



Draft Agenda
ASHRAE TC 4.7 Energy Calculations - Main Meeting
1/23/2024 Chicago Winter Meeting
4-6:30 PM CT
Hybrid: Marriott Marquis Chicago, George Pullman (3) onsite, Link
below for online
Chair: Neal Kruis (neal.kruis@bigladdersoftware.com)

[MOTION]

1. **Crawley moves to approve Tampa Minutes. Fontanini seconds. Approved 7-0-0 CNV.**
2. **Pruett moves to approve Chicago Agenda. Fontanini seconds. Approved 7-0-0 CNV.**
3. **DeGraw moves to approve revised scope. Crawley seconds. Approved 7-0-0. CNV**
4. **Miller moves to approve revised title. Crawley seconds. Approved 6-1-0. CNV**
5. **Crawley moves to adjourn. Fontanini seconds. Approved 8-0-0 CNV. (Haberl joined late)**

[ACTION]

1. **Kruis to send revised title and scope to TAC Section 4 Liaison (Pat Marks)**
2. **Subcommittee chairs to review website for updates to their respective sections.**
3. **PBM and DDM Chairs to finalize scopes for TC approval at Annual Meeting in Indianapolis.**

JOIN WEBEX MEETING

<https://ashrae.webex.com/wbxmjs/joinservice/sites/ashrae/meeting/download/22fd6de9fbea45dfb96cab0b37a7b25b?siteurl=ashrae&MTID=m005dc70d56788783940f1175c2f05aef>

[4:00 \[15 min\] Call to Order & Introductions \(Kruis\)](#)

[4:15 \[1 min\] Review Code of Ethics Commitment \(Kruis\)](#)

[4:16 \[4 min\] Call of Voting Members \(H. Kim\)](#)

[4:20 \[5 min\] Approve Agenda & Past Minutes \(Kruis\)](#)

[4:25 \[5 min\] Announcements/Liaisons \(Kruis\)](#)

[4:30 \[5 min\] Review TC 4.7 Title & Scope \(Kruis/Crawley\)](#)

[4:35 \[2 min\] Basecamp \(Kruis\)](#)

[4:37 \[5 min\] Membership \(Kruis\)](#)

[4:42 \[13 min\] Website \(Kruis/J. Kim\)](#)

[4:55 \[15 min\] Review Topical Subcommittee Scopes and Expectations \(Kruis/H. Kim\)](#)

[5:10 \[64 min\] Subcommittee Reports](#)

[5:10 \[15 min\] Standards \(Neymark\)](#)

[5:25 \[5 min\] Honors, Awards, and History \(Haberl\)](#)

[5:30 \[8 min\] Handbook \(Baltazar\)](#)

[5:38 \[10 min\] Program \(Kastl\)](#)

[5:48 \[10 min\] Research \(McDowell\)](#)

[5:58 \[8 min\] Physics-Based Modeling \(Judkoff\)](#)

[6:06 \[8 min\] Data-Driven Modeling \(McNeill\)](#)

[6:14 \[10 min\] Related Activities Reports](#)

[6:24 \[6 min\] New Business](#)

[6:30 Adjourn](#)

[Appendix A: Upcoming Meetings](#)

[Appendix B: Resources](#)

4:00 [15 min] Call to Order & Introductions (Kruis)

- Neal Kruis, Chair
- Hyojin Kim, Vice-Chair
- John Pruett, Secretary
- Juan Carlos Baltazar, Handbook Chair
- Brian Kastl, Program Chair
- Tim McDowell, Research Chair
- Joel Neymark, Standards Chair
- Jeannie Kim, Webmaster
- Ron Judkoff, Physics-Based Modeling Subcommittee Chair
- James McNeill, Data-Driven Modeling Subcommittee Chair
- Jeff Haberl, Honors, Awards, and History Subcommittee Chair
- Ralph Muehleisen, Web/Hybrid Meeting Guru

4:15 [1 min] Review Code of Ethics Commitment (Kruis)

In this and all other ASHRAE meetings, we will act with honesty, fairness, courtesy, competence, inclusiveness and respect for others, which exemplify our core values of excellence, commitment, integrity, collaboration, volunteerism and diversity, and we shall avoid all real or perceived conflicts of interests.

4:16 [4 min] Call of Voting Members (H. Kim)

Present?	Last	First	Term Ends	Company	Email
x	Miller	Clayton	2025	Nat. U. of Singapore	clayton@nus.edu.sg
x	Crawley	Dru	2024	Bentley	dru.crawley@bentley.com
x	DeGraw	Jason	2027	ORNL	jason.degraw@gmail.com
x	Fontanini	Anthony	2026	NREL	anthony.fontanini@nrel.gov
x (late)	Haberl	Jeff	2024	Texas A&M	jhaberl@tamu.edu
x	Kim	Hyojin	2026	NJIT	hyojin.kim@njit.edu
x	Kim	Jeannie	2027	Argonne National Lab	jihyun.kim@anl.gov
x	Kruis	Neal	2024	Big Ladder	neal.kruis@bigladdersoftware.com
x	Pruett	John	2026	ZMM	jap@zmm.com

4:20 [5 min] Approve Agenda & Past Minutes (Kruis)

[Motion 1] Crawley moves to approve Tampa Minutes. Fontanini seconds. Approved 7-0-0 CNV.
[Motion 2] Pruett moves to approve Chicago Agenda. Fontanini seconds. Approved 7-0-0 CNV.

4:25 [5 min] Announcements/Liaisons (Kruis)

- TAC Section 4 (Pat Marks)
Increased interaction within Section 4 proposed by Neal Kruis at TC Chair breakfast and will be initiated by Pat Marks within the next few weeks.
- Research (Dennis Landsberg)
Funding is back up, backlog is cleared and RAC is accepting new proposals.
- Handbook (Jeff Boldt)
Jeff is retiring. We will be getting new liaison.

4:30 [5 min] Review TC 4.7 Title & Scope (Kruis/Crawley)

Title: TC 4.7 Energy Calculations

Scope: TC 4.7 identifies, evaluates, develops, and recommends procedures for calculating energy performance of the built environment.

Crawley proposed changing name of TC 4.7 to “Building Performance Simulation” and changing scope to “TC 4.7 identifies, evaluates, develops, and recommends procedures for calculating energy and environmental performance of the built environment.”

Discussion led to title of “Building Performance Modeling”

Discussion led to scope of “TC 4.7 identifies, evaluates, develops, and recommends procedures for calculating performance of the built environment, including energy, emissions and economics.”

[Motion 3] DeGraw moves to approve revised scope. Crawley seconds. Approved 7-0-0 CNV.

[Motion 4] Miller moves to approve revised title. Crawley seconds. Approved 6-1-0 CNV.

[Action 1] Kruis to send revised title and scope to TAC Section 4 Liaison (Pat Marks)

4:35 [2 min] Basecamp (Kruis)

All correspondence through Basecamp. Contact Chair to be added.

4:37 [5 min] Membership (Kruis)

- Changes in TC 4.7 Leadership
 - PBM Chair: Judkoff
 - PBM Vice Chair: Lee
- Voting Members
 - Emergency roster change:
 - Wang -> J. Kim
 - Rolled on in July 2023:

- DeGraw
 - Rolling off in July 2024:
 - Kruis
 - Haberl
 - Crawley
- Will need a minimum of 1 new, prefer to replace all 3.
- Corresponding Membership
 - Attendance sheet has been updated:
 - “Not on Roster”, you have not applied to join the TC (or name on attendance sheet doesn’t align with the roster)
 - If you’ve been attending regularly, and would like to be promoted to CM, indicate on the attendance sheet, or contact the Chair

4:42 [13 min] Website (Kruis/J. Kim)

Looking to update the website and maintain what needs to be maintained.

Will update the FAQ section to include new subcommittee scopes.

[Action 2] Subcommittee chairs to review website for updates to their respective sections.

4:55 [15 min] Review Topical Subcommittee Scopes and Expectations (Kruis/H. Kim)

Preliminary subcommittee scopes after discussion in the full committee meeting:

PBM Scope:

The Physics-Based Modeling (PBM) subcommittee develops, applies, and validates physics-based models, algorithms, and computational frameworks for building performance calculations. Physics-based models simulate real systems using mathematical equations to describe the interactions and physical phenomena. Physics-based modeling is sometimes referred to as forward modeling and can be used to predict the behavior of systems that do not yet exist and for which there is no performance data.

DDM Scope:

The Data-Driven Modeling (DDM) subcommittee develops and validates models and algorithms (such as machine learning and artificial intelligence) that use data, either measured or simulated, to determine model forms and/or parameters. Hybrid methods that incorporate both data-driven models and physics-based models are included. Uses of these models and algorithms include measurement and verification, load disaggregation, energy forecasting, and advanced controls.

[Action 3] PBM and DDM Chairs to finalize scopes for TC approval at Annual Meeting in Indianapolis.

5:10 [64 min] Subcommittee Reports

5:10 [15 min] Standards (Neymark)

Note: ASHRAE has formed the Global Technical Interactions Committee (GTIC) to support internationalization of ASHRAE standards.

TC 4.7 is cognizant TC for the following five Standards:

- SSPCs 140, 205, and 209 that are on continuous maintenance
- SPCs 229P and 232P

Standards:

- 140: Method of Test for Evaluating Building Performance Simulation Software

McDowell reporting:

- Standard 140, first published in 2001, is widely referenced (ASHRAE 90.1, 90.2, 189.1; IECC; and others)
- Glazer also working on promulgating updated references by CEC, NCEB, and others.
- 140-2023 Continuous Maintenance Revision was published last Fall.
 - It includes existing 140-2020 + Addendum A (Weather Drivers test suite) and Addendum B (acceptance criteria), and reorganization developed by McDowell that facilitates adding new test suites and other material to the Standard.
- Airside HVAC BESTEST Volume 2 test suite led by Neymark
 - Airside 2 builds more realistic annual hourly software-to-software comparative tests off of Airside 1 steady-state tests that compare software to analytical solutions.
 - Test spec development in progress, though delayed this cycle for 140-2023 continuous maintenance revision publication review and Empirical Validation work.
- Multizone Modeling led by McDowell
 - 5 test cases (solar radiation and shading), originally developed as an IEA task, edited to be more 140 style, weather data format changed to epw
 - Field trial planned after ETNA trials
- DOE empirical validation test suites
 - Test specifications intended for Standard 140 are being developed by Argonne, NREL and ORNL.
 - The Argonne/ETNA (EdF data) test suite (led by Neymark and Muehleisen) The initial test suite applying artificial climate steady-state data focuses on developing base case models of twin test cells and extension cases for validating surface heat transfer modeling. It was distributed to software developers for field trials. There are a total of 7 tested programs in the trials: 5 software developers provided results, along with 2 programs tested by the project team.
 - The NREL iUnit project (led by Craig Simmons) applies a transportable modular apartment unit, also with data collection in artificial and natural climate

configurations (like ETNA). The NREL team has updated its test specification and supporting appendices and developed a plan for externally (outside of tested programs) imputing thermal conductivities (following the ETNA process) and thermal mass properties (in collaboration with the ETNA team).

- For ORNL/FRP project (led by Piljae Im and Sungkyun Jung), data has been collected for a multi-zone test facility with typically constructed HVAC and air-distribution systems. Simulation trials have been done by ORNL and Argonne Lab with two modeling tools. A draft spec was developed describing all aspects of the test facility. ORNL will address comments and revise their test spec as they proceed toward external simulation trials.
- Compliance Modeling Tests , led by Jian Zhang and Yan Chen of PNNL
 - This addresses building types applied in Standard 90.1 and is a broader software-to-software (no empirical truth standard) comparative testing paradigm than the more diagnostic isolated-physics test suites applied so far for Std 140.
 - SSPC 140 formed a Working Group for this project. The WG recommended a building geometry option applying a 10-zone per floor model for a 3 floor building (30 zones total), SSPC 140 straw-polled to accept this model. The PNNL project team will proceed applying this geometry, pending discussion of zone load/schedule-type blending, especially among internal zones.
 - This builds on feasibility work of developing 90.1 medium office building test specs interpretable by multiple programs was completed with three building performance simulation tools. Initial feasibility looks good with good agreement among results.
 - Test specification work will continue, pending adaptation of further WG recommendations regarding zone load/schedule blending described above.
- 90.1 ECB/140 “Acceptance Criteria and Referencing” WG led by Jason Glazer and Tim McDowell
 - 90.1 committee is working on updating its reference to Standard 140 for 90.1-2025. Consideration to reference 140-2023 as recommended by 140 AccCrit/Referencing WG discussed at ECB in Chicago. Needs more ECB discussion
 - Also working on promulgating referencing of 140 by other standards: e.g., IECC, California Energy Commission, NECB (Canada), other states and cities.
- SSPC 140 voted to recommend IBPSA-International co-sponsorship of Standard 140 at the Atlanta meeting last February
 - Dru Crawley is following up with both the ASHRAE BoD and the IBPSA-World BoD.
- 140 Stakeholder meeting for 2023:
 - DOE held a Stakeholder meeting October 2023 to gather feedback from AHJs, regulators, building code officials, and introduce the acceptance criteria (Addendum D), also automation efforts, and the IBPSA USA 140 Compliance Portal.
 - 31 participants, but were only able to draw a few AHJs and code officials – their main comment is that summary materials they receive about 140 must be very brief.

- Other items SSPC 140 is working on include Automation of the standard (e.g., processing submitted results) and a User's Manual – both intended to facilitate use of the Standard and led by Jason Glazer; and updating the Standard 140 Roadmap that comprises a summary of Standard 140 related activities along with known test suites for consideration for 140 (see <http://data.ashrae.org/standard140/>), led by Tim McDowell.
- 205: Representation of Performance Data for HVAC&R and Other Facility Equipment
Barnaby reporting:
 - 205 is developing a scheme for adapting machine readable schema information from a common base source; this promotes consistency of data content/format.
 - 205 was published in 2023 with a total of 7 equipment types included.
 - 3 Addenda have been completed and ready to be published.
 - Work is progressing to extend the Standard with 4 more equipment types.
 - DOE/Argonne project team is working to apply and promote the standard
 - EnergyPlus has a component that can read a 205 model
 - ORNL has a heat pump model that generates 205 maps.
- 209: Energy Simulation Aided Design for Buildings Except Low-Rise Residential Buildings
Kolderup reporting:
 - PC reformed in 2021 as SSPC: Up to 40+ members (VMs and NVMs)
 - 13 topical Working Groups (e.g., facades, quality assurance, etc)
 - 5 Addenda nearing completion.
 - Working on a 2025 update.
 - Title, purpose and scope are being revised.
 - Supplemental appendices under way: predictive modeling, greenhouse gas (GHG) calculations, thermal comfort.
- 229P: Protocols for Evaluating Ruleset Application in Building Performance Models
Kruis reporting:
 - Protocols are for evaluating models from defined rule sets, e.g., for baseline and proposed models.
 - The standard defines a schema that can be read for the purpose of ruleset checking
 - Pushing for public review - will vote via letter ballot soon.
 - PNNL is developing a checking tool for 90.1-2019 modeling.
 - 229 intended to be updated as needed, as rule bases change
- 232P: Common Content and Specifications for Building Data Schemas
McDowell reporting:
 - Proposed Standard defines data structures (rules) and conventions that would be used for BPS models, but not defining data models themselves. This draws/evolved from 205 and 229, both of which are describing data models. 232 implies a single method for how to describe data models.
 - Areas of focus include time-series and time-stamp schema.
 - The PC has a vote in progress to submit the standard for P/PR. If no vote changes in the next day, it will have unanimous approval and be eligible for fast track public review.

5:25 [5 min] Honors, Awards, and History (Haberl)

Jeff will be rolling off. Looking for replacement.

5:30 [8 min] Handbook (Baltazar)

Last leg of this cycle. Revisions due by March 25th to Juan Carlos. Revised Chapter to be issued to ASHRAE after Indianapolis meeting. Vote to accept Chapter will be required at Indianapolis meeting.

5:38 [10 min] Program (Kastl)

1 program approved for this meeting. 3 co-sponsored programs not approved.

3 potential programs for Indianapolis meeting.

Brian would like to step down from this position. Looking for a replacement.

5:48 [10 min] Research (McDowell)

4 ongoing research projects.

RP1661: Paper nearly complete and ready for publication.

RP1815: Work ongoing. Requested extension through June.

RP1816: Many delays due to COVID. Contractor is working on final report. Hoping to complete by summer.

RP1857: Project has not yet kicked off. Student awaiting visa.

5:58 [8 min] Physics-Based Modeling (Judkoff)

Discussed scope of PBM subcommittee.

Acknowledgement of the need to explain and define the many acronyms commonly used in TC 4.7

Tim McDowell provided a summary of the RTAR process and has posted it on BaseCamp.

Edwin Lee & Jeff Haberl discussed putting together list of successful RTARS / work projects as a resource / reference for future RTAR preparation.

6:06 [8 min] Data-Driven Modeling (McNeill)

Discussed scope of DDM subcommittee.

Talked through some RTARs currently being developed as well as ideas for several others.

Jeff Haberl to develop several one pagers for RTAR ideas.

TC1.13 interested in collaboration opportunities.

Approximately 80 attendees for Seminar 21.

6:14 [10 min] Related Activities Reports

- TC 4.1: Load Calculation Data and Procedures
Working on 2025 Fundamentals revisions. Looking at potential major overhaul of their Chapters for the 2029 cycle.
- TC 4.2: Climatic Information
Working on updates for 2025 Fundamentals and expanding number of weather stations. Representative from NASA shared information on improved data available.
- Other TCs?
- Standard 90.1: Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings
- Guideline 14: Measurement of Energy, Demand and Water Savings
Published in 2023. Beginning new cycle.
- Other Standards/Guidelines?
- MTG.RES (DeGraw)
Looking to add TC4.7 representation. DeGraw is Chair. Next meeting will be virtual March/April time frame.
- IBPSA-USA
Simbuild conference is back, will be in Denver May 21-23.
Online career fair February 9.
Updating BIM training workshop. Will be put online in May.
- IBPSA-World
Building Simulation 2023 last year was in Shanghai. Next conference will be 2025
- [CalBEM](#)
- Modelica
Conference this fall at University of Connecticut October 14-16.
- Others?
CIDCO (Conference on Integrated Design, Construction and Operation) - ASHRAE conference will overlap with Annual Conference in Indianapolis. Will become an annual event.

6:24 [6 min] New Business

6:30 Adjourn

[Motion 5] Crawley moves to adjourn. Fontanini seconds. Approved 8-0-0 CNV.

Appendix A: Upcoming Meetings

- June 22, 2024 - Indianapolis, IN
- Feb 8, 2025 - Orlando, FL
- June 21, 2025 - Phoenix, AZ
- Jan 31 - Feb 4, 2026 - Las Vegas, NV
- June 27 - July 1, 2026 - Austin, TX

Appendix B: Resources

- ASHRAE's Research Proposal Process:
 - <https://www.ashrae.org/file%20library/technical%20resources/research/ashrae-research-flowchart-r6.pdf>
- ASHRAE Acronym Guide:
 - https://www.ashrae.org/file%20library/about/marketing/final_ashrae-acronyms.pdf
 - Common Acronyms:
 - Research:
 - RTAR: Research Topic Acceptance Request
 - PTAR: Publication Topic Acceptance Request
 - WS: Work Statement
 - RP: Research Project
 - RAC: Research Administration Committee
 - Program:
 - CEC: Conferences and Expositions Committee
 - Standards:
 - SPC: Standard Project Committee
 - SSPC: Standing Standard Project Committee
 - SPLS: Standards Project Liaison Subcommittee (of Standards Committee)
 - MOP: Manual of Procedures
 - SH: Section Head
 - YEA: Young Engineers in ASHRAE
- 4.7 Committee Home Page:
 - <http://tc0407.ashraetcs.org/>
- 4.7 BaseCamp Page:
 - <https://3.basecamp.com/3106353/projects/8174587>