



AGENDA
ASHRAE TC 4.7 ENERGY CALCULATIONS – MAIN MEETING
GEORGE R. BROWN CONVENTION CENTER, LEVEL 3,
ROOM 370 A, B, D, E
HOUSTON, TX
TUESDAY, JUNE 26 2018, 6:00 PM – 8:30 PM

“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. (See full Code of Ethics: <https://www.ashrae.org/about-ashrae/ashrae-code-of-ethics>)”

MOTIONS

Approve Chicago Draft Meeting Minutes, 9-0-0 CNV

Approve to sponsor great predictor shootout III on Kaggle, with 1.5 co-sponsoring, 9-0-0 CNV

Approve Atlanta program submissions, 8-0-0 CNV (one VM had to leave)

ACTION ITEMS

RP 1661 chiller control strategy online PMS (Cockerham to organize)

Mail in ballot for vote to cosponsor WS1730 (Balbach to call vote)

Mail in ballot revote to sponsor WS1748 (Balbach to call vote)

6:04 Meeting called to order

1. Roll call and introductions (5 minutes)

Abushakra

Bass recites Code of Ethics commitment at the top of this page.

Introductions then call of VM.

Balbach call of voting members :

Malcom Cook absent,

We have 10/11 VM present, we have a quorum

2. Accept agenda & approve minutes of previous meeting (10 minutes)

Abushakra

Chris, Tony Second

Bass asked for changes to agenda. None put forward

Agenda approved

9-0-0 CNV

Dru moved, Joshua seconded

Joel N. asked if the SSP 140 minutes would be attached. Ralph explained that those are attached as appendices with the approved main meeting minutes. The vote is only for approval of main meeting minutes.

Motion approved 9-0-0 CNV

3. Announcements/Liaisons (5 minutes)

Abushakra

Dennis Wessel Section 4 Liaison

You can get a roster, from member, go to profile, you can see your list of committees and from there you can download a full roster.

Any use of the letterhead outside of the society needs approval of ASHRAE and president

There is info on the website for the Hightower or Research award nominations.

ASHRAE's 125th anniversary coming up. Historical programs for Orlando and Austin are being reviewed. Historical programs for KC are already full.

Proposed name change from "buildings" to "built environment" will be voted on tomorrow morning by TAC

Mike Pouchak research Liaison.

A TC chair, a Project monitoring sub committee (PMSC) chair or member all have to view the video on PMSC responsibilities. Copy Mike on minutes and correspondence for PMSC, WS and RTARs. There is an initiative to make sure all the WS have progress milestones that are clear.

Thank you to our research chair for attending breakfast. PMSC are not private, they are public so meetings should be scheduled and get on the program if being done at the conference. Submit with the room requests. If you do things online make sure that they are publicly announced via TC mailing list or website so others can attend.

Mike is setting up a Section 4 Research Basecamp to aid in exchange of documents.

- Program Submittals:
 - o Talk to the Track Chair before submitting
 - o Conform to one of the Tracks
 - o Physics vs new technology: interest of audience (declining programs). Show new technology used.

New technology attracts people and so those are more likely to be accepted.

- o Propose a Track to CEC, for Atlanta (Winter 2019) and Beyond.

Need to update this to remove Atlanta

- 2019 ASHRAE Winter Conference in Atlanta:
 - o Conference Papers are due July 9
 - o Seminar, Forum, Debate, Panel and Workshop proposals are due August 3
- 2019 ASHRAE Annual Conference in Kansas City:
 - o Conference Paper Abstracts, Technical Papers and Paper Session requests due August 21
- 125th History in a couple of years (Historical Committee). TC's can organize or sponsor a program session for the 2019-2020 meetings.

Jeff: We have 5 papers for KC. Looking for papers for Orlando and Austin. Papers need to look back 20-30 years

- Cc cEmergency Rosters can be submitted anytime during the year so that changes in subcommittees or other positions can be made official on the rosters (instead of waiting till after July 1).
- Review the TC1.4 (Controls Fundamentals and Applications) proposal for a new Special Publication (document distributed to TC4.7 memberships) and forward your comments to Chris Balbach, incoming TC4.7 Chair.

Jeff asks that we all please read its only 1 page.

- Nominating ASHRAE Fellows: Haberl

Jeff we do not have enough fellows given the size of the committee. Jeff agrees to act as a clearing point to make sure we are not duplicating. He especially asks fellows to make some nominations.

4. Membership (5 minutes) Abushakra

- By the Manual of Procedures, the maximum number of voting members on a committee is 18. However, the drawback of a high number of VM would be the quorum in meetings.
- We currently have 11 Voting Members.
- Neil Krus will roll off on July 1 2018

Ralph asked about how long until he's back on. Bass said the plan is to bring him back after 1 year off

- Joe Huang and Antony Fontanini will roll on, on July 1 2018
- Hyojin Kim will be promoted to Voting Member on July 1 2018
- This will bring the Voting Members count to 13, on July 1 2018
- Bass Abushakra will chair the Program Subcommittee for 1-year term (2018-2019).
- Provisional Corresponding Members should go to: Onebuilding.org, to Subscribe to the TC4.7 Mailing List (TC47-L). Once subscribed, PCM, will stay up-to-date with the TC4.7 business.

Bass: The TC officers are supposed to review and promote from PCM to CM. They look for regular activities and attendance.

We should have a discussion of keeping onebuilding email list vs basecamp at next meeting.

5. Subcommittee reports

5.1 Multiscale Building Energy Modeling (10 minutes)

Judkoff

26 attendees. Name changed from applications to MBEM

Several sessions not submitted to Houston. V&U session will be submitted in Atlanta. Airside HVAC BESTEST (Ron and Joel, Ralph with submitting) Joshua will submit Urban Scale Session 9. In KC Erik K will submit something on IBPSA Project STASIO

In Houston, Urban 8 took place. Std 209 session took place with Erik. RP 1588 session.

WS: 1813 Attic Duct Systems got rejected again. Jeff and Mini will update
NK and TM will submit ground heat transfer for the August meeting

5.2 Data-Driven Modeling (10 minutes)

Fontanini

DDM met 7:30-9, 16 members attended.

Very large and extensive discussion about how to teach energy building simulations, could be a series.

Members of DDM are discussing bringing back the great predictor shootout but do it on Kaggle

We want to go here and get some fresh ideas to DDM. Are there people not at the DDM subcommittee meeting who want to help coordinate? Ralph, Neal, Sagar, Tony said yes.

TC 1.5 will co-sponsor if TC 4.7 will sponsor.

MOTION: Approve sponsor great predictor shootout III on Kaggle.

Dru move to sponsor.

Chris second

9-0-0 CNV

5.3 Simulation and Component Models (10 minutes)

Huang

No program ideas – all research ideas. The WS and RTAR ready will be discussed later by Jeff

Here are things not ready for voting but looking for full TC interest

RTAR 15xx TC 5.5 wants us to co-sponsor. Chip Barnaby

BIM to BEM, Jeff is interested Sagar will work with

Improving van coils, PC Thomas initiated. Peter Lyons said that PC is still interested and that it should stay on docket.

New RTAR from TC 1.4 Optimizing control of DOAS. Just brought up to 1.4. They will likely as 4.7 to co-sponsor since simulation. Joe will upload the RTAR to basecamp to vote on co-sponsorship.

New research area: Moisture transport and transfer in buildings. This can be handled by dedicated programs but there might be a better need to do that in more complete simulation.

5.4 Research (15 minutes)

Haberl

5.4.1 Research Projects

- Upcoming RTAR's and WS's submission to RAC dates:
 - August 15: for RAC Fall meeting consideration
 - December 15: for RAC Winter meeting consideration

Communicate with both Jeff and Mike Vaughn. Make sure you let Mike review before you submit.

- Completed Projects
 - Update of any.
- Awarded Projects
 - 1741-RP, "Understanding Fan Coil Components and how they relate to Energy Consumption and Energy Modeling"; Responsible Committee: TC 5.3 (Room Air Distribution); Co-sponsoring TCs: TC 4.7. Neal Kruis is a member of the PMSC. RP was awarded to ULA-Lafayette and Baylor. One of the outcomes is a Standard 205 representation of FCU's. Latest update (Neal Kruis).

Kruis: Big experimental component. This is going well. They are having a bit of a challenge on the modeling needs. One outcome is a draft specification for Standard 205.

- 1661-RP Development of Near-Optimal Control Sequence for Chiller Plants with Water Side Economizer using Dynamic Models (PES Report). Project moved from U. of Miami to Colorado. PMSC met on Sunday afternoon for

about an hour and a half with a full attendance from the reviewers and the contractor was resent with two people. They reviewed progress to date including reviewing an updated report sent to PMSC late last year. They reviewed the technical issues surrounding the 5 tasks identified for their project. The contractor is making good progress. Their next review of the report is scheduled for late February 2018, with a conference call / web meeting right after this. Latest update (Keith Cockerham).

1661 chiller control strategies did not meet. They will do online.
ACTION ITEM: Keith to make sure that this is clearly advertised.

- Approved RTAR
 - 1763-RTAR, "Development of an Improved Inverse Model Toolkit (RP1050) and Diversity Factor Toolkit (RP1093) for Analyzing Bldg Energy Savings from Time Series Data" (RTAR accepted July 29, 2015). Author (Haberl). A WS was written taking into consideration the comments the authors received on the RTAR. Sent to ASHRAE and was added to the draft agenda for the RAC 2018 Spring Meeting for consideration by the RAC Chair for inclusion. Chris Balbach, Ralph Muehleisen, and Tony Fontanini agreed to serve on the PES if the WS is approved.
 - 1816-RTAR, "Reporting the Energy Use and Heat Gain from Imaging Equipment". Responsible Committee: TC 9.6 (Healthcare Facilities); Co-Sponsors: None; Status: Accepted with comments. Developed into a WS. Contact Glenn Friedman (gfriedman@taylor-engineering.com) if interested in serving on the project evaluation and project monitoring committees once the WS is approved by RAC. Latest update (no update from 9.6 so far).

This was accepted by RAC, Jeff will be on PES and PMS.

- Approved WS
 - Update if any.
 -
- Returned WS with Comments
 - 1748-WS, "Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations - Phase 2". Authors (Huang and Fontanini) DDM Update

Tony: Comments back from RAC. Tony sent out last night. Needs to get to RAC by Aug 15 deadline. Comment of RAC. Wanted a revote because it did not have a lot of people voting. Joe recommends using doodle poll.
ACTION ITEM: MAIL VOTE

- Rejected RTAR to be Revisited
 - 1813-RTAR, "Development of an Accuracy Test Method for Residential Attic Duct System Simulations in Whole-Building Energy Simulation Programs". (Mini). The RTAR passed vote by 4.7 for resubmittal, and was submitted for the RAC 2018 Spring Meeting.

Jeff: Jeff will work with Mini to try again. Joshua will help too.

- WS, RTAR, Requests for Co-sponsorship
 - Update if any.
- New RTAR
 - XXXX-RTAR: Interested DDM members in the Occupancy Modeling, can cooperate with the MTG-OBB. contact Bing Bing Dong (Bing.Dong@utsa.edu) and Burak Gunay [<mailto:burakgunay@cunet.carlton.ca>]
 - XXXX-RTAR "Improved simplified methodology for describing and calculating heat conduction through the ground". McDowell and Kruijs. MBEM and SCM had some comments and recommended that it get submitted with those changes. Latest update.

Getting review from Mike Vaughn and then will be submitted for Aug review.

- o XXXX-RTAR "Toolkit for Passive Solar and Whole Building Simulations". The tool will be independent from commercial software; like hvac01, and hvac02 toolkits. How to get to netzero". Lead author is Montana State University. Latest update.

No progress keep on list

- o XXXX-RTAR "Merged HVAC01, HVAC02, Loads toolkit". Lead author TAMU. Haberl and Muehleisen. Jason Glazer expressed interest in this RTAR and suggested some script languages to be used. Latest update.

No progress Keep on list

- o XXXX-RTAR "Occupancy-based thermostats". Hyojin Kim has some ideas towards a useful RTAR from some recent work done in D.C. Latest update (potential overlap with an approved RTAR by Rob Hitchcock).

Keep on list.

- o XXXX-RTAR: "Baseline Modification when a Building Behavior Changes". Carlos B., and Bass A. from DDM, and 2 members of MTG-OBB will write the RTAR. Latest update.

Keep on list

- o XXXX RTAR: Better modeling of night time heat exchange. EnergyPlus and DOE2 were both wrong in an LBNL simulation of Flexlab, and the cause is not clear. Talk with Joe or Phil Haves to help develop an RTAR. (SCM subcommittee).

Keep on list

- o XXXX-RTAR: Water simulations; cooperation with TC6.6.

There is further discussion on another one with TC 7.6, related to submeter and water modeling.

Vote to co-sponsor 1730 by mail ballot.

ACTION ITEM: MAIL VOTE

Joe: XXXX-RTAR. Joe w/ Neal. This would be research to compare simple, detailed, and detailed out of RP1588. Comparing this for energy differences across many buildings and regions. This is not a big project (only \$25k or so). Joe thinks this can probably be written directly as a WS. Jeff wants to try to get 1588 results and tool put into code (90.1) and other standards like 189.1. PNNL has a similar tool that is used in the modeling of code changes but the code itself doesn't require it.

Sagar will take this back to 4.5 for co-sponsorship. Peter Lyons (one of the RP1588 contractors) is putting together a paper for Rome IBPSA and wants to coordinate the research.

Jeff: In MBEM we discussed need to model new buildings. Add to list

5.5 Handbook (10 minutes)

Pruett

Handbook met with 11 attendees and 2 new attendess.

Discussed proposed new topics for the next cycle and gathered volunteers for writing sections

Schedule for finalizing scope of revision will be done in atlanta

John said committee will begin using Basecamp

5.6 Program (15 minutes)

Cockerham

- o Endorsement of Optimization in HVAC&R Track for 2019 (supported by DDM and SCM. Prepare Seminar and Technical Session Papers.
- o

Keith: In KC there is a whole modeling track

- o Houston, June 2018
 1. Sunday 8:00AM – 9:30AM, Seminar 3, New Advances in Simulating Fenestration Systems. Sponsor: 4.7 Energy Calculations. Chair: Jeff Haberl. 3 Seminars with Speakers: Kruis, Barnaby, and Huang.

Joe Huang: Speaker order was worst possible order. They asked the order to be changed the day before and it was no problem to change.

Jeff: In the future get the slides in on-time but bring it with you too. The computer server crashed without a backup plan. All the presenters were able to load them at the computer.

Attendance was low (about 20 in audience).

2. Sunday 11:00AM – 12:30AM, Seminar 16, Urban-Scale Energy Modeling, Part 8. Sponsors: 1.5 Computer Applications, and 4.7 Energy Calculations. Chair: Joshua New. 3 Seminars with Speakers: Nagpal, Hong, and Cox.

Joshua: USEM went well. These sessions talks have mostly been about methodologies (how to create and run lots of buildings). This was a first one to talk about use/implementation of results.

3. Monday 3:15PM – 4:45PM, Seminar 22, New ASHRAE Standard 209 on Simulation Aided Design for Buildings. Sponsor: 4.7 Energy Calculations, and SPC 209. Chair: Erik Kolderup. 5 Seminars with Speakers: Glazer, Menchaca, Denson, Brophy, and Dunn.

Erik: Pretty good attendance with an intro to study and the others were case studies. We need to “hone the elevator pitch”

- o Atlanta, January 2019, and beyond

Beyond

1. Historical Committee (Seminar. Haberl)

Beyond

2. Aging Grid and Power Lines Reaching Normal Rating Capacity – Load Growth Projection Modeling (Seminar. DDM Subcom. Abushakra)

Presented at Houston. Drop.

3. New Advances in Simulating Fenestration Systems (Seminar. SCM Subcom. Haberl)

Drop

4. Data Visualization (Seminar. Application Subcom. Balbach)

Beyond

5. What does the difference between data driven models and measurements mean? (Seminar. DDM Subcom. Chair)

Beyond

6. So you think you're Normal? Many regression models assume normal distributions (Seminar. DDM Subcom. Fontanini)??

Beyond

7. How to remove outliers from data before using DDM (Seminar. DDM Subcom. Chair. Potential Speakers: Bass, Chris B., Carlos B., using data from Cornell U)

8. Service water heating co with TC 6.6. Chair Jim Lutz (jdLutz@hotwaterresearch.net). This is to spur a discussion between modelers and those who use related design systems. How to validate such a model.

Jim Lutz reported they tried to get a Forum for Houston. Didn't get accepted. It got tossed out because the full forms were not filled out completely.

Asking for Vote for Co-sponsorship again

Move to KC.

9. Seminar on VRF with TC8.7 (Balbach)
10. Standard 140 Seminar (Ralph, Ron, Joel)
11. Airside HVAC Besttest (Ralph)
12. Other Ideas??

Program for Atlanta:

Validation and Uncertainty Seminar 4 speakers

Standard 140 Airside HVAC BESTEST Seminar 2 speakers

Service Water Heating Forum (co with 6.6)

Multiscale Building Energy Modeling, Part 9

Chris moved, John seconded
8-0-0 CNV, Dru absent

KC

5.7 Historical (5 minutes)

- Historical Committee - 125 Anniversary.

Haberl

5.8 Standards (15 minutes)

- SSPC 140 SMOT for Evaluation of Building Energy Analysis Computer Programs

Neymark

Neymark

Joel:

New Standard 140-2017 Sold out by 2pm on Sat.

Referenced by a number of standards. 9 programs qualified for 179D, (used to be 13). 27 people attended (record attendance). Revision to referencing 140 by 90.1 have been approved by SSPC 140 and by 90.1 committees.

Finishing thermal fabric test update. Range of disagreement is decreasing as the tools and test spec are improved.

Making progress on prioritizing new test suites for inclusion or updating.

Ron :V&U is short for empirical validation of computer simulation programs. We don't have empirical tests (yet) in the standard because it's really hard to lock down inputs and have a very controlled experiments. DOE is funding labs to generate some new data: LBL (flexlab), ORNL (FRP), NREL has performance maps of high efficiency equipment for updating several test suites. The project update was presented with information for 140 to "chew on" and help them prioritize inclusion of data

- Internal Revenue Service Section 179D Tax Deductions – Citation of Std 140 Judkoff
- SPC 205 Standard Representation of Performance Simulation Data for HVAC and Other Facility Equipment Barnaby

Chip: About to go to public review, hoping public review draft ready by August. Efforts to implement the standard are underway as well.

- SPC 209P Energy Simulation Aided Design Kolderup

Erik: 209 is in the bookstore. Now we need to spread the word on getting people to begin use it. Contact Erik if you have ideas on how to market it.

Bass: Erik and Bass have been looking at a subcommittee for 209. Erik wants this to be on the 4.7 docket to ensure that there is a place to discuss ongoing use and promotion. It might be appropriate to find a home within MBEM.

5.9 Web Site (5 minutes) (<https://tc0407.ashraetcs.org/>)

New

Joshua: Web site has been updated. Minutes date from 1995. Upload things to basecamp and Joshua will move to web page. Website is TC47.org

6. Related activities reports (10 minutes)

SPC 191 Standard for the Efficient Use of Water in Building and Mechanical Systems

No report

MTG O&MEE Operations and Maintenance Activities That Impact Energy Efficiency

Need to check if it still exists

MTG OBB Occupant Behavior in Buildings

Bass: This is very active MTG. This might turn into a TC

MTG.BIM Building Information Modeling

Jeff: Continuing along trying to get standardized methods for BIM and get other models from BIM

Rob Hitchcock is Working on a WS. There is a follow-n project to 1468 announced.

MTG ACR Air Change Rates (Contact Dennis Knight to join this MTG)

Check it it exists

TC 2.8 Building Environmental Impacts and Sustainability

No report

TC 4.1 Load Calculation Data and Procedures

No report

TC 4.2 Climatic Information

Joe: Updating climactic tables with every cycle of the handbook. New WS approved to update handbook in 2021 will go out in fall. Ongoing project to evaluate reanalysis data with a program item. Reanalysis: Using climate

forecast models to run them in a retrospective mode (i.e. get historical data). This gives you more “historical” data throughout the atmosphere. The project is to review how good these data are. Project is halfway through. They have calculated design tables and are comparing them. They will now be looking at a massive amounts of full historical hourly data.

Another approved RTAR on evaluate ASHRAE design day procedure against historical data. Will be turned into WS

TC 4.3 Infiltration & Ventilation Requirements

No report

TC 4.5 Fenestration

Sagar: RP1710, effects of dynamic shading on daylighting and energy savings

TC 6.5 Radiant Heating and Cooling

No report

TC 7.5 Smart Building Systems

No report

TC 7.6 Building Energy Performance

Jeff: Looking at a name change of Energy and Water Performance. Completed RP1702. Liping Wang. Looked at case studies of applying all 3 levels of performance metric protocols. Problems with some end-use measurement. Presentations made at this meeting.

To add to list for next time

TC 1.5 Computer Technologies – changing name to Emerging Technology Applications

TC 9.12

BuildingSMART (formerly IAI International Alliance for Interoperability)

No report

IBPSA: USA, Canada, World

Erik: IBPSA-USA had dinner. Will have again in Atlanta. SimBuild is in Chicago Sept 24-26 2018. Nominations for IBPSA-USA awards are open.

Chip: World: Building Sim 2019 is in Rome. Call for abstracts due July 20. Buildingsimulation2019.org

BPI-2400-S-2011 Standardization Qualification of Whole-house Energy Savings Est.

No report

Guideline 14

Jeff: Met on Sunday, Working to update the guideline. Moving slowly. Section in guideline 14 that uses calibrated simulation should be of interest to 4.7. Contact Jeff if you want to get involved.

IEA Annex 60 Modelica for Building Simulations

Annex 60 is closed.

Michael Wetter: IBPSA Project 1 is going on from Annex 60. 5 year projects developing modelica libraries, and BESTEST for building optimization and control sequences. Next meeting in Paris on Oct 1 and 2.

First Modelica conference at MIT. Oct 7. There will be training

IEA Annex 66 Occupant Patterns

Annex 66 is completed. Jim Lutz and Michael W; This is being continued by Annex 79.

7. Awards Nomination

2018-2019 Hightower Award: Nominations due to Section head by September 1, 2018

To Dennis Wastle

2018-2019 Service to ASHRAE Research Award: Nominations to RAC Liaison by September 1, 2018

8. Old Business

Abushakra

9. New business

Abushakra

- Assigning a Liaison to Std 90.1 (Interpreting Chapter 11 and Appendix G for energy modelers)

Jeff is U-liaison

Neal First, Jeff second.

RESOURCES

DEADLINES

2019 ASHRAE Winter Conference in Atlanta:

<http://www.ashrae.org/atlanta>

- a. Conference Papers are due July 9
- b. Seminar, Forum, Debate, Panel and Workshop proposals are due August 3
- c. Program notifications go out September 14
- d. Web site opens for presentation uploads on November 30
- e. All presentations due online January 4, 2019

Atlanta, January 2019 Tracks

2019 Winter Conference Chair is Corey Metzger, corey.metzger@resourcece.com

Track 1: Systems and Equipment. Joe Firrantello, jfirrantello@gmail.com

Track 2: HVAC& R Fundamentals and Applications. Rick Hermans, herma015@umn.edu

Track 3: Refrigeration Sonya Pouncy, sonya.pouncy@gmail.com

Track 4: Construction, Operation and Maintenance of High Performance Systems. Leticia De Oliveira Neves, leneves@gmail.com

Track 5: Common System Issues and Misapplications. Lee Riback, lee.riback@gmail.com

Track 6: The Convergence of Comfort, Indoor Air Quality and Energy Efficiency. Ashish Rakheja, ashish.rakheja@aeonconsultants.in

Track 7: Building Integrated Renewables and Natural Systems. Maggie Moninski, maggie.moninski@gmail.com

Track 8: The Engineer's Role in Architecture. Ashu Gupta, ashu.energy@gmail.com

2019 ASHRAE Annual Conference in Kansas City:

www.ashrae.org/kansascity

- a. Conference Paper Abstracts, Technical Papers and Paper Session requests due August 21, 2018
- b. Conference Papers due November 30, 2018

Kansas City, June 2019 Tracks

2019 Annual Conference Chair is Carrie Anne Monplaisir, carrie.monplaisir@gmail.com

Track 1: Systems & Equipment in the Built Environment. Kimberly Pierson, kdpwildcat@gmail.com

Track 2: Fundamentals and Applications. Gary Debes, gary.debes@comcast.net

Track 3: Optimization in HVAC&R. Vikrant Aute, vikrant@umd.edu

Track 4: Commissioning New & Existing Buildings. Raul Simonetti, raul.simonetti@carel.com

Track 5: Occupant Health & Safety. Chris Reinders-Caron, creinders@cannondesign.com

Track 6: Modeling Throughout the Building Life Cycle. Nivedita Jadhav, nivi2307@gmail.com

Track 7: Professional Development. Rich Rose, richr@mticontrols.com

Track 8: Research Summit. Bing Liu, bliu@neea.org

Track 9: (Mini-Track): Radiant Heating & Cooling Mini-Track. Devin Abellon, devin.abellon@yahoo.com