	(2020 Annual) WS in progress; to be completed before the next conference.  (2021 Winter, from Basecamp) WS draft is ready but needs polishing; to be completed after the winter conference.  (2021 Annual, by email) Dennis is still working on the WS draft.  (2022 Winter) Dennis plans to complete this WS after G14 is done.  (2022 Annual) G14 is near completion, and Dennis plans to complete this WS soon. Scott West is interested in this topic and volunteers to help out to address RAC comments.  (2023 Winter) Jeff Haberl said that this idea by Dennis came from work by the NAS/TRB on airport terminal buildings where EUIs don't describe the buildings. Jeff will help this effort.  (2023 Annual) No progress. Jeff to collaborate with Sooyeon Cho and Juan-Carlos Baltazar on this WS.  (2024 Winter) Dennis plans to complete WS after the ASHRAE meeting. Will ask SSPC 100 for a couple of reviewers and aim for the RAC meeting in April.
3	<b>New Idea</b> Do buildings designed to 90.1 / 189.1 comply with Standard 100?	Scott West, Joseph Firrantello, Dennis Landsberg	(2020 Annual) Scott West to obtain the input from ASHRAE 189.1 and Joe F. to obtain the input from ASHRAE 100.  (2021 Winter) No updates.  (2021 Annual, from Basecamp) SSPC 189.1 is still interested in this. They are looking at an outcome-based energy performance option. However, it is not clear how 189.1 energy performance compares to Standard 100 performance levels.  (2022 Winter) Still interested in this idea. Not many buildings complying with 189.1. Scott will check RP-1771.  (2022 Annual) Scott said it is hard to find good empirical data collected from buildings complying with 189.1. Amanda suggested to redirect this study to compare modeled vs. measured energy use of buildings complying with different versions of 90.1. Dennis volunteered to help this effort.

			<p>(2023 Winter) Amanda said benchmarking data might be one way to move forward for this RTAR. A lot of information needs to be collected at the time a building is built. Scott will check the final report of 1814-RP. Hyojin said how to find good data can be a part of this project.</p> <p>(2023 Annual) Scott presented first draft RTAR (Background and Research Need), pending completion of Objectives and Expected Approach. Will focus on 90.1. Amanda and Nicholas will review the completed RTAR.</p> <p>(2024 Winter) Scott has narrowed down the scope to 90.1 (excluding 189.1) and intends to complete the RTAR draft by the 2024 Annual Conference. Amanda will connect Scott with a researcher at PNNL.</p>
4	New Idea follow-up project of 1836-RP	Amanda Webb	<p>(2022 Annual) Amanda Webb agreed to work on a new RTAR as a follow up project of 1836-RP to create a large database/dataset using the developed EEM classification system.</p> <p>(2023 Winter) Nicholas Long said there is an effort that is happening in Washington DC about standard ECMs. He agreed to help with the follow-on RTAR.</p> <p>(2023 Annual) Some ideas, but no substantial progress. Still plan to pursue. Amanda to discuss 1836 outcomes with Std 211/100.</p> <p>(2024 Winter) Amanda has no time to pursue this. Nicholas agreed to host a meeting after the conference to brainstorm ideas.</p>
5	New Idea Evaluate barcode technology as the ID technology for capturing time-series data according to its parent device or system	Gregory Cmar, Eric Yang	<p>(2023 Winter) A rough draft was posted on Basecamp. Idea is to use bar codes to help define the global database, including site keys, equipment keys, point keys, etc. Eric said this RTAR is geared toward a process using bar code and then map the point automatically. TC 7.3 is in favor of cosponsoring this. There's a presentation on this topic – Seminar 44 at Atlanta.</p> <p>The committee agreed that this is an issue, but RTAR still needs some work to define this project (e.g., who owns the data, identify vendors). Jeff suggested one way to proceed would be to have an RTAR that defines the different methods available in the industry and puts them into a common framework for evaluating how to proceed: e.g., an Annotated Bibliography.</p> <p>(2023 Annual) Plan to have the first draft at the 2024 Chicago meeting.</p> <p>(2024 Winter) The team decided to not to proceed with it. This item will be delisted.</p>

## 5. New Ideas / Topics / Business

- PTAR for "Procedures for Commercial Building Energy Audits" (PCBEA) by Joe Hofstetter
  - The draft is ready. Joe submitted his draft PTAR to James Bogart (RAC liaison for 7.0) last August, but received no responses. Hyojin will follow up with Jim tomorrow at the Research Chair's Breakfast meeting.
- New idea on latest HVAC&R technology and applications
  - Annie Smith and Amanda Webb will check the ASHRAE 1651 Final Report, Development of Maximum Technically Achievable Energy Targets for Commercial Buildings, which was completed in 2016, and may incorporate carbon aspects.

## 6. Adjourn 1:54 PM CST

## Appendix A: Final Report Abstracts of Recently-Completed Projects

- 1836-RP Developing a Standardized Categorization System for Energy Efficiency Measures (Final report published on February 2022; Revised on February 2023)
  - This report describes the development of a standardized system for categorizing and characterizing energy efficiency measures (EEMs). EEMs are the fundamental mechanism for improving energy performance in buildings. As a result, they play a central role in building energy modeling, energy auditing, and energy data collection and exchange. An EEM is defined as “an action taken in the operation or equipment in a building that reduces energy use of the building while maintaining or enhancing the building’s safety, comfort, and functionality” [1]. This broad definition underscores the foundational nature of EEMs and highlights the wide-ranging set of possible actions that may be considered an EEM.
- 1771-RP Energy Modeling of Typical Commercial Buildings in Support of ASHRAE bEQ Energy Rating Program (Final report published on May 2022)
  - The evaluation of building energy performance requires a baseline for comparison. Historically, an empirical baseline has been used for existing buildings and a modeled baseline has been used for new buildings. ASHRAE Research Project 1771 is to reconcile the differences between the empirical and modeled baselines for energy performance comparison for new and existing commercial buildings, allowing seamless translation of different building energy performance metrics. This report summarizes the results of ASHRAE Research Project 1771: Energy Modeling of Typical Commercial Buildings in Support of ASHRAE Building Energy Quotient Energy Rating Program. This project identified 1080 commercial prototype building models (18 building types × 4 vintages × 15 climate zones), including three building types (college/university, religious worship, and auto repair & service) created by this project. The four vintages include Pre-1980, Post-1980, ASHRAE Standard 90.1-2004, and ASHRAE Standard 90.1-2013. This project identified and evaluated 36~50 possible sensitive input variables of each building type and created 30 OpenStudio measures to modify most of these variables of building models. These measures were applied to designed procedures to evaluate the energy performance of buildings, to create new models based on prototypes building types automatically, and to do large-scale simulation automatically. To support bEQ In Operation rating, this project developed a method to adjust the empirical EUI to account for the energy impact of program design features (PDFs). The empirical and modeled baselines are connected by using this method. We generated the adjustment factors of sensitive PDFs for 18 building types in 15 climate zones. To support bEQ As Design rating, this project developed a method to translate different building energy performance metrics. Using this method, this project calculated the code adjustment factors of energy use intensity (EUI) that align the modeled Standard 90.1 baseline EUI to the modeled bEQ baseline EUI for 18 studied building types in 15 climate zones. As an outcome of this project, we developed building energy models based on 2003 commercial buildings energy consumption survey (CBECS) data, which include 18 commercial building types in two vintages (pre-1980 and post-1980) in 15 climate zones in the U.S. These models were publicly released in <https://www.colorado.edu/lab/sbs/BEM>.
- 1814-RP Actual Energy Performance of Secondary Schools Designed to Comply with ASHRAE Standard 90.1-2010 (Final report published on January 2023)
  - The objectives of the ASHRAE 1814 research project are: 1) compare national averages of the actual annual Energy Cost Indices (ECI) from the analysis of utility bills for secondary schools designed and built to comply with Standard 90.1-2004 and 2010 (or equivalent); 2) determine the factors common to relatively well-performing buildings, as well as the factors common to relatively poorly-performing buildings, based on building surveys and site visits to a sample of school buildings comply with Standard 90.1-2010 (or equivalent); 3) provide recommendations for making future versions of Standard 90.1 more effective in achieving energy savings. In this project, the 2012 International Energy Conservation Code (IECC) is assumed equivalent to ASHRAE Standard 90.1-2010, unless “weakening amendments” have been included in the former (Makela, Williamson, & Makela, 2011). It is worth mentioning that originally the project scope also included medium office buildings. However, through initial outreach to potential building owners and very few responded or were interested in participation and providing building information including monthly energy use data needed for our research. Later this portion of the scope was dropped.