MINUTES
ASHRAE TC 4.7 ENERGY CALCULATIONS – MAIN MEETING
VIRTUAL CONFERENCE
TUESDAY, JULY 21, 2020, 4:00 PM – 5:30 PM EDT

MOTIONS:

- **Motion by Kruis, Neymark seconds: Recommend to TAC that the name changes: TC 4.7 identifies, evaluates, develops, and recommends procedures for calculating energy performance of the built environment. 9-0-0 CNV.**
- **Motion: Approve Orlando meeting minutes. Ralph moves, John seconds. 9-0-0 CNV**
- **Motion: Ralph moved to approve the proposed RTAR: "Building energy data-driven prediction modeling toolkit". John Pruett seconded. Approved 9-0-0 CNV**
- **Motion: Ralph moves to adjourn, John seconds. Approved 10-0-0 Chair voting!**

ACTION ITEMS:

- **Action: Ralph to work with ASHRAE staff to resolve membership issues**
- **Action: Ralph to form an awards committee**

1. **Reciting of Code of Ethics Commitment and Introductions** (5 minutes) Balbach

Commitment to the ASHRAE Code of Ethics: In this and all other ASHRAE meetings, we will act with honesty, fairness, courtesy, competence, integrity and respect for others, and we shall avoid all real or perceived conflicts of interest.

Attendance form https://forms.gle/fRmw8KuCPQ2ZyyC76 put in zoom chat

2. **Review TC 4.7 Scope:** Balbach

TC 4.7 is concerned with identifying, evaluating, developing, and recommending procedures for calculating energy performance of the built environment.

Joshua New: TC 4.2 changed theirs to be more active voice.
Ralph: TC 4.7 can consider minor wordsmithing offline

Motion by Kruis, Neymark seconds: Recommend to TAC that the name changes: TC 4.7 identifies, evaluates, develops, and recommends procedures for calculating energy performance of the built environment. 9-0-0 CNV.

3. **Call of Voting Members** Kruis

10 voting members present. Only Sagar and Malcom (non-quorum) absent. We have quorum.
Action: Ralph to double check Joshua as being listed as NVM

4. **Accept agenda & approve minutes of Orlando meeting** Balbach

Motion: Approve Orlando meeting minutes. Ralph moves, John seconds. 9-0-0 CNV

5. **Announcements/Liaisons** Balbach

- Jim (Jamie) Bennett (Section 4 Liaison)
- David Claridge (Research Liaison)
  David Claridge to be replaced by Natascha Milesi-Ferretti after this meeting.
- Bass Abushakra (Handbook Liaison)

6. **Membership** Balbach

Action: Ralph to work with ASHRAE staff to resolve membership issues.

7. **Subcommittee Reports**

7.1 Web Site (*https://tc0407.ashraetcs.org/*) New

Website is up-to-date. Joshua New doing a bangup job

7.2 Program Kastl

Kastl: 3 seminars submitted and accepted for Austin.
Balbach: did not get a mini track into Chicago

7.3 Research Haberl / Balbach

New Research liaison
Starting spreadsheet on basecamp to take better care of

7.4 Handbook Pruett

No online meeting because we submitted chapter update to Bass.
Waiting for proofs to come back from ASHRAE. Lots of revisions and addition in this update.

7.5 Historical Haberl / Balbachl

7.6 Data-Driven Modeling Fontanini
23 attended online meeting. About the same number as the live meeting
See subcommittee chair notes/minutes for more info
Proposed RTAR : Building energy data-driven prediction modeling toolkit. Has been circulated.
Motion: Ralph moved to approve the proposed RTAR: "Building energy data-driven prediction modeling toolkit". John Pruett seconded. Approved 9-0-0 CNV

7.7 Simulation and Component Models Lee

No actions needed at main committee meeting.

7.8 Multiscale Building Energy Modeling Judkoff

27 attended online meeting. About the same as online.
One session on Resiliency at virtual meeting
Proposed session for Chicago: Session on MBEM based on the new chapter.:
Discussion on MBEM name. Maybe worth exploring in the future.
Expect WS-1857 turnaround response to RAC for vote by Aug. 15.

7.8 Standards Neymark

See subcommittee chair minutes

8. **Related activities reports**

90.2 None
TC 4.1 None
TC 4.4 None
TC 4.2 Co-sponsor WS re: rooftop entering temperatures. Tim: Recalls 4.7 supports, but doesn't co-sponsor since energy calculations weren't involved.
TC 7.6 None

IBPSA

Dru: IBPSA USA holding virtual austin meeting next Wed 7/29/2020
Dru: IBPSA World, extended time for abstracts until next month.
Neal: IBPSA has developed a new data exchange committee

9. Awards Nomination Balbach

Action item for Ralph: Form an awards committee:

10. New business Balbach

11. Adjourn Balbach

Motion: Ralph moves to adjourn, John seconds. Approved 10-0-0 Chair voting!

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Minutes
TC 4.7 Simulation and Component Models Subcommittee
Wednesday, July 15, 2020
14:00-15:00 CDT
Virtual Online Meeting

Call to Order & Introductions

- Chris Balbach, Committee Chair
- Ralph Muehleisen, Committee Vice-Chair, Incoming Committee Chair
- Neal Kruis, Committee Secretary, Incoming Committee Vice-Chair
- Alamelu Brooks, Incoming Committee Secretary
- Brian Kastl, Committee Program Chair
- Joshua New, Committee Webmaster
- John Pruett, Committee Handbook Chair
- Ron Judkoff, Multi-scale Building Modeling Subcommittee Chair
- Anthony Fontanini, Data-driven Modeling Subcommittee Chair
- Edwin Lee, Simulation and Component Models Subcommittee Chair

For follow-up conversations about research/program ideas, my email is: edwin.lee@nrel.gov.

Changes to the Draft Agenda

- Added 2 new research ideas:

    - Dynamic Models of Heat Pump Systems
    - Improved Compressor Models
- Added my contact information for follow-up threads

Research Projects

(old projects purposely left on to demonstrate new agenda format)
1741-WS: Understanding Fan Coil Components and how they relate to energy consumption and energy modeling

- Status:
    - CONCLUDED, REMOVE FROM AGENDA
- 2019 Annual
    - Item appeared on agenda for discussion
- 2020 Winter
    - Concluded, Subcommittee recommended removal of item from agenda

1769-RTAR: Experimental Evaluation of Efficiency of Belt Drives for Fans

- Status:
    - REMOVE FROM AGENDA
- 2019 Annual
    - Item appeared on agenda for discussion
- 2020 Winter
    - Subcommittee recommended removal of item from agenda

1661-WS: Development and Validation of Dynamic Models for the Evaluation of Chilled-Water Systems Control Strategies in the ASHRAE Handbook

- Status:
    - UNCERTAIN
- 2019 Annual
    - Item appeared on agenda for discussion
- 2020 Winter
    - Scope change had been accepted, may need no-cost extension, but PMSC has not voted, so TC cannot vote on it. Needed to check with Wangda about an April 30 deadline (Tim)
- 2020 Annual
    - Wangda: in task 3, meeting with PMSC, after approval, will test remaining models by end of summer, another meeting with PMS, with approval will complete task 3… task 4 and 5 will continue after that...no cost extension goes to April 30, 2021. Not anticipating another NCE.
    - Change name to 1661-RP (Anthony Fanatntnnntntii)

Draft Work Statements/RTARs

- ...

New Research Topics

- New Research Topics (RTARs and WSs can be submitted 4 times a year -- six weeks prior to Winter/Annual meetings, and 6 weeks prior to March 1/August 1)
- Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations – Phase 2
    - Current Assignee
        - No one, if no one is assigned, this will be removed from the agenda
    - 2019 Annual
        - Item appeared on agenda for discussion
    - 2020 Winter
        - Previously known as 1748-WS, but the topic has expired. If we want to continue, we can get a new number and re-submit. (Tony)
    - 2020 Annual
        - Tony not interested in championing this, unsure of where RAC comments ended up, probably still need to address any comments. Joe willing to look for RAC communication, if RAC didn't show interest we will drop it. Ralph ask Tim to look up RAC comms related to this. If comments are reasonable, Joe will work on it. We will wait until new research liaison, so Edwin check back on this mid-August. (New research liaison, unknown, not David)
- Development of an Accuracy Test Method for Residential Attic Duct System Simulations in Whole-Building Energy Simulation Programs
    - Current Assignee
        - No one, if no one is assigned, this will be removed from the agenda
    - 2019 Annual
        - Previously known as 1813-RTAR, but rejected by RAC in June 2018. If we want to continue, we can get a new number and re-submit.
    - 2020 Winter
        - No update
    - 2020 Annual
        - Ralph - was Jeff/Minnie, Neal thinks it could be proposed in 140. REMOVE FROM AGENDA
- Development of a Reference Building Information Model (BIM) for Daylighting Optimization
    - Current Assignee
        - Joe
    - 2020 Winter
        - Potential TC 1.5/TC 4.7 cosponsorship. No progress on RTAR, but welcome Juan Carlos Baltazar's related experimental findings
    - 2020 Annual
        - Joe to get in touch with Jeff, Edwin will reach out in a couple weeks
- Rooftop Entering Air Temperature Underestimated and Affected by Local Environment
    - Current Assignee
        - Joe
    - 2020 Winter

        - Potential 4.7/4.10 cosponsorship, RTAR approved, then delayed, converted to work statement. Literature review shows conflicting predictions, Craig Wray took measurements that did not show significance. We could do cosponsorship once WS is completed. (Joe)
    - 2020 Annual
        - Joe: Tentatively approved by 4.2, not 4.10. Submitted as full WS, with 4.7 cosponsoring. Joe to send correspondence about this to Tim/Edwin. Did 4.7 already vote? Who would be on the PMSC? Wangda: 4.10 did vote to cosponsor, not part of 4.7. REMOVE FROM AGENDA.
- Comparing Heat Transfer and Temperature Predictions in Attics by Different Models
    - Current Assignee
        - Joe/Neal
    - 2020 Winter
        - Joe to work with Neal to try to get an RTAR and coordinate this with 140 creating new test cases for section 5 that include attics
    - 2020 Annual
        - Neal: this came from Joe's paper on this topic, so Joe is the driving force here. Joe: Could be merged with accuracy test/140 topic. Neal proposes talk with 140, decide if they want to put together a research project or not. Neal should talk with 140. Tony says atticsim and others are available for this, but atticsim only does attics so can't (reasonably?) participate in 140. Tim doesn't see RAC wanting to fund this, so maybe we don't want to spend time on this, at least get a better name, better scoping. Neal thinks just more discussion for now, along with members of 140, to determine best path forward. 140 could formalize Joe's testing. Edwin will set up a side call with relevant folks.
- Follow-on to RP-1588 (Window Modeling): Address Future Work Recommendations
    - Current Assignee
        - Joe/Mahabir
    - 2020 Winter
        - Quantify energy differences between the modeling methods, improve the search method of the solver, Joe wants help in writing. Mahabir will help. Action item: Joe to coordinate with Mahabir of ORNL on writing
    - 2020 Annual
        - Joe: No real update, will take an update for August 15 deadline. Edwin to check in a couple weeks. Cosponsors? Joe thinks 4.5 (Window people)
- Evaluation and improvement of chilled water and dx coil models for high latent loads
    - Current Assignee
        - Neal
    - 2020 Winter
        - Neal - can ask Doug during 205 meeting
    - 2020 Annual
        - Neal: Original idea from PC Thomas, No champion, REMOVE FROM AGENDA.
- Improved interior surface convection algorithms
    - Current Assignee
        - Ralph

    - 2020 Winter
        - Ralph will follow up with Phil
    - 2020 Annual
        - Ralph didn't. Not happening before August 15, Edwin will check this Fall to make sure things are moving. (Use ToDo on basecamp for these things)
- (NEW) Analyze online resources for simulation issues/limitations
    - Current Assignee
        - Edwin
    - 2020 Annual
        - Maybe not a research task in and of itself, but potentially a generator of ideas. Collect and process questions on forums and other resources to create a list of problem areas in simulation. Finding issues that are common to multiple simulation models would lend themselves as the most pressing topics to research.
        - Neal: Problems aren't hard to find, but champions are. Erik: Surveys have been done periodically. Tim: Could IBPSA do this faster than ASHRAE? Edwin may convene offline thread.
- (NEW) Aging components
    - Current Assignee
        - Edwin
    - 2020 Annual
        - Research has been done on dirty and faulty equipment, but I haven't heard of much lately. Is it worth considering aging/dirty/faulty equipment again? Not just HVAC equipment, but building envelopes as well?
        - Tony: Jon Winkler may have a potential study on it, but this is faulty installation. Ralph: some other things from DOE, just hold on this and see what happens at next year's peer review. Tony: Aging hasn't been studied too much. Joe: Ideal cases are simulated, what about typical? TC 4.4 (Material people) may have aging curve data. -- Edwin touch base with them.
- Dynamic Models of Heat Pump Systems
    - Current Assignee
        - Edwin (w/ Craig Bradshaw)
    - 2020 Annual
        - Zone dynamics are captured well, but equipment models are often lacking temporal effects. For this project, the performer would create/use high-fidelity dynamic models for coils and compressors. Then integrate the high-fidelity models into a system model, and generate a reduced order model for controls. The high-fidelity model would be made available in the system model for advanced users to regenerate their own reduced order models later. Dynamic psychrometric chambers at Oklahoma State could be used for development and/or validation work.
        - Edwin and Craig will write.
- Improved Compressor Models
    - Current Assignee
        - Edwin (w/ Craig Bradshaw)

    - 2020 Annual
        - Compressor models are basically at two ends of a spectrum. One end has computationally expensive, incredibly detailed compressor design tools. The other end is the standard 10 coefficient AHRI map, which is useless outside of tuned range and does not capture compressor economizing or variable speed. There is a need to develop a new reduced order model that captures modern compressor capabilities, that is semi-physical to allow some extrapolation.
        - Tim: Liaison with 205...Edwin will discuss there. Neal: AHRI reached out to 205, already a connection.

Program Ideas

- 1741 topics
    - 2020 Winter
        - Edwin & Brian to follow up with Neal to see if it's time for a 1741 related session.
    - 2020 Annual
        - We were only a cosponsor, other TC will do a program.
- Roof temperature myths
    - 2020 Winter
        - Briefly mentioned but no action items assigned
    - 2020 Annual
        - Premature to do something now...REMOVE THIS ITEM
- Explore the issues of why you need different calcs for load and whole building simulation.
    - 2020 Winter
        - Chip will try to coordinate with someone from 4.1. Probably a better fit for MBEM.
    - 2020 Annual
        - Brian: took over contact, need to contact 4.1.
- (NEW) Pressing the Limits of Building Simulation, part 1
    - 2020 Annual
        - Presentations could push the simulation from high-level design information to brutally detailed data, and present the value of added detail breaking down. This could be done for a number of different aspects of the building simulation (geometry, material data, HVAC performance data, scheduling/occupancy data). (Track 2)
- (NEW) Pressing the Limits of Building Simulation, part 2
    - 2020 Annual
        - Present cases where our building simulation models are suitable in extreme environments, and cases where the simulation models break down. For example, we can't model on the moon with EnergyPlus, but why? Solar calculations and the exterior air boundary condition are obvious, but has anyone fleshed out the list of things that would need to be done to be able to simulate there? (Track 2)
- (NEW) Building Efficiency in 2020 and Beyond
    - 2020 Annual

        - With the increased availability of renewable energy, building efficiency is being positioned as a secondary energy issue. When the life cycle of a building is considered, building efficiency should be a significant piece of the energy problem. Improved building efficiency can obviously ensure a lower first cost of on-site solar, but when panels need to be replaced, ideally the building energy would be less to reduce the amount of material needed. (Track 6)
- ...

New Business

- ...

Action Items for Committee

- ...

Upcoming Meetings

- January 25, 2021 – Chicago, IL
- June 26, 2021 – Phoenix, AZ
- January 31, 2022 – Las Vegas, NV
- June 25, 2022 – Toronto, ON

Appendix A: Resources

- ASHRAE's Research Proposal Process:
    - https://www.ashrae.org/file%20library/technical%20resources/research/ashrae-research-flowchart-r6.pdf
- 4.7 Committee Home Page:
    - http://tc0407.ashraetcs.org/
- 4.7 BaseCamp Page:
    - https://3.basecamp.com/3106353/projects/8174587

Appendix B: 2021 Winter (Chicago) Program Tracks

1. **HVAC&R Fundamentals and Applications:**
    - Fundamentals are the foundation for understanding applications in engineering. Key components of ASHRAE fundamentals include thermodynamics, psychrometrics, fluid and mass flow. This track provides opportunities for papers and presentations of varying levels across a large topic base. Concepts, design elements and shared experiences for theoretical and applied concepts of HVAC&R design are included.
2. **Systems and Equipment:**

- HVAC&R Systems and Equipment are constantly evolving to address the changing requirements of the built environment. Papers and programs in this track will focus on the development of new systems and equipment, improvements to existing systems and equipment and the proper application and operation of systems and equipment.

3. **Refrigeration and Refrigerants:**
   - Refrigeration is a critical element of modern life, from preserving food and medicine to maintaining comfort. With significant changes on the horizon for refrigerant regulations, along with new applications for refrigeration systems being frequently applied, there is more need than ever to understand both the fundamental and advanced concepts and issues related to refrigeration. Papers and programs in this track will focus on refrigerants, refrigerant regulation, refrigeration cycles and refrigeration applications.
4. **Environmental Health Through IEQ:**
   - HVAC&R systems play a significant role in maintaining indoor environmental conditions. As people spend increasingly more time in the built environment, health concerns are becoming paramount to design. This track will seek papers and programs on developing, evaluating and predicting optimal indoor environmental conditions, especially as they pertain to environmental health.
5. **Building Performance and Commissioning for Operation and Management:**
   - Modern HVAC&R systems are complicated and designed for high efficiencies. In order to optimize their use and provide proper operation, commissioning is recommended. This track provides an opportunity to provide papers and presentations surrounding building operation and commissioning practices as well as case studies in performance and commissioning.
6. **Energy Conservation:**
   - Whether it is new construction, renovation, routine maintenance or energy audits there is a major concern over the use of energy in the built environment. Designs are using more techniques to reduce energy with the use of energy wheels and pipes, solar energy, photo voltaic, and more efficient equipment and new concepts that are pushing to be standard design practice. In addition, modeling is being used to generate more life cycle cost decisions for the design and value-engineering decisions beyond standard HVAC practice. This track will highlight case studies and research that expand on the simple to the complex energy savings measures being implemented in today's and tomorrow's designs.
7. **International Design:**
   - Design for various environmental elements, geography and culture demand that new and innovative strategies be developed. As an international organization, ASHRAE strives to meet the needs of a global membership. HVAC&R systems vary globally and this track provides an opportunity to share innovative and necessary design elements that can be shared internationally.
8. **Standards, Guidelines and Codes:**
   - ASHRAE is known for its standards and design guidelines – and they are constantly evolving with the intent on improving the built environment and its systems. Designers, Contractors, Architects and Owners must be able to keep up with the continuing changes in the current cycle but to also be prepared for the future changes. In addition, there is a large interaction of ASHRAE with the code authorities and government to incorporate these standards and guidelines. The series of sessions in this track highlight the changes to the standards and guidelines, their projected path and optimum design techniques to meet or exceed the standards.

TC4.7 Data-Driven Models Subcommittee
Wednesday; July 15, 2020, 3:00 PM–4:00 PM CDT
Location: Virtual Meeting

Agenda:

7:30 Call to order / Introductions / Changes to the agenda

- Call to order at 3:01 PM CDT

7:40: Upcoming Due Dates (5 minutes)

- Winter Meeting 2021 (Chicago, IL – January 23-January 27, 2021)
  - Monday, August 3, 2020: Website Closes for Seminar, Workshop, Forum, Debate, and Panel Proposals
  - Monday, August 17, 2020: Final Conference Papers Due - Submitted for Review (Includes Bio, Learning Objectives and Methods of Assessment); Request for Conference Paper Sessions Due
  - Monday, August 31, 2020: Conference Paper Accept/Revise/Reject Notifications
  - Monday, September 14, 2020: Revised Conference Papers/Final Technical Papers Due
  - Monday, September 21, 2020: Conference and Technical Paper Final Accept/Reject Notifications
  - Monday, October 5, 2020: Seminar, Workshop, Forum, Debate, and Panel Accept/Reject Notifications

7:45: Research: Work Statements / RTAR's (30 minutes)

- Current Work Statements/RTARS
  - Update on WS 1763 – Development of an Improved Toolkit for Analyzing Building Energy Use from Time Series Data: Update to the Inverse Model Toolkit. (Balbach, Koran, Haberl)
    - Jeff: Does not know if WS is active. May need to get back RTAR. 20 years old, no software built around it. Update language from FORTRAN. Stay at the toolkit level.
    - Chris: LBNL gave a talk on the BETER framework.
    - Clayton: Maybe related to the RTAR that follows up to the Kaggle Competition
    - Neal: ASHRAE has been funding some of the code to open source.
    - Villa: Sometimes benefit to staying in compiled languages
  - WS 1898 - Enhancing Whole-Building Calibrated Simulation Using Indoor Environmental Data (Kim)
    - "The team met and discussed the comments we got from the RAC and currently look at how to address them in the WS (especially the comment related to high budget while including empirical validation in addition to analytical validation). Thus, it is not yet ready to be presented in this annual meeting."
- Kaggle Competition Update (Miller, Balbach)

- ASHRAE Scientific Journal accepted paper on the competition and winning solutions.
- Seminar held for virtual meeting. Still have access to view.
- RTAR XXX - Building Energy Data-Driven Prediction Modelling Toolkit
    - Potentially Combine WS 1763 with this RTAR?
    - Jeff: distinction between monthly and interval use cases. Test datasets are needed. RP 1063 might also be a candidate. Jeff suggest to keep separate except maybe a couple functionality. Has a lot of momentum to get through RAC.
    - Chris: Tools need documentation and validation.
    - Clayton: Proposed RTAR is to have the test and train data
    - If moving forward, WS 1763 needs to be explicitly different than this RTAR.
    - Action Item: Clayton, Jeff, Tony to talk about the differences between WS 1763 and this RTAR.
    - Clayton: Make analysis workflows (ex: notebooks), tutorials.
    - Tim: RTARs should not have full work plan. RAC is working on procedure for funding publications.
    - Jeff: Suggests a PTAR might be an option.
    - Tim: Could just go to work statement.
    - Action Item: Bring up at full meeting for a vote.

- Kamel: Suggestion to try ML algorithms perform with synthetic software.
    - Jeff: Has compared different modeling approaches and compared coefficients.
    - Ron: To use synthetic data as ground truth.

- IEA EBC Annex 81 Data Driven Smart Buildings

- New Research Topics

Potential RTAR Topics		
RTAR Title	**Champion(s)?**	**Status/Notes**
Determining when a building's behavior have changed, Re-baselining	Bass Balbach Added: Juan-Carlos	Important for EPC projects. Keep on list. Juan Carlos interested to help get going DROP FROM LIST
Data-driven clustering methods	C. Balbach K. Haddad	Updates: Fits into/augments the Kaggle. Keep on list. Probably Addressed in Competition winner solutions. Might remove after next meeting.

Fully automated inverse models for building energy predictions		Covered by Clayton's RTAR. REMOVE.
Best practice of using machine learning models for building energy predictions	C. Miller A. Fontanini	Jeff. Literature review also needed not just competition. Villa: Clear documentation. Action Item: A Fontanini, Miller, Balbach to have follow up call.

8:15 Discussion of Program (15 minutes)

- Annual Meeting (Austin, TX - Virtual) Review
  - Related Program Information
    - Seminar 12: Winners and Winning Solutions from the ASHRAE Great Energy Predictor III Machine Learning Competition
    - Debate 1: Technical Consultants aren't 'Designers of Record,' so No E&O Insurance is Needed
    - Seminar 60: Modeling and Optimization of Sustainable Communities
    - Seminar 69: Am I Resilient? Using Building Energy Models to Assess the Resilience of Buildings and

Winter Meeting 2021 (Chicago, IL)	
Track 1:	HVAC&R Fundamentals and Applications
Track 2:	Systems and Equipment
Track 3:	Refrigeration and Refrigerants
Track 4:	Environmental Health Through IEQ
Track 5:	Building Performance and Commissioning for Operation and Management
Track 6:	Energy Conservation
Track 7:	International Design
Track 8:	Standards, Guidelines and Codes
Track 9:	Mini-track based on Chuck Gulledge's Presidential Theme (to be announced and not accepting papers)

Potential Session Topics				
Meeting	**Session Type**	**Session Title**	**Tentative Session Chair(s)**	**Speakers**
	Seminar	Predictor Shootout III: Data-Driven model selection considerations	C. Miller	
	Seminar	Predictor Shootout III: Data cleaning, lessons learned	C. Miller	
	Seminar	Are you normal? - REMOVE	L. Wang R. Muehleisen - Remove	Qi Li

8:30: Handbook: (15 minutes)
8:45: New Business (15 minutes)

Balbach – TC 4.7 may eventually need to have a 140 for DDM.

- Ron: ANSI Standard
- Action Item: Schedule a follow up call.

9:00: Adjourn
Adjourn 4:03

Multi-Scale Building Energy Modeling (MBEM) Subcommittee of TC4.7

Agenda

Austin Virtual Meeting

Thursday July 16, 2020

1:00-2:00pm CDT

NOTE: Make sure to Register for the GO TO Webinar that has been distributed by Chris Balbach via BaseCamp and List-Serv. You need to do this ahead of time to get the meeting link.

Introductions and Agenda Review (5 minutes)

- Sign-up sheet; **27 attendees.**
- Around Room
- Agenda Mods & Requests

Announcements (5 minutes)

- Call for Chicago Program
- Josh New reports that the roster has been corrected to show Judkoff as subcommittee chair for MBEM (not applications
- Chris Balbach: Status of ASHRAE TC Reorg. **Drop from the agenda**

Program (15 Minutes) (Brian Kastl)

2020 Summer (Austin Virtual) Status

- Title: Data Visualization to Achieve High Performance Design (Kolderup)? Did this happen?
  Drop in future (this is Stasio)
- Seminar 67: Back to the Future on High Efficiency Design and Operation. Was given virtually. The Q&A was live on 6/30/20. Peter Adams, Wahid Maref, and R. Judkoff gave talks. Fitsum Tariku chaired, and Paolo Tabares initiated. **This did not show as cosponsored by TC-4.7. MBEM chair needs to make sure that program proposals are filled out properly with TC-4.7 listed as sponsor or co-sponsor.**

- Did Ralph's Resiliency session happen (he was going to submit)?
  Ralph: A couple talks were given but not as a clear MBEM session. Brian Kastl: There was a session on Resiliency.
- Others?

To revisit

2021 Winter (Chicago maybe) Proposals

- Ralph submit V&U session for Chicago? (LBNL, ORNL, NREL, ANL). Is it ready yet?

Not ready

- Project Stasio IBPSA Erik Kolderup thinking to submit for Chicago?
  Remove: See above
- Joshua: (idea only – someone should lead) Empirical validation of multiscale buildings
  Keep on the docket until after chicago with focus on calibration
- Joshua (idea only – someone else should lead) What data layers contribute what value to a multiscale (no takers) model.
  - Hong, Muehleisen, Fontanini for Chicago? No Take off Docket.

- Tianzhen thinking of submitting something on "Performance Gap" for Chicago.
  - **Keep on docket until after Chicago**

Tianzhen: Seminar on new MBEM Chapter

- **Paulo Submitting for Chicago: Hybrid renewable energy resources analysis in rural communities using bottom-up demand prediction. Wangda Zuo. (came in after 4.7 mtng) Those interested to present, contact Paulo.**
- **Paulo: Energy storage optimization for multiple buildings (Possibly Ralph or Eric Kozubal @ NREL)**

BEQ: How Building EQ can work with BEMs. Status? (5min)

- John Pruitt
- Qinbo Li (boboannli@tamu.edu)

Research (30 minutes)

Status: Potential RTARS/Work Statements (5 minutes each max)

WS 1816. Load profiles for hospital imaging equipment. TC-4.7 voted to co-sponsor with TC-9.6 on May 10. Jeff Haberl volunteered for PES for this. This will stay in MBEM and not moved to SCM. Put out for bid, one proposal received. Evaluation of bid was positive. Recommendation put forward to RAC to accept. This has been awarded and is getting started. Haberl will be on the PMS.

PMS has had meetings with contractor. Good progress despite COVID-19.
Change title to 1816-RP for next meeting

RTAR approved by RAC. WS-1857 started by Neal Kruis and Tim McDowell. "Improved simplified methodology for describing and calculating heat conduction through the ground. TC-4.4 will co-sponsor. 90.1 and 4.1 are other potential co-sponsors. ACTION: Neal and Tim to work with Chris for an online/teleconference vote. Info sent out to full TC for comments.

Just got back comments from RAC. Mostly supportive--asking for clarifications. Plan to address comments in time for Aug. 15 deadline?
Letter ballot between meetings - no vote at next main meeting next week.

Approved by 4.7. Approved by 4.1. 4.4 mail ballot. 90.1 still needs to discuss. Neil and Tim will move forward with it if there is too much delay by 90.1.

APPS: WS-1730 “Research to Determine the Mass Flow Rate Correlations for Standard Venting Strategies & Components in Attic Spaces with Sloped Roofs”. Fontanini sent to RAC. Rejected. Response being formulated to RAC comments.

Fontanini needs to get comments from research chair to push it forward. It has been re-activated by RAC.

Ralph/neal/tim to follow up with Anthony and get in one and only one subcommittee docket.

Check with Jeff Haberl

- MBEM: Optimizing change-over mixed-mode cooling systems for houses, using building simulation (Liping Wang, Jeff Haberl, Kamal Haddad). Liping had to leave before the MBEM meeting. She is considering updating this WS.

  Needs to be resubmitted.
  No update from Jeff
  ACTION: Jeff to follow up with Liping

- RTAR-xxx, Toolkit for Passive Solar and Whole Building Simulations. Transys, Energy Plus. Make it independent from commercial software; like hvac01, and hvac02 toolkits. How to get to netzero. (Jaya; Montana State University) Jeff says this is under construction but is going slowly.

  No status update.
  ACTION: Jeff to follow up with Jaya.

New Research Ideas

Why we have to use different calculations for loads vs. whole building simulation. Chip Barnaby. (moved from SCM)

Action: Clear up if this is SCM or here and if this is a program item or an RTAR/WS idea

Future: meeting in this subcommittee to review BEQ results from RP 1771 when it’s complete. Balbach

Move out of research to status update/ related activities. Perhaps do this as a mid-year seminar

Model calibration for future weather climate change. Villa. RTAR half written. MBEM/DDM?

ACTION: Ralph to check Check with Daniel Villa on this

Jeff Haberl: Query of MBEM members on how many are doing MBEM (multiscale / urban scale). Send out a survey.

ACTION: Jeff to write a survey question - Ralph will get it out.

Ron: Idea for a research study to optimize passive house for more US climates and develop better passive house us specification. Is it needed?

Chris: Utilities are shifting away from reducing energy use to reduced demand. Is there a way to calculate avoided demand or shifted demand. Are there metrics?

Jeff: No document on clear method of how to check a simulation (base case vs proposed) Ron: this sounds a lot like 229. Jeff: this idea is more simple than that. Erik: Maria Carpman working with PNNL and developing a template.

- **Ron J: Need more Research topics from MBEM. Please brainstorm on this for next meeting. There is some confusion about what research topics are suitable for MBEM. All topics that used to fit into "Applications" still fit into MBEM.**

Updates on related activities (2 minutes)

- IBPSA Project: BIM/GIS and Modelica Framework for building and community energy systems design and operation
    - MODELICA Libraries, Building and City Models, Dissemination.

New Topics for Discussion (1 min)

- New 4.7 Handbook Chapter Submitted by John Pruett (applause).

Attachment 1: Tracks and Deadlines for Chicago (Jan 23-27, 2021)

Brian Kastl

SSPC 140 Meeting Summary – 16Jul2020 (submitted to TC4.7 7/21/20)

Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs.

Chair Announcements

- **ASHRAE 90.1 and 189.1 reference Standard 140;**
  - 90.1-2019, published Oct 2019, refs 140-2017 (except Sections 7, 8).
- **2018 IECC cites 140-2014;** IGCC citation accords with IECC.
- **ASHRAE 90.2-2018;** references Standard 140, Section 7
- **IRS rules** re the deduction for energy efficient **commercial buildings** require software used for assessing tax credits be tested as follows for projects placed in service:
  - On/after Jan 1,2016: test to 140-2014 (except Secs. 5.2.4, 7, 8) **13 progs (33 vers.) qualified; 1 new prog and 1 new versions since last Jan.**
  - On or before Dec 31, 2015: test to 140-2007, **13 programs qualified**.

  New submittals to ron.judkoff@nrel.gov.
  Qualified programs listed at http://energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions (Last check 08Jul2020).
- **RESNET or DOE list 4 (1 new prog since Jan)** (last check 08Jul2020 tools as either accredited for HERS ratings or "45L" tax credit compliance (DOE https://www.energy.gov/eere/buildings/list-approved-software-calculating-energy-efficient-home-credit). Required tests are Std 140-2011, along with equipment modeling and other modeling tests developed by RESNET. "45L" submit to DOE (45Lsoftware@ee.doe.gov) **Other submittals to RESNET** (http://www.resnet.us/professional/programs/software).

Building Thermal Fabric Tests Update (140, Section 5.2)

- Address advances in modeling state of the art since 1995
- Revisions to existing test cases and inclusion of additional excursion (parametric sensitivity) test cases are completed.
- 140-2017 Addendum A, building thermal fabric model test update
  - **Underlying NREL and Argonne Lab project final report to be published by Argonne Lab in August.**
  - **Addendum A publication/public review ended Jun 29 with no comments.**
  - Next steps:
    - Publish addendum (Summer/Autumn 2020)

New Title, Purpose and Scope (TPS):

- Editorial revisions to the original 140-2001 TPS that better align with the industry
- **New title: *"Method of Test for Evaluating Building Performance Simulation Software"***
- Next steps: Public review, ASHRAE to indicate when this will be.

Continuous maintenance revision

- On track for Autumn 2020 if no major comments on TPS.

New Test Suite: Weather Drivers

- Led by Tim McDowell
- Primarily a weather data transcription test, some model tests related to incident solar and humidity calculations
- In Round 2 of simulation trials.

Prioritization of Possible Test Suites to Develop after Completion of Building Thermal Fabric Tests Update (from Jun 2019):

- After polling the PC members we concluded that four test suites can be given the highest priority by the PC members, these include (in alphabetical order):
  - Airside HVAC BESTEST Volume 2
  - Update of HVAC BESTEST cases applying empirically determined performance maps
  - Weather-Driven Infiltration and Natural Ventilation
  - Weather-Drivers (in progress, see above)

Update of Section 5 to include elements of Section 7 tests is also under consideration. This would allow deletion of Section 7 tests which are approaching obsolescence as most residential models are directly applying hourly simulation engines.

The following test suites also remain under consideration:

Empirical Validation Tests

- New DOE "Validation and Uncertainty" project tests
  - LBNL Flexlab test cases
  - ORNL FRP test cases
- NREL indoor/outdoor apartment module tests
- "ETNA BESTEST" Empirical Validation Test Spec (JNA, Electricite de France, NREL)

Other Analytical Verification and Comparative Tests

- IEA-34/43 Multi-Zone Test Suite
- More Ground-Coupled Heat Transfer Cases
- 2/3-D conduction cases (e.g., window frames and thermal bridges)
- ASHRAE RP-1052 "Development of an Analytical Verification Test Suite for Whole Building Energy Simulation Programs – Building Thermal Fabric
- Domestic Hot Water
- Standard 205 Performance Map Tests

Empirical Validation: Work sponsored by DOE is in progress. Experimental data is being developed along with simulation results for comparison with empirical data. The participating labs are LBNL (Kohler, Haves), ORNL (Im, New), NREL (Judkoff) and Argonne Lab (Muehleisen)

- Continuation of original 3 year project
- Data gathering and reconfiguration efforts are slowed down by Covid-19 restrictions
- Uncertainty analysis:
  - Argonne's analysis applied to differentiate test case quality (ability to simulate)
- A new project in this is NREL's indoor/outdoor apartment module that allows empirical determination of exterior wall conductance related inputs, which is difficult to determine without the controllable environment that is possible by initially running experiments indoors.
- Another new project is Argonne/JNA for mining ETNA BESTEST data. The data was originally collected by Electricité de France (1999-2001) under guidance of J. Neymark & Associates and NREL.

Empirical validation (where program results are compared to empirical data) is much more difficult than comparative testing (comparing software to each other) or analytical verification testing (comparing program results to analytical solution results developed outside of whole building energy sim progs). This is because test specifications are more complex (real experimental facility versus idealized analytical verification or comparative tests for simplicity of input) and inputs must be empirically determined (in addition to the target output results)**.**

Referencing of 140-2017 in 90.1-2019 (from Jun 2019):

- SSPC 90.1 has updated via addendum their reference of 140 for 90.1-2019 to 140-2017

90.1 ECB/140 collaborative software acceptance criteria working group

- Primary objective is to develop acceptance criteria for 140 test results.
- Monthly web meetings
- Work on referencing language and statistical criteria is in progress.

In Orlando (Feb 2020), SSPC 140 voted unanimously to endorse continuation of the ECB-140 working group that will provide proposals to:

- Amend Standard 140 to include a normative section with a methodology and all necessary thresholds to assess BEM software using the existing test cases, and
- Amend Standard 90.1 Section 11, Appendix C, and Appendix G to include a reference to the new normative section of 140 using simple numeric criteria to determine what software can be used.

Standard 140 DOE Stakeholder Meeting:

- Meetings are run by DOE/Argonne Lab
- Agenda: Working with stakeholders to develop acceptance criteria for use with Standard 140, automation of test suites (output and input), 140 users' manual, and prioritization of new test suites
- 1st Stakeholder meetings in March and April generated good feedback
- Future meetings will focus more on individual topics
- Contact ashrae140@anl.gov for info and invite.

References to Standard 140. Standard 140 is referenced by:

- IRS, Standard 90.1
- Standard 189 (High Performance Green Building Design) Appendix D
- Standard 90.2-2018 references Section 7 tests (adapted from HERS BESTEST 1995)
- IECC, IGCC
- RESNET references Section 7 tests.
- Florida Building Commission
- The developing COMNet (BPI, Energy Foundation et al) User's Manual.
- Implicitly referenced for ASHRAE Building Energy Quotient IF that is based on the COMNet User's Manual;
- Various international references.

Listing of test suites included in ANSI/ASHRAE Standard 140, Analytical Verification Tests and Comparative Tests (year added to Standard 140 in parenthesis below.)

- NREL/IEA 12/21 "IEA BESTEST", building thermal fabric comparative tests (2001)
- NREL/IEA 22 "HVAC BESTEST Volume 1", working-fluid side analytical verification tests (2004)
- NREL/IEA 22 "HVAC BESTEST Volume 2", working-fluid side comparative (2007)
- NRCan/IEA 22 "Furnace BESTEST", analytical verification and comparative (2007)
- NREL/HERS Council "HERS BESTEST", comparative tests, simplified residential analysis tools (2011)
- NREL/IEA-34/43 "Ground-Coupled Slab-On-Grade In-Depth Tests", analytical verification (2014)
- ASHRAE RP-865 "Air-Side HVAC BESTEST, air-side mechanical equipment analytical verification tests based on ASHRAE 865 RP (2017)

Full SSPC 140 meeting notes are available at
https://3.basecamp.com/3106353/buckets/2566706/vaults/2856796276**.**