

**SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING ENGINEERS,
INC.**
1791 Tullie Circle, NE / Atlanta, GA 30329
404-636-8400

TC/TG/TRG MINUTES COVER SHEET

(Minutes of all meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/TRG No. TC 4.7 DATE: June 27, 2017
 TC/TG/TRG TITLE: Energy Calculations
 DATE OF MEETING: June 27, 2017 LOCATION: Long Beach, CA

MEMBERS PRESENT	YEAR	MEMBERS ABSENT	YEAR	EX-OFFICIO MEMBERS &
Bass Abushakra (CHAIR)	2012	Kamel Haddad	2013	
Chris Balbach (VICE CHAIR)	2013	Malcom Cook	2012	See attendance sheet
Joel Neymark (Standards Chair)	2011			additional attendees
Wangda Zuo	2013			
Ralph Muehleisen (Secretary)	2013			
Erik Kolderup (Handbook)	2013			
Joshua New (Webmaster)	2015			
Dru Crawley (SCM)	2015			
Ron Judkoff (Applications)	2013			
Neil Kruis	2015			
Jeff Haberl (Rsch) - phone	2015			
Keith Cockerham (Prog) - phone	2013			

Total attendance of voting members: 10 present, 1 absent.

DISTRIBUTION

ALL MEMBERS OF THE TC/TG/TRG

TAC CHAIR	Walter T. Grondzik
TAC SECTION HEAD	Michael R. Bilderbeck
SPECIAL PUBLICATIONS LIAISON	
STANDARDS LIAISON	James Dale Aswegan
HANDBOOK LIAISON	David P Yuill
PROF DEV COMM LIAISON	Hugh D. McMillan
CHAP TECH TRANSFER LIAISON	Harris Sheinman
STAFF LIAISON (RESEARCH)	Michael Vaughn
STAFF LIAISON (TECH SERVICES)	Michael Vaughn
STAFF LIAISON (STANDARDS)	

HANDBOOK RESPONSIBILITIES

Year & Volume	Chapter Title	No.	Deadline	Handbook Subcom. Chair/Liaison
2017 Fundamentals	Energy Estimating Methods	19	June 2016	Pruett/Yuill

These minutes have been approved

**ASHRAE TC 4.7 Energy Calculations
Chicago Meeting**

MOTIONS AND ACTION ITEMS

MOTION: A motion passed to accept the minutes from Long Beach. 10-0-0 with Chair Voting

MOTION: Decision to co-sponsor WS-1769 Experimental Evaluation of the Efficiency of Belt Drives for Fans”, TC 5.1 Fans lead. 10-0-0 CV

MOTION: Motion to Approve Chicago Program. 8-1-0 CNV.

TC/TG/TRG MEETING SCHEDULE				
LOCATION – past 12 months	DATE	LOCATION - planned next 12 months	DATE	
St. Louis	June 2016	Chicago	January 2018	
Las Vegas	January 2017	Houston	June 2018	
TC/TG/TRG SUBCOMMITTEES				
Function	Chair			
Program	Keith Cockerham			
Research	Jeff Haberl			
Handbook	John Pruett			
Standards	Joel Neymark			
Data Driven Models	Anthony Fontanani			
Simulation and Component Models	Joe Huang			
Applications	Ron Judkoff			
RESEARCH PROJECTS – Current		Monitoring	Report Mode	
Project Title	Contractor	Comm.Chm.	At Meeting	
1661-RP Development of Near-Optimal Control Sequence for Chiller Plants with Water Side Economizer using Dynamic Models	U. of Colorado.	Keith Cockerham	Yes	
LONG RANGE RESEARCH PLAN				
Rank	Title	W/S Written	Approved	To R & T
HANDBOOK RESPONSIBILITIES				
Year & Volume	Chapter Title	No.	Deadline	Handbook Subcom. Chair/Liaison
2021 Fundamentals	Energy Estimating Methods	19	??	Pruett/Yuill
STANDARDS ACTIVITIES - List and Describe Subjects				
SPC 140 Standard Method of Test for Building Energy Software – Joel Neymark				
SPC 205 Data Exchange Protocols for Energy Simulation of HVAC&R Equipment Performance - Chip Barnaby				
SPC 209 Energy Simulation Aided Design – Jason Glazer				
TECHNICAL PAPERS from Sponsored Research - Title, when presented (past 3 yrs. present & planned)				
Appendix 3				
TC/TG/TRG Sponsored Seminars - Title, when presented (past 3 yrs. present & planned)				
Appendix 4				
TC/TG/TRG Sponsored Forums - Title, when presented (past 3 yrs. present & planned)				
Appendix 5 – NONE				
JOURNAL PUBLICATIONS - Title, when published (past 3 yrs. present & planned)				
None				

Attendance

Below is a complete listing of attendees at this meetings. Voting members are listed in the last column by VM.

Present at Meeting								
Long Beach Jun' 2017		Las Vegas Jan 17						Status 06/17
YEA5	Non-YE	YE	Non-YE	Last Name	First Name	Affiliation	E-mail	VM, CM, PCM, Visit
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Appendix 1

TC 4.7 ENERGY CALCULATIONS RESEARCH PROJECTS STATUS (JAN 23, 2018)

Active projects

#	Title	Joint TC	Cog SC/ Contractor	PMSC	Dates / status
1661-RP	Development of Near-Optimal Control Sequence for Chiller Plants with Water Side Economizer using Dynamic Models		U. of Colorado	Cockerham	Cockerham reports that PI moved from U. of Miami to U. of Colorado and contract moved with PI. Project is making good progress.

Completed projects

#	Title	Joint TC	Cog SC/ Contractor	PMSC	Dates / status
1413-RP	Developing standard procedures for filing missing weather data	4.2 (lead)	Oklahoma State University		Completed.
1629-RP	Testing and Modeling Energy Performance of Active Chilled Beam Systems	5.3	Applications/		Completed
1588-RP	Representative layer-by-layer descriptions for fenestration systems with specified bulk properties such as U-factor and SHGC	4.5	SCM/ White Box Technologies	Haberl	Report complete – team developing papers

Appendix 2
TC 4.7 Energy Calculations RESEARCH PLAN (Jun 27 2017)

Title	Society status	TC 4.7 Status	Actors or TC 4.7 Prime Contact	Subcommittee*
Active co-sponsored projects led by another TC				
1741-TRP "Understanding Fan Coil Components and How They Relate to Energy Consumption and Energy Modeling", TC 5.3 Room Air Distribution is the lead TC.	In Progress	In Progress Award made to U. of LA-Layfayette	Kruis	SCM
WS approved by TC				
1748-RP Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations (Phase Two)	WS not accepted by RAC	WS returned with comments from RAC. Comments and concern that it was too similar to 1744-RP to be addressed by Fontanini with coordination with 1744-RP to avoid work duplication	Joe Huang , Simon Rees, Eric Kolderup, Malcolm Cook, Iain MacDonald, Anthony Fontanini	SCM
WS under development				
1763-WS Development of an Improved Inverse Model Toolkit (RP1050) and Diversity Factor Toolkit (RP1093) for Analyzing Bldg Energy Savings from Time Series Data	RTAR accepted by RAC on July 29, 2015. Needs Work Statement	WS written by Haberl and submitted for consideration by RAC in Spring 2018 Meeting	Haberl	DDM
1816-RTAR, "Reporting the Energy Use and Heat Gain from Imaging Equipment".	Joint with TC 9.6 (lead) RTAR accepted with comments	WS under development. Looking for TC47 liason	???	SCM
1769-RTAR "Experimental Evaluation of the Efficiency of Belt Drives for Fans" TC 5.1 Fans is lead TC	RTAR not yet accepted by RAC.	TC voted to cos-sponsor 3-2-2 (Wangda and Josh abstaining)	Zou, New	SCM
1813-RTAR "Method of Test to test the Accuracy of Residential Duct Models"	RTAR Rejected and returned to TC4.7	Agreed to let Malhatra update to address RAC concerns and resubmit after review by TC 4.7	Mini Malhatra	APP
RTAR "Merged HVAC01, HVAC02, Loads toolkit	No RTAR Submitted to RAC	Lead by Haberl with Muehleisen, Henry, and Glaser to help	J. Haberl, R. Muehleisen	APP
RTAR "Toolkit for Passive Solar and Whole Building Simulations".	No RTAR Submitted to RAC	Create HVAC01,02 like toolkit independent of commercial software. Under development	J. Mukhopadhyay	APP
RTAR "Baseline Modification when a Building Behavior Changes"	No RTAR Submitted to RAC	Juan Carlos and Bass will work with members of MTG-OBB to write	Balthazar and Abushakra	DDM

Appendix 3
TECHNICAL PAPERS FROM SPONSORED RESEARCH

RP	Title	Contractor	Approved	Paper
1404	ASHRAE RP1404 <i>- Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance</i>	MSOE-ASU	Louisville June 2009	Singh, Reddy, Abushaka 2013 “Predicting Annual Energy Use in Buildings Using Short-Term Monitoring and Utility Bills: The Hybrid Inverse Model Using Daily Data (HIM-D)”
1404	ASHRAE RP1404 <i>- Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance</i>	MSOE-ASU	Louisville June 2009	Singh, Reddy, Abushaka 2014 “Predicting Annual Energy Use in Buildings Using Short-Term Monitoring: The Dry-Bulb Temperature Analysis (DBTA) Method”
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	Reddy, T.A., 2006. "Literature Review on Calibration of Building Energy Simulation Programs: Uses, Problems, Procedures, Uncertainty and Tools", ASHRAE Transactions, vol 112(1).
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	Sun J. and Reddy T.A., 2006, "Calibration of Building Energy Simulation Programs Using the Analytic Optimization Approach (RP-1051)", Int. J HVAC&R Research 12(1) 177-196.
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	Reddy, T.A., I. Maor and C. Ponjapornpon, 2006, "Calibrating Detailed Building Energy Simulation Programs with Measured Data- Part I: General Methodology", accepted for publication in Int. J HVAC&R Research.
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	Reddy, T.A., I. Maor and C. Ponjapornpon, 2006, "Calibrating Detailed Building Energy Simulation Programs with Measured Data- Part II: Application to Three Case Study Office Buildings", accepted for

				publication in Int. J HVAC&R Research.
1050	Development of an Inverse Model Toolkit	Univ. of Dayton, Texas A&M	December 2001	Kissock, K., Haberl, J., Claridge, D. 2003. "Inverse Model Toolkit (1050-RP): Numerical Algorithms for Best-Fit Variable-Base Degree-Day and Change-Point Models," ASHRAE Transactions-Research, Vol. 109, Pt. 2, pp. 425 – 434.
865	Accuracy Tests for Simulations of VAV Dual Duct, Single Zone, Four Pipe Fan Coil and Four Pipe Induction Air Handling Systems (4796)	Univ Nebraska, Texas A&M	July 2002	Yuill, G., Haberl, J. 2006. "Accuracy Tests for Simulations of VAV Dual Duct, Single Zone, Four Pipe Fan Coil and Four Pipe Induction Air Handling Systems (4796)," ASHRAE Transactions-Research, Vol. 112, Pt. 1 (January).
865	Accuracy Tests for Simulations of Constant Volume, Dual Duct and Variable Volume Air Handling Systems (4796).	Univ. Nebraska, Texas A&M	July 2002	Yuill, G., Haberl, J., Caldwell, J. S. 2005. "Accuracy Tests for Simulations of Constant Volume, Dual Duct and Variable Volume Air Handling Systems (4796, RP-865)," ASHRAE Transactions-Research, Vol. 111, Pt. 2, No. 4796, pp. 137 – 153 (June).

Appendix 3 (continued)
TECHNICAL PAPERS FROM SPONSORED RESEARCH

1050	Development of an Inverse Model Toolkit	Univ. of Dayton, Texas A&M	December 2001	Kissock, K., Haberl, J., Claridge, D. 2003. "Inverse Model Toolkit (1050-RP): Numerical Algorithms for Best-Fit Variable-Base Degree-Day and Change-Point Models," ASHRAE Transactions-Research, Vol. 109, Pt. 2, pp. 425 – 434.
1050	Development of an Inverse Model Toolkit	Univ. of Dayton, Texas A&M	December 2001	Haberl, J., Claridge, D., Kissock, K. 2003. "Inverse Model Toolkit (1050-RP): Application and Testing," ASHRAE Transactions-Research, Vol. 109, Pt. 2, pp. 435 – 448.
1093	Diversity Factors and Schedules for Energy and Cooling Load Calculations	Texas A&M	June 2000	Abushakra, B., Haberl, J., Claridge, D. 2004. "Overview of Literature on Diversity Factors and Schedules for Energy and Cooling Load Calculations (1093-RP)," ASHRAE Transactions-Research, Vol. 110, Pt. 1 (February), pp. 164 – 176.
1093	Diversity Factors and Schedules for Energy and Cooling Load Calculations	Texas A&M	June 2000	Claridge, D., Abushakra, B., Haberl, J. 2003. "Electricity Diversity Profiles for Energy Simulation of Office Buildings (1093-RP)," ASHRAE Transactions-Research, Vol. 110, Pt. 1, pp. 365 – 377 (February).

Appendix 4

Chicago Meeting TC/TG/TRG SPONSORED SEMINARS

PRESENTED:

Urban-Scale Building Energy Modeling, Part 5 (Co-Sponsoring. Seminar. Abushakra)
Urban-Scale Building Energy Modeling, Part 6 (Co-Sponsoring. Seminar. New)

PLANNED:

Chicago Meeting

Building performance Ratings with Data Collection (Balbach)
Simulation in Code Compliance (Muehleisen)
Urban Scale 7 and 8. (TC 1.5 Sponsor, TC4.7 to cosponsor) (New)

TC 4.7 Main Meeting Agenda and Minutes (in red)



AGENDA ASHRAE TC 4.7 ENERGY CALCULATIONS – MAIN MEETING ROOM 101A, LONG BEACH CONVENTION CENTER, LEVEL 1, LONG BEACH, CA TUESDAY, JUNE 27, 6:00-8:30 PM

1. Roll call and introductions (5 minutes) Balbach
Meeting called to order 6:03
9 VM present, 2 NP (,Haddad, and Cook), Haberl and Cockerham to join online in a couple minutes

- We will have 5 people rolling off to put us at 8 (see addendum), Bass wants this up to 10.
2. Accept agenda & approve minutes of previous meeting (10 minutes) Abushakra
Balbach moved, Kolderup , 9 in favor, no opposed, jeff, Keith still offline
Approve minutes Crawley moved, Zuo second, 9 in favor, none opposed, jeff, keith still offline.

3. Announcements/Liaisons (5 minutes) Abushakra
Membership liason: Problems with roster membership updates fixed, online updates now working.
Abstracts for Chicago seminar and forum,
Name badges are available for free for people attending committee meetings and not sessions.

8:15, Cockerham and Haberl now online at meeting.

Bass discussing the process of program submittal.

- People should talk to the chapter chair.
- Physics vs new technology. Programs are chosen to attract attendees

TC should vote on continuing operations under current scope, Vote should be put in the TC activity sheet and both documents sent to the section head.
Members are encouraged to send Bass an email if you want to suggest scope changes

125th anniversary in a couple years. TC can organize or sponsor a program session for 2019-2020 meetings
Haberl (on history committee): There are several programs being solicited. Looking for not only presentations but also articles for the transactions. TC Members are encouraged to contact Jeff

Emergency Rosters can be submitted anytime during the year so that changes in subcom or other positions can be made official on the rosters instead of waiting until July 1.

4. Membership (5 minutes) Abushakra
4.1 Five VM will roll off after Long Beach. We will have Eight VM as a result. The Executive Committee will convene and decide how many CM will roll on as VM. It helps to have all TC officers as VM. So far, Neymark and Huang agreed to roll-on based on an executive committee discussion. 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.

Joel: Are Joe Huang and Joel going to be added by the July 8 deadline
Bass: The plan is to submit that in time for July 8

4.2 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.

5. Subcommittee reports Juckoff
5.1 Applications (10 minutes)

Ron: We had a very productive meeting, with many program submission. Building Performance Ratings (Balbach) for Chicago, Standard 209 Simulation Aided Design (Kolderup) for Chicago or Houston, Validation and Uncertainty (Muehleisen) for Houston in the research summit, Large Demand Side Management (Abushakra and New) in Chicago, Modeling for Code Compliance (Muehleisen) in Chicago, Window Layering from a simple description (Haberl) probably in Chicago (Chip, Kruis, and others as speakers).
There was a large description of move Urban Scale Modeling in TC 4.7

New: TC 1.5 wants a co-sponsor of urban 7 and 8 sessions

New: The urban scale subcommittee in 1.5 came about to discuss the use of computing systems and methods for building energy modeling of many buildings. It's time for it to move to a more permanent home.

Bass: Are there any comments?

Bill Koran: As utilities start doing more advanced modeling for all kinds of reasons, they want to

Chris: We may want to revisit the name - Urban is a bit limiting as this applies to things more and more

Jeff: Have we been submitting papers? We should be starting to do that.

New: contact the building sim authors. Ralph: talk to me about the ibpsa

5.2 Data-Driven Modeling (10 minutes)

Fontanini

Tony: 16 people attended. A lot of discussion and update of IMT. There was a discussion that focused around defining who the end user was and to ensure methods are scaleable to many buildings. Haberl is doing this with Koran and Balbach.

Discussions for RP that have come up are machine learning techniques, clustering methods, Bayesian methods for detecting change, and a long discussion of when to re-baseline your building. And a bit on using IMT to help calibrate buildings.

Seminars: What do to with the differences between calibrated and measured data (Balbach) Do you think you are normal? (Most modeling assume residuals normal, are they?)(Muehleisen, Balbach, and L. Wang).

5.3 Simulation and Component Models (10 minutes)

Huang

Balbach speaking for Huang

21 attendees. Spent most of the time talking about RP. Possible SPC205 in Houston but probably not Chicago.

5.4 Research (15 minutes)

Haberl

5.4.1 Research Projects

- Completed Projects
 - Update of any.

Haberl: 1588 finished in spring of 17, looking forward to papers and presentations coming soon.

- 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. Latest status on progress report.**
 -

Kruis: Project awarded to U. of Louisiana-Layfayette. Have many donors of equipment and are building facilities. Kruis on in case there is any modeling results or needs. This is fairly heavily experimental

- 1661-WS 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. Status report on progress so far.**

Zuo: contract just signed and moved to Boulder with his move to start August 1st.

- 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 is**

now written taking into consideration the comments the authors received on the RTAR

Haberl: Make sure the WS is available on basecamp or wherever we post things. Update from Fortran to something more convenient. Bill Koran and Chris Balbach have given some good feedback. The current toolkit is being used by utilities consultants. There is editing to be done on the WS, it will be shared with the TC for comments and possibly a vote before Chicago.

- 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. Chair of TC9.6 was contacted and there was no response.
- 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 Fantonini) DDM Update.

Fantonini: Good discussion in DDM. Some comments included were the lack of midyear milestones and deliverables and the appearance of similarity to another, and why a particular building is specified. The updated WS is to be sent to the listserv for comments and hopefully a vote before Chicago.

- 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). Some progress on rewriting has been achieved since.
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This was discussed in HVAC app, TC will review and revote. Because of the low turnout we had low vote so this will be sent to listserv and we will revote by mail ballot.

- WS, RTAR, Requests for Co-sponsorship
 - 1769-RTAR "Experimental Evaluation of the Efficiency of Belt Drives for Fans", TC 5.1 Fans lead. TC 4.7 voted (3-2-2) to cosponsor. RTAR was approved by RAC, and TC5.1 wrote a WS already. It will not be reviewed by RAC this meeting (probably they missed the deadline). Should we just provide them with a letter of support without a co-sponsorship, or revote (to improve the vote).
 -

Bass: This vote was split because the project really didn't fit into the scope of our committee. RTAR was passed and a WS was developed and will be submitted (missed deadline for long beach). TC 5.1 was not pleased with the vote.

Muehleisen motion to "reconsider the decision to co-sponsorship 1769-WS." Balbach seconded.

Discussion: New thinks the discussion: 1) Fan belts are small amounts of energy, 2) there wasn't much modeling to be done.

Ron: Isn't energy efficiency of belts an input to fan models

Erik: Energyplus does have efficiency of belts in the fan model

Kruis: There is so much information that you rarely have for a fan to do the subcomponent modeling so is this a good use of time

Ron: For people who do model the dynamic systems in details.

Haberl: The results of this project could help HVAC 02 toolkit update.

Voting 10, 0, 0 in favor of reconsidering. Cockerham has dropped off.

The updated WS and minutes of conversation will be circulated by email for an online vote.

- 1752-WS-or-RTAR "A guideline for Calculating the Avoided Source Energy Consumption Due to Waste Energy Recovery (WER) AND Heat Pump (HP) Technologies". (MTG-ASEC). The chair of the MTG (Cary Smith) was contacted and there was no response).

We don't know the liason and they haven't responded to Bass's email so we will drop from the agenda for now.

- New RTAR
 - 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. Update. 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. Ralph and I working on this we can make some progress toward an RTAR for the next meeting.

Haberl: We are making progress on passive solar, it's slow but there is progress.

Haberl: Chip mentioned loads is underway so that will drop off the title. Anyone else who wants to join in should email Jeff to join.

Ralph: We will work with Jason to define the scope and that will help define the required language.

Ron questions why we need a passive solar toolkit when whole building simulations can do this fine.

Jeff: He's not sure about the ability to do some exotic constructions

Ron: The exotic constructions are not used because of market and not from inability to model.

Jeff: We need tools for design (not simulation, design tools) for some that might be used in very advanced buildings.

- Xxxx-RTAR "Improved Submodels of Air-to-Air Energy Recovery Exchangers for Use in Building Energy Modeling Software". TC5.5, Air-to-Air Energy Recovery, is asking us for a co-sponsorship. They actually send it to us one year ago (to D. Crawly).
-

Bass: we had a discussion in SCM and we sent it around before. Ralph discussed the outcome of that discussion that Diekmann was to put together a list of the equations to be implemented and he'll set up a meeting with TC5/7 and TC 5.5 reps to discuss this before it comes back to the TC for a vote.

- Xxxx-RTAR "Occupancy-based thermostats". Hyojin Kim has some ideas towards a useful RTAR from some recent work done in D.C
-

Kim: The basic idea comes from M&V of occupancy of guest rooms in hotel. They wanted to match the results of the M&V with simulation and couldn't do it. They had problems with the modeling. They want to develop a new methods for calibrating a simulation occupancy.

Haberl: Besides the DC hotel data, they have military base data and even with individual profiles. When the occupant is not home. This is problem calibrating.

Koran: This has two dimensions: data driven vs calibrated simulation and how is this used and accounted in savings programs. Understanding the uncertainty and how they will combine together when there are many, many buildings is interesting.

5.5 Handbook (10 minutes)

Kolderup

Kolderup: We handle chapter 19 of the fundamentals. It was just published in June. In our meeting we discussed areas we want to update and add. Contact Erik if you want to contribute.

Bass: By Chicago we should all have read the chapter and have suggestions for the next update.

Erik for now is continuing as the subcommittee chair unless someone is interested in chairing that committee. Send Bass an email.

5.6 Program (15 minutes)

Cockerham

Long Beach, June 2017

1. Urban-Scale Building Energy Modeling, Part 5 (Co-Sponsoring. Seminar. Abushakra)
2. Urban-Scale Building Energy Modeling, Part 6 (Co-Sponsoring. Seminar. New)

Joshua New: We had 67 people in part 5. It's 9:45 – 10:45 next door.

Chicago, January 2018, and beyond

1. SPC 205 (Seminar. Standards Subcom. Barnaby, McDowell)??
2. Historical Committee (Seminar. Haberl)??
3. Aging Grid and Power Lines Reaching Normal Rating Capacity – Load Growth Projection Modeling (Seminar. DDM Subcom. Abushakra)??
4. Building Energy Modeling Software Testing with ANSI/ASHRAE Standard 140 (Seminar. Standards Subcom. Neymark)

Joel will resubmit – it got lost.

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

Haberl will chair

6. SPC 209 Energy Simulation Aided Design (Seminar. Standards Subcom. Kolderup)??

Kolderup: This will

Building performance Ratings with data collection (Balbach)
 Validation and Uncertainty (Muehleisen) for Houston
 Simulation in Code Compliance (Muehleisen) for Chicago
 TC 1.5 will have Urban Scale 7 and 8. Want 4.7 to cosponsor.

Judkoff Ron moved to co, Wangda second.
 Discussion: Balbach who are the speakers
 New: Luke Leung, Christof Reinhard, Krishna Gouri, Cybercity 3d , CityZenith, Symbiotic Technology and Ecology.

8 vote yes, 1 abstain, no opposed.

- ~~7. Data Visualization (Seminar. Application Subcom. Balbach)??~~
8. What does the difference between data driven models and measurements mean? (Seminar. DDM Subcom. Chair)??.

Renamed Understanding Residuals, try for Houston or later, keep on list

9. So you think you're ~~Gaussian?~~ Normal Many regression models assume normal distributions (Seminar. DDM Subcom. Fontanini)?? Houston or later, keep on list
10. How to remove outliers from data before using DDM (Seminar. DDM Subcom. Chair)?? **Houston or later, keep on list.**
11. Other Ideas??

5.7 Historical (5 minutes) Haberl
 Historical Committee - 125 Anniversary – is looking for History Papers. Contact Haberl.

5.8 Standards (15 minutes) Neymark
 • SSPC 140 SMOT for Evaluation of Building Energy Analysis Computer Programs Neymark

Neymark: 140 is referenced by 90.1 and soon 90.2 140 Addendum A, airside HVAC besttest suite has been published. Integrating this into 140-17. Building fabric tests being updated. Details in 140 subcommittee meetings. Discussions about Empirical Validation work being developed in labs. Empirical validation is much more difficult to describe than analytic tests as there are so many more inputs that need to be described in detail.

o Internal Revenue Service Section 179D Tax Deductions – Citation of Std 140 Judkoff

The law was changed in 2016 requiring that standard 140-14 be used instead of 140-07. So there are 8 programs with 12 versions that have qualified. For projects prior to 2016 there are 13 programs and more versions.

- SPC 205 Standard Representation of Performance Simulation Data for HVAC and Other Facility Equipment Barnaby

Advisory public review draft voted out today. Trial implementations will go on during the review period.

- SPC 209P Energy Simulation Aided Design Kolderup

209 just completed the 2nd public review. There are only a few comments that should be dealt with fairly quickly. Hopefully by Chicago it will be a final draft.

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

New

New: TC47.org is easier to remember. Go there. You can go there to apply as a provisional member.

6. Related activities reports (10 minutes)

SPC 191 Standard for the Efficient Use of Water in Building and Mechanical Systems (no one to brief)

MTG O&MEE Operations and Maintenance Activities That Impact Energy Efficiency (no one to brief)

MTG OBB Occupant Behavior in Buildings (Abushakra is

We need reviewers for the White Paper currently under development to serve as a main document explaining the importance of building occupant behavior for sensing technology and building energy modeling. Volunteers' contact info will be forwarded to the MTG Chair.

Interested people contact Abushakra

They are thinking of creating a new handbook chapter devoted the topic

MTG is thinking of going into applications rather than fundamentals.

MTG.BIM Building Information Modeling (Barnaby)

Activities going on primarily with international entities.

New: TC 1.5 received a letter from higher ups that BIM was to be considered where applicable in

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

TC 2.8 Building Environmental Impacts and Sustainability (no one to brief)

TC 4.1 Load Calculation Data and Procedures

Barnaby: Handbook updated. Doug Hittle passed recently and he had a huge impact on simulation as well as loads

TC 4.2 Climatic Information

Carlos: Project approved for climatic info via prediction where there are no weather models.

TC 4.3 Infiltration & Ventilation Requirements (no one to brief)

TC 4.5 Fenestration (no one to brief)

TC 6.5 Radiant Heating and Cooling (no one to brief)

TC 7.5 Smart Building Systems (no one to brief)

TC 7.6 Building Energy Performance (Balbach)

Guideline 14 revision is under consideration. Interested parties should get in touch with Chris.

BuildingSMART (formerly IAI International Alliance for Interoperability) (no one to brief)

IBPSA: USA, Canada, World

Building Simulation in SF in Augo 2017. IBPSA-World will have many meetings on Sunday and Thursday after the conference. IBPSA-World is expanding IEA Annex A with equation based modeling.

BPI-2400-S-2011 Standardization Qualification of Whole-house Energy Savings Est. (no update)

Guideline 14 (mentioned above)

IEA Annex 60 Modelica for Building Simulations

Wangda : Will officially end as IEA projects and will start as IBPSA-world project and expand to urban scale.

IEA Annex 66 Occupant Patterns (no one to brief)

7. Awards Nomination

2017-2018 Hightower Award: Nominations due to Section head by September 1, 2017

2017-2018 Service to ASHRAE Research Award: Nominations to RAC Liaison by September 1, 2017

Bass: We need to nominate more people from our TC to these positions.

Haberl: This starts with ASHRAE fellows. Only three in room: Chip, Jeff, Dru. Jeff will do a working group with them. ASHRAE has the "recall program" to talk with people who have a legacy to record conversations. If you have someone else you want to see have a conversation, let Jeff know.

8. Old Business

Abushakra

9. New business

Abushakra

Urban-scale Building Energy Modeling, a proposed move from TC1.5 to TC4.7 (discussed earlier)

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

Bass: we don't have a liason to 90.1. We should have someone active there to help influence how things are written.

Jeff and Dru: we need a liason to ECB. Kolderup has some interest.

Looking for reviewers for papers for Chicago.

Josh new interest in bldg. performance data in energy model calibration a lit review.

10. Adjourn

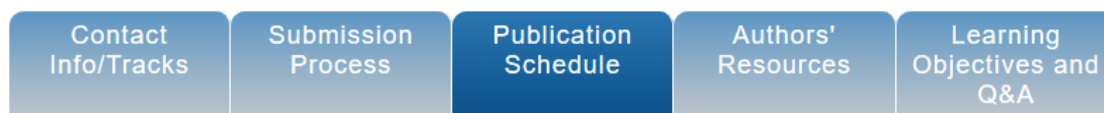
Abushakra

Chip moved to adjourn, Ralph seconded. Voted 9,0,0

RESOURCES

Deadlines

Chicago, January 2018



This is the overall publication schedule for the ASHRAE 2018 Winter Conference, Chicago. For specific details and questions regarding these dates, please contact the appropriate Track Chair.

Wednesday, March 01, 2017	Conference Paper Abstracts, Technical Papers and Paper Session Requests Due
Monday, March 27, 2017	Conference Paper Abstract Accept/Reject Notifications
Friday, June 02, 2017	Website Opens for Seminar, Forum, Debate, Panel and Workshop Proposals
Friday, July 07, 2017	Final Conference Papers Submitted for Review (Includes Bio, Learning Objectives and Methods of Assessment); Request for Conference Paper Sessions Due
Monday, July 24, 2017	Conference Paper accept/reject notifications
Tuesday, August 01, 2017	Seminar, Forum, Workshop and Paper Proposals Due
Monday, August 07, 2017	Revised Conference Papers/Final Technical Papers Due
Monday, August 21, 2017	Conference and Technical Paper Final Accept/Reject Notifications
Wednesday, September 06, 2017	Seminar, Forum, Workshop Accept/Reject Notifications
Friday, December 01, 2017	Upload of PPTs Begin
Monday, January 08, 2018	All PPTs Due Online
Wednesday, January 17, 2018	Final Day for Commercialism Revision Upload prior to on-site
Saturday, January 20, 2018	Speaker's Lounge Opens

2018 ASHRAE Annual Conference in Houston, TX:

- Conference Paper Abstracts due Monday, August 28, 2017
- Conference Papers due Friday, December 8, 2017
- Seminar, Forum, Panel, Debate and Workshop proposals are due Friday, February 9, 2018
- Web site opens for presentation uploads Monday, April 30, 2018
- All presentations due online Friday, June 1, 2018

Chicago Program Tracks

Track 1: Systems and Equipment
Track Chair: Carrie Anne Crawford
Email: carriecrawford@eeace.com

Track 2: Fundamentals and Applications

Track Chair: Kevin Marple

Email: kmarple@benzco.com

Track 3: Standards, Guidelines and Codes

Track Chair: Corey Metzger

Email: corey.metzger@resourcece.com

Track 4: Earth, Wind & Fire

Track Chair: Ashish Rakheja

Email: ashish.rakheja@aeonconsultants.in

Track 5: Transportation IAQ and Air Conditioning

Track Chair: Dimitris Charalambopoulos

Email: dimitris@ashrae.gr

Track 6: Tall Buildings

Track Chair: Leticia Neves

Email: leneves@gmail.com

Track 7: Modeling Throughout the Building Life Cycle

Track Chair: Joseph Firrantello

Email: j.firrantello@gmail.com

Track 8: Heat Exchange Equipment

Track Chair: Vikrant Aute

Email: vikrant@umd.edu

Track 9: Refrigerant Mini Track @ Expo*

Track Chair: Gary C. Debes

Email: gcdebes@verizon.net

*Section will determine topics, speakers, session types, etc.

Track 10: Residential Mini Track @ Expo*

Track Chair: Gary C. Debes

Email: gcdebes@verizon.net

*Topics, speakers, session types, etc. will be determined by the cognizant committee.

Houston, June 2018 Tracks

Track 1: Systems and Equipment

Track 2: HVAC&R Fundamentals and Applications

Track 3: District Energy and Cogeneration Plants

Track 4: Safeguarding our HVAC&R System

Track 5: Residential: Modern Buildings in Hot & Humid Climates

Track 6: Professional Skills

Track 7: Controls: Troubleshooting Building Management Systems

Track 8: Research Summit

Track 9: Mini-Track: HVAC&R Analytics

ASHRAE Research Strategic Plan 2010-2018

Goal 1: Maximize the Actual Operational Energy Performance of Buildings and Facilities

Goal 2: Progress toward Advanced Energy Design Guides (AEDG) and Cost-Effective Net-Zero-Energy (NZE) Buildings

Goal 3: Reduce Significantly the Energy Consumption of HVAC&R, Water Heating and Lighting in Existing Homes

Goal 4: Significantly Advance our Understanding of the Impact of Indoor Environmental Quality (IEQ) on Work Performance, Health Symptoms and Perceived Environmental Quality in Offices, Providing a Basis for Improvements in ASHRAE Standards, Guidelines, HVAC&R Designs and Operation Practices

Goal 5: Support the Development of ASHRAE Energy Standards and Reduce Effort Required to Demonstrate Compliance

Goal 6: Building Information Modeling of Energy Efficient, High Performing Buildings. BIM is a Rapidly Developing Field of Knowledge which Stretches Beyond the Traditional Boundaries of the HVAC&R Industry to the Wider Construction Sector

Goal 7: Support Development of Tools, Procedures and Methods Suitable for Designing Low-Energy Buildings

Goal 8: Facilitate the Use of Natural and Low Global Warming Potential (GWP) Synthetic Refrigerants and Seek Methods to Reduce their Charge

Goal 9: Support the Development of Improved HVAC&R Components Ranging from Residential through Commercial to Provide Improved System Efficiency, Affordability, Reliability and Safety

Goal 10: Significantly Increase the Understanding of Energy Efficiency, Environmental Quality and the Design of Buildings in Engineering and Architectural Education

Goal 11: Understand Influences of HVAC&R on Airborne Pathogen Transmission in Public Spaces and Develop Effective Control Strategies.

Attachments

- A. TC 4.7 Main Meeting Agenda
- B. Simulations and Component Models Subcommittee Agenda and Minutes
- C. Data-Driven Models Subcommittee Agenda and Minutes
- D. Applications Agenda and Minutes
- E. Handbook Subcommittee Agenda and Minutes
- F. SSPC 140 Agenda and Minutes



AGENDA
ASHRAE TC 4.7 ENERGY CALCULATIONS – MAIN MEETING
ROOM 101A, LONG BEACH CONVENTION CENTER, LEVEL 1,
LONG BEACH, CA
TUESDAY, JUNE 27, 6:00-8:30 PM

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 - 5.4.1 Research Projects
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- 5.5 Handbook (10 minutes) Kolderup
- 5.6 Program (15 minutes) Cockerham
- Long Beach, June 2017
- 1. Urban-Scale Building Energy Modeling, Part 5 (Co-Sponsoring. Seminar. Abushakra)
- 2. Urban-Scale Building Energy Modeling, Part 6 (Co-Sponsoring. Seminar. New) Houston, January 2017, and beyond
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- 2. Historical Committee (Seminar. Haberl)??
- 3. Aging Grid and Power Lines Reaching Normal Rating Capacity – Load Growth Projection Modeling (Seminar. DDM Subcom. Abushakra)??
- 4. Building Energy Modeling Software Testing with ANSI/ASHRAE Standard 140 (Seminar. Standards Subcom. Neymark)
- 5. New Advances in Simulating Fenestration Systems (Seminar. SCM Subcom. Haberl)??
- 6. SPC 209 Energy Simulation Aided Design (Seminar. Standards Subcom. Kolderup)??
- 7. Data Visualization (Seminar. Application Subcom. Balbach)??
- 8. What does the difference between data driven models and measurements mean? (Seminar. DDM Subcom. Chair)??.
- 9. So you think you’re Gaussian? Many regression models assume normal distributions (Seminar. DDM Subcom. Fontanini)??
- 10. How to remove outliers from data before using DDM (Seminar. DDM Subcom. Chair)??
- 11. Other Ideas??
- 5.7 Historical (5 minutes) Haberl
- Historical Committee - 125 Anniversary – is looking for History Papers. Contact Haberl.
- 5.8 Standards (15 minutes) Neymark

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

- SPC 209P Energy Simulation Aided Design Kolderup

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

6. Related activities reports (10 minutes)

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

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

MTG OBB Occupant Behavior in Buildings

We need reviewers for the White Paper currently under development to serve as a main document explaining the importance of building occupant behavior for sensing technology and building energy modeling. Volunteers' contact info will be forwarded to the MTG Chair.

MTG.BIM Building Information Modeling

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

TC 2.8 Building Environmental Impacts and Sustainability

TC 4.1 Load Calculation Data and Procedures

TC 4.2 Climatic Information

TC 4.3 Infiltration & Ventilation Requirements

TC 4.5 Fenestration

TC 6.5 Radiant Heating and Cooling

TC 7.5 Smart Building Systems

TC 7.6 Building Energy Performance

BuildingSMART (formerly IAI International Alliance for Interoperability)

IBPSA: USA, Canada, World

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

Guideline 14

IEA Annex 60 Modelica for Building Simulations

IEA Annex 66 Occupant Patterns

7. Awards Nomination

2017-2018 Hightower Award: Nominations due to Section head by September 1, 2017

2017-2018 Service to ASHRAE Research Award: Nominations to RAC Liaison by September 1, 2017

8. Old Business Abushakra

9. New business Abushakra

Urban-scale Building Energy Modeling, a proposed move from TC1.5 to TC4.7

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

10. Adjourn Abushakra

RESOURCES

Deadlines

Chicago, January 2018



Attachment B :
Draft Agenda in Black and Minutes in Red

Draft Agenda

TC 4.7 Simulation and Component Models Subcommittee

6:00-7:30 pm, Monday, 26 June 2017

Long Beach Convention Center 101A (LBCC-1)

6:00 Call to order / introductions / changes to the agenda
Balbach

*6:05 call to order and intros with Chris Balbach filling in for Joe Huang
No changes to agenda*

In attendance: Bass Abushakra, Erik Kolderup, Joshua New, Tony Fontanini, Charlie Curcja, Chris Balbach, Alamelu Brooks, Bill Koran, Ron Judkoff, Jamie Fine, Ralph Muehleisen, Liam Buckley, Amir Roth, Jan Kosny, Mike Koupriganov, Daniel Villa, Dru Crawley, Sreenidhi Krishnamoorthy, Fahrad Omar, Christian Kohler, Brian Kastl,

6:10 **Research Projects**

- **1741-WS** Understanding Fan Coil Components and How They Relate to Energy Consumption and Energy Modeling (TC 5.3, TC 7.7 and TC 4.7 co-sponsoring) .
Status: Project
awarded in Fall 2016 to University Louisiana-Lafayette, currently underway

TC 4.7 representative on PMS (Kruis ?)

Mike Copranos, is on 5.3. He says this project has started and is on track.

- **1661-WS** Development and Validation of Dynamic Models for the Evaluation of Chilled-Water Systems Control Strategies in the ASHRAE Handbook (TC 4.7/ TC 7.5 / TC 1.4)
Status: Project awarded in Spring 2017 to University of Colorado, with start date 8/1/17
ending 10/31/2018.
Zuo/Wetter

Looks to appear to have been awarded to Wangda Zuo, now at U. Colorado. No one is able to confirm. Committee is unsure of why there was a delay in the award.

- **1748-WS** Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations – Phase 2 (TC 4.7 / TC 4.10) **Status:** returned from RAC w/comments Oct. 28, 2016, WS authors' response to be discussed at Long Beach

Fontanini/Cook

Tony's update, they just got the comments and have a year to respond. He wonders a year from when?. Jeff's response: Tony should contact Mike directly to ask. Changes/comments; RAC wants the WS to have intermediate milestones. Tony has questions about intermediate milestones and wants to know how they differ from deliverables. Jeff is unsure. Phil says that they want some check boxes. Tony wants to call some of the middle deliverables as intermediate milestones. Ron and Phil agree that intermediate deliverables can probably fill that gap.

Jeff says Tony should get the most current form.

Another major comment deals with 1744-WS, another project on natural ventilation. RAC was wondering about the overlap of the projects. 1744 deals with flow physics within rooms using CFD, 1748 is assessing capabilities of current tools within energy modeling communities to predict thermal comfort and associated stuff. So they are different.

Ron says, that if you had a good detailed simulation from 1744, it can be used as a "test case" or validation for the stuff of 1748 and so he thinks they maybe could be combined. Tony says 1748 will actually compare to measured data. Tony says there are data available from one good example building (Judson College) and they are getting access to the data.

Action Item:

Tony to update and share with TC. Likely will not be done in time for the TC meeting in Long Beach so this will likely be shared via email and voted on via email before next meeting in Chicago.

- **1804-WS** A Guideline for Calculating the Avoided Source Energy Consumption (ASEC) Due to Waste Heat Recovery (WHR) and Heat Pump (HP) Technologies **Status:** according to Research Report Feb. 8) "Returned to MTG ASEC with comments",
unclear whether there has been any involvement from TC 4.7 on WS.

Anyone from TC 4.7 involved in the

RTAR/WS

No one at this meeting claims involvement. We decided to wait for them to approach TC 4.7 rather than seek them out.

- **1769-WS** Experimental Evaluation of the Efficiency of Belt Drives for Fans (TC 5.1 Fns, TC

4.7 co-sponsor). **Status:** RTAR was approved in July 2016, WS submitted for Long Beach but review has been delayed till Fall because of absence of TC votes.

Anyone from TC 4.7 involved in the RTAR/WS

RTAR approved in July. WS submitted for long beach. Bass contacted 5.1 and has been back and forth with the chair of 5.1. There was debate within 4.7 whether this was something that was within our jurisdiction. 5.1 was worried that if 4.7 was split it might look bad. There was discussion of what should we do and does this fit. Chip suggests we drop co-sponsors and give a letter of support – if they are not interested enough to show up and pitch it to us, then we should reconsider cosponsoring.. Ralph asked if any of the people who voted for it had enough interest to sit on the committee. Bass is volunteering to do it. It is proposed (by several people) to vote again tomorrow. Chip suggests we clearly develop the motion for the subcommittee.

Action Item:

Motion to be presented at the full TC: “Motion to reconsider the decision to co-sponsorship 1769-WS.”

“Motion to co-sponsor 1769-WS with Bass as represented”.

If motion passes, in discussion for motion will reconsider will discuss the option to vote down and send a letter of support.

- **xxx-RTAR** Improved Submodels of Air to Air Energy Recovery Exchangers for Use in Building Energy Modeling Software **Status:** No RTAR has yet to be submitted as of June 2017, thus no tracking number. Dieckmann (from TC 5.5)

The 5.5 committee sees that the models in simulation software as used in 90.1 and other places need improvement. This includes latent vs sensible loads, control schemes, defrost modes, etc. The RTAR was sent to the committee for review and sent by Bass before the meeting. 5.5 wants 4.7 involved because our committee deals with simulation. Chip says that this should not be hard, the problem is that we don’t actually know the controls sequences. If we knew those we could easily model them. Phil says we need a clear statement about the deficiency in the knowledge (i.e. what is researched). John Deikmann says maybe they can write down the details of how they implement and then will come and talk to a group to talk about how/if it can be implemented. It was said that this is similar to a comparison that was done for chilled beams (TRP 1629). It was suggested that it might be the way to do things. Chip mentions that this hasn’t been incorporated into standard 205 and he thinks ERV could be represented in the performance mapping.

Action Item: Follow up with Dieckmann to set up a call between interested parties in TC 5.5 and 4.7 to discuss further.

6:50 New Research Topics/Research Plan

- New Research Topics (RTARs and Ws can be submitted 4 times a year—six weeks before Winter and Annual meetings and 1 March/1 August.)
- Several new research topics at recent meetings:
 - Research for new ground heat transfer tables in the HOF (Kruis)
Research for new ground heat transfer tables (Kruis and McDowell). Tim is talking with Neal and we should decide a committee (here or in HVAC apps). Ron says this comes up in HVAC apps.
 - Research on coils, higher latent loads not covered by current coil models. RTAR to be circulated (PC Thomas/Australia)
Phil: PC Thomas's suggested Research on latent loads on coils are important to DOAS.
 - Updating the HVAC 01 and 02 Toolkits. (Haberl/Huang)

Jeff: Jason Glazer has expressed interest in HVAC 01 and 02 updates. Ralph, Jason Glazer and Jeff will work on getting an RTAR on HVAC toolkits.

Chip: Part of 1766-TRP is translating LOADS from Fortran to C++ and doing updates. The motivation is a new toolkit for education

HVAC Toolkit update: Phil asks for clarification on whether this is just translation, updating (as in improving coils), looking/vetting the modeling library at LBL (modelica models). Maybe we should have validation/vetting of the models as part of the project. Chip says the second toolkit has test cases. Maybe part of the project is review the models and correct/extend as needed (e.g. coils handling latent loads). Tim: Any updates should be super well documented with inputs, outputs and test cases (unit tests) so this will be ready for future updates and translations a well.

Chip: the primary toolkit with physical models is less well documented. This is an opportunity to update the documentation.

Jeff: Jeff poked around the toolkits, HVAC 01 and HVAC 02 are completely different toolkits that will be non-trivial to merge. We need to consider the use case (teaching/practitioners) in this.

Phil: If we had things in equation based form, (e.g. modelica) inversion and coupling is much easier. So we might want to consider that.

Jeff: There might be more than one project here.

Bass: He has been worried that this project of just conversion that would be of interest to RAC, if we put the educational wrapper on it that could help sell it. Maybe we could try instead to do this as a shootout/competition and get contractors decide what they want to do.

Chris: We need to move this to an offline discussion to get onto Program Discussion

7:20 Program Ideas

-
- 2018 Winter (Chicago), 2018 Annual (Houston), 2019 Winter (Atlanta)

Chris: Seminars/Forums/Debates for Chicago are due Aug 1.

One track: Modeling throughout the building lifecycle.

Chip: There might be something from SPC205 for June but not Chicago.

7:25 **New Business**

Phil: Building Simulation 2017 in San Francisco in Aug.– everyone should come

7:30 **Adjourn**

Meeting Adjourned at 7:29

Next Meeting: Monday, Jan 22, 2018 Chicago, Illinois



Attachment C
Draft Agenda in Black and Minutes in Red

TC 4.7 Data Driven Models Subcommittee Meeting
Location: Long Beach, CA; Renaissance Long Beach, Dawson (R-3)

Agenda:

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

Called to order at 7:39

In attendance:

Henry Amastadi, Bob Ramirez, Alamelu Brooks, Bill Koran, Ron Judkoff, Chris Balbach, Ralph Muehleisen, Liang Zhang, Yumin Chen, Daniel Villa, Liping Wang, Farhad Omar, Edward Tsui, David Burchfield, Bass Abushakra, Anthony Fontanini

7:40: Upcoming Due Dates (5 minutes)

- Winter Meeting 2018 (Chicago)
 - **July. 7th 2017** – Final Conference Papers Submitted for Review Due
 - **Aug. 1th 2017** – Seminar, Forum, Workshop and Paper Proposals Due
- Annual Meeting 2018 (Houston)
 - **Aug 28th, 2017** – Conference Paper Abstracts, Technical Papers and Paper Session Requests Due
 - **Dec. 8th, 2017** – Final Conference Papers Due - Submitted for Review
 - **Feb. 9th, 2017** – Program (Seminar, Forum, Workshop, Debate and Panel) Proposals Due

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

- Current Work Statements
 - 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: Rtar came back from RAC with questions. Jeff made some additional changes and rewrote as a WS. He had input from several people, Bill Koran and Chris Balbach. He has this in the new format including milestones. This would be great if we could vote tomorrow night. There are a couple things to fill in on the form and suggested comments.

Tony has had a chance to look at it. He says its not clear how this combines spreadsheets, interpreted and compiled software.

Bill Koran: He has some spreadsheets based on the original, and R is well used.

Jeff: This isn't so much new algorithms as retooling/retesting of the existing algorithms and updating to reflect and incorporate other ASHRAE TRP (RP-1093, RP-1404, RP-1413).

Chris: Can you elaborate on 4: (spreadsheet add-in)

Jeff: It isn't useful in its current format, if we have something that can be called from a spreadsheet with canned graphs.

Ralph: Do we need the spreadsheet if we work in Python or R.

Tony: who is the primary audience?

Bill: ECAM is used by utilities and many others. Primarily used for M&V purposes. Improved and new algorithms would be useful to them. Improved uncertainty equations are necessary for hourly data.

Ralph: I think that the WS needs to be clarified for an end user.

Henry: Taking what has been done in the past that and making it more accessible for just for an excel notebook will not make it as extensible.

If instead we do a Jupyter notebook or an R studio format, it is more accessible, extendible, and more future proof because of the ease of converting to something later.

Chris: R is a bit more fragile and is less scalable. The guidance to the contractor needs to make it scalable.

Tony: WS should be updated to clarify the end user and possibly language and it can go to an email vote.

Action Item: Jeff to Update WS1763 to reflect the conversation above and send to committee for review and TC 4.7 voting members for email vote of resent to RAC.

- Current RTARs
 - None

- New Research Topics

Bill Koran: Has a paper about uncertainty in M&V out of guideline 14 (gave lots of details of what he's been doing). He will be presenting at the International Energy Evaluation Conference in August. Work has had a lot of critical review. Maybe there is an RP for evaluating uncertainty estimates and adding uncertainty to higher parameter models. Ralph with work with Bill to start an RTAR.

Bass: Let's make sure we write this RTAR starting from the research problem and need/gaps.

Action Item: Bill Koran and Ralph to work to get started on an RTAR related to uncertainty in M&V and related DDM

Potential RTAR Topics		
RTAR Title	Champion(s)?	Status/Notes
Determining memory/forgetting factors for DDMs	A. Smith A. Reddy	

Understanding DDM calibration/forecasting residuals	A. Smith A. Reddy Bill Koran	
Establishing standard procedures for identifying outlier and bad data during the data cleaning	A Reddy, C. Balbach, L. Wang, J. Balthazar,	
Bayesian techniques for determining when a building's behavior have changed	A. Fontanini	Look at combining with DDM residuals and rebaselining
Data-driven clustering methods	C. Balbach, K. Haddad A. Fontanini	Chris has read lots of papers on clustering to pull info out of clustering (schedules), Tony has been looking at load profiles. There are no standard methods.
Rebaselining		
Inverse model toolkits for calibrating simulations.	Jeff	Jeff found the IMT very useful in helping calibrating models

When is it time to rebaseline? Bill Koran

Bass has done some work in this area.

Bass: Related: also, when to use which option for evaluation. ESCOs need this. How can we as a DDM committee help them.

Chris: The community needs transparency and credibility. There are lots of solutions, but have any of them been validated and transparent.

Ralph: Doesn't this fit in with Tony's idea of Bayesian techniques for identifying behavior change?

Tony: There isn't much literature on using Bayesian

Jeff: The Bayesian methods won the IMT shootout

Jeff: Are we looking at massive modeling and data mining and is this within 4.7 or is it in 1.5.

Tony: I'll reach out to Joshua New in 1.5 to discuss something. Jeff says they are more into demonstrations than algorithms/toolkits.

Jeff: Maybe we have an RTAR for demonstration of applying techniques. Not quite a toolkit, but more than a list search. We are not at a consensus for what is best yet. The successful contractor would bring data sets. Example in 1093 there was some hourly data sets. RP1017 was a demonstration. There were demos for ANN.

Henry: He was suggesting tossing out taking Bacnet data and data mining those data.

Action Item: Tony to reach out to Joshua New about data mining and massive DDM modeling with TC 1.5

8:15 Discussion of Program (15 minutes)

- Annual Meeting 2017 (Long Beach) Review
 - TC 4.7 Program Information
 - Seminar 29: Urban-Scale Building Energy Modeling, Part 5
 - Monday June 26th – 11:00 am – 12:00 pm, Room: 101A
 - Seminar 29: Urban-Scale Building Energy Modeling, Part 6
 - Wednesday June 28th – 9:45 am – 10:45 am, Room: 102AB

Winter Meeting 2018 (Chicago)		Annual Meeting 2018 (Houston)	
Track 1:	Systems and Equipment	Track 1:	HVAC&R Systems and Equipment
Track 2:	Fundamentals and Applications	Track 2:	Fundamentals and Applications
Track 3:	Standards, Guidelines and Codes	Track 3:	District Energy and Cogeneration Plants
Track 4:	Earth, Wind & Fire	Track 4:	Safeguarding your HVAC&R System
Track 5:	Transportation IAQ and Air Conditioning	Track 5:	Residential - Modern Buildings in Hot and Humid Climates
Track 6:	Tall Buildings	Track 6:	Professional Skills
Track 7:	Modeling Throughout the Building Life Cycle	Track 7:	Research Summit
Track 8:	Heat Exchange Equipment	Track 8:	HVAC&R Control Freaks
Track 9:	Refrigerant Mini Track @ Expo*	Track 9:	HVAC&R Analytics
Track 10:	Residential Mini Track @ Expo*		

Potential Session Topics				
Meeting	Session Type	Session Title	Tentative Session Chair(s)	Speakers
Chicago	Seminar	What do the differences between calibrated energy models and measured data tell you?	C. Balbach	Not sure on speakers
Chicago	Seminar	So, you think you are Gaussian?	R. Muehleisen, L. Wang A. Fontanini	Email exchange among interested
Chicago	Seminar	Identifying and removing outliers for DDMs	A. Reddy, C. Balbach, L. Wang, J. Balthazar	Chris will contact the list and add. B. Koran

8:30: Handbook: (15 minutes)

8:45: New Business (15 minutes)

9:00: Adjourn



Attachment D
Draft Agenda (in Black) and Minutes (in red)

TC 4.7 Applications Subcommittee Meeting
3:30-5:00 pm, Tuesday, 27 June 2017
101A Convention Center (LBCC-1)

Introductions and Agenda Review (5 minutes)

- Sign-up sheet
- Around Room
- Agenda Mods

Started at 3:30 pm

Ron wants to discuss the purpose of the subcommittee. He thinks that there is not a consensus on what “applications” is vs DDM, vs simulation and component models.

Chris: Application has a user and a specific use case.

Ron: What is the IMT? Is that an application?

Bass: DDM was focused on whole building energy performance.

Ralph: if it was focused on whole building energy performance why was it in TC 4.7 and not 7.6?

Ron: One way to think of it is that the different subcommittees have differing expertise and maybe we shouldn't worry about which TC an RTAR comes from as all committees might want to feel free to give input.

Bass: The TC chairs asked that the TC meetings always discuss whether the committee scope needs any updating or reconsideration.

Ron wants to change the order of the Agenda and move new items/research up after simple review/announcements.

Announcements (5 minutes)

- ASHRAE Calls for Papers
 - Long Beach: Closed
 - Chicago: Open
- TC 4.1 new ANSI/ASHRAE Standard 203-2014, “Method of Test for Determining Heat Gain of Office Equipment Used in Buildings” (was it approved?)

No one has any new information

Ron: We will remove this from the agenda.

Action Item: Ron to remove from agenda

Program (15 Minutes)(Keith Cockerham)

Ron reviewed the 2017 program listed below

- 2017 Summer (Long Beach)
 - Urban-Scale Modeling Part 5, Sponsor: (1.5 Computer Applications, 4.7 Energy Calculations) (Chair: Bass Abushakra, PhD.)
 - Automatic Building Energy Model Creation (AutoBEM), Joshua New, Ph.D.

- Simplified Estimation of Energy Use Intensity Based on Building Façade Features, Joon-Ho Choi, Ph.D
 - Retrofitting District-Scale Buildings to Cut Energy Use By 50%: A Case Study, Yixing Chen, Ph.D. and Tianzhen Hong, Ph.D.
 - Urban Scale Modeling Part 6 (1.5 Computer Apps & 4.7)(Chair: Joshua New)
 - Agent Based Modeling to Estimate the Adoption of Energy Efficient Building Technologies, Ralph Muehleisen, Ph.D., P.E.
 - Virtual Reality UBEM, Drury Crawley, Ph.D.
- **Status on papers and program going forward?**
- 2018 Winter (Chicago)
 - Status on papers and program?

Ron asked about a session on Standard 209 Simulation Aided Design with case studies.

Erik: The standard is not published yet (just finishing 2nd public review). There will not likely be things ready for Chicago but maybe Houston. Erik will talk to other committee members.

Joel & Ron will do A session on SSPC-140 Addendum A.

Joel thought he had submitted. But somehow it seems to have gotten “lost” in the machine. They will try again in Chicago. This Addendum is the airside HVAC besttest.

Action Items:

Erik talk to others in SPC209 about a 209 standards session.

Joel to resubmit 140 session for Chicago.

- See schedule Attachment 1
- 2018 Summer (Houston)
 - Status on papers and program?
 - See schedule attachment 2

Erik: Will the Validation & Uncertainty work be ready to give anything?

Ralph: I think we could do something both in Chicago and in Houston.

Bass: It's a good idea to send to the Track Chair and email to ask if the session is a fit

Ralph will put together a Validation and Uncertainty related to the with Ralph, Ron, Phil, and Piljae Im.

Ron: This project is a discussion of measurements on very controlled facilities, uncertainty characterization, and some very detailed measurement of equipment.

Bass: I have been doing a bit of projections on future load analysis (using DDM). We could do a session on the modeling for the power grid.

Chris: I'd like to do a session about DOE Asset Score and associated tools. Something named like Building Performance Rating for Existing Buildings.

Joshua: 1.5 is doing Urban Scale 7 and 8. He also has a possibility and some interest 4.2 is doing a seminar on future weather. He will talk with Bass about the possibility.

Ralph will look at moving Validation and Uncertainty to the Research Summit for Houston because there are so many other sessions for Chicago.

Ron: Has there been anything from TP1588? (layer by layer windows inverse estimating from bulk)
Neal: The session wasn't submitted in time for Long Beach. There will be a technical presentation associated with the paper that is being written. Jeff Haberl will be the chair and will work with Joe Huang on organizing that

Research (65 minutes)

Work Statement Returned with Comments:

- 1748-WS, Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations - Phase 2; Responsible Committee: TC 4.7 (Energy Calculations); CoSponsors: TC 4.10 (Indoor Environmental Modeling; Co-funding: None; Estimated Duration: 18 months; Estimated Cost to ASHRAE: \$180,000; Status: Returned with comments. Work with Research Liaison (RL) to revise work statement before resubmitting it to RAC for review. (Tim Matheson, Brian Reynolds, Craig Wray)

Approved Work Statement Available for Bidding:

- 1661-TRP, Development of Near-Optimal Control Sequence for Chiller Plants with Water Side Economizer using Dynamic Models; Responsible Committee: TC 4.7 (Energy Calculation); CoSponsors: TC 7.5 (Smart Building Systems); TC 1.4 (Control Theory and Application); Estimated Duration: 15 months; Estimated Cost to ASHRAE: \$150,000; (Wangda Zuo) Status: Project Evaluation in Las Vegas.
-

RTAR Rejected:

- WS (RTAR-1730), "Research to Determine the Mass Flow Rate Correlations for Standard Venting Strategies & Components in Attic Spaces with Sloped Roofs", Anthony Fontanini. Originated in TC-4.4 and they are seeking co-sponsorship from TC-4.7.

Tony: The title is being shortened. He thought this was going to be ready. TC 4.4 didn't look at it until this meeting and they did not vote this meeting. They are making some minor changes. Tony asks this subcommittee also do some review.

Ron: WS get decided at the full committee. Tony should decide if he wants to submit to the subcommittee.

Tony: This is trying to get attic ventilation modeled to get good network models for programs like EnergyPlus. They need info for flow coefficients, etc for the models. The project is 3 major tasks: survey of residential attic vents and associated things. This gets flow coefficients and resistances.

Ron: If you are getting the pressure coefficients, isn't this what the input models need?

Erik: Aren't these things all ready tested by manufacturers

Tony: The data that are given (net free area) are not comprehensive enough for modeling

Erik: And there are also problems with roof vents with geometry and wind flow

Tony: The connection devices are also a problem and will be part of the test.

Bass: There is a lot of activity in Urban Scale Modeling coming out of several labs. TC 1.5 computer applications is doing much of this work at ASHRAE and being led in the committee by Joshua New. Do we want to bring this to TC 4.7 as a new subcommittee or put it into the Applications subcommittee?

Joshua New: TC 1.5 emerging application is tasked with looking at new thing. It is natural for this to move to an MTG or another committee as it starts to mature.

Ron: This is not really about new building types of calculations its about using data to generate a bunch of models.

Bass: This is a growth area for our committee.

Ron is TC 1.5 ready for the transfer? Joshua says he thinks so.

Jeff: The TC 4.7 chair should write a letter to chair of 1.5 asking for transfer.

Ron: Is there any opposition? (None presented to the committee)

Jeff: TAMU is doing code compliance study to the states and would be willing to present.

Ralph: I can put together a session with Jeff & Juan Carlos, Maybe Bass. Someone from the Midwest Energy Efficiency Alliance (MEEA) who does a lot of compliance studies with models for DOE.

Action Items:

Tony to send to 1730 TC when it's been updated

Ralph: set up session on compliance modeling in Chicago

Joshua and Bass to get speakers for a demand side management / load prediction in Houston.

- 1813-RTAR, Development of an Accuracy Test Method for Residential Attic Duct System Simulations in Whole-Building Energy Simulation Programs; Responsible Committee: TC 4.7 (Energy Calculations); Co-Sponsors: None; Status: Rejected. By rejecting this topic, RAC is strongly suggesting to the TC that this particular topic be dropped from the TC research plan based upon the information provided and RAC's understanding of the RTAR.
 - Did Mini, Jeff, or anyone follow up on this RTAR?

Mini circulated copies of the response and explained things.

Ron: The RTAR needs to emphasize the end use and not the physics.

Bass: They want to emphasize technology.

Mini: The first 2 pages have the comments and responded.

Mini explained how she responded to each of the five comments. (Those details are not explained here because the RTAR will be passed around)

Action Item: Ball to get 1831 RTAR sent around to TC voting members for review and suggestions for improvement and then there will be an email vote soon after.

- Potential RTARS/Work Statements (15 minutes each max)
 - Urban-scale building energy modeling. Bass Abushakra.
 - Update the ASHRAE F and C Ground Coupling Factors (Neil Kruis)

Neal: I'm discussing this with people in 90.1, there are some people receptive.

- Optimizing change-over mixed-mode cooling systems for houses, using building simulation (Liping Wang, Jeff Haberl, Kamal Haddad)

Ron: This is on the backburner

Fred Baumann: Finishing in 5.3 an WS about testing modeling of chilled beams. Which subcommittee is best for this. The background is there is some data from a previous test project RP 1629?. He wants to know who the right contact and cosponsor.

Answer from someone (I didn't catch who) is Joe Huang and S&C subcommittee).

Chip: SPC205 has a role to play.

Meeting adjourned at 7:2??

- Reconciling differences between simulation results and actual energy use (Joe Huang, Som Shrestha, Jeff Haberl, Neil Kruis)
- Impact of input uncertainties on output uncertainty: Correlated vs non-correlated parameters (Chris Balbach)
- Hybrid forward and data driven modeling (Chris Balbach)
- Guidelines on simulating tall buildings (Joe Huang)
- Comparing ASHRAE 90.1 App G Models to Real Buildings (Joe Huang)
- How to process, convert, or modify weather files for use in energy simulation (Jeff Haberl)
- Jeff is interested in an RTAR related updating the three toolkits so you can pipe one to another and inputs/outputs are consistent. Anyone interested in helping him? This is very important for educators who pull out subroutines / algorithms for teaching. With totally different authors for different routines it is difficult to do use this in a class. Would it make sense to merge these?
- Others?
- Updates on related activities (10 minutes each)
 - Update on SPC 209P, *Energy Simulation Aided Design for Buildings Except Low-Rise Residential* (Jason Glazer)
 - Update on SPC 205, *Standard Representation of Performance Simulation Data for HVAC&R...* (Neil Kruis)

RTARs In Process

- RTAR-1763, Development of an Improved Toolkit for Analyzing Building Energy Use from Time Series Data: Update to the Inverse Model Toolkit (RP-1050) (Jeff?). On Jeff's pile and will submit to Mike ASAP. Got tentative approval after a few corrections. Jeff will copy to Joe and Bass.
- Co-sponsor with TC5.1, RTAR 1769, Experimental evaluation of the efficiency of belt drives for fans (Tim Mathson, Brian Reynolds, and Craig Wray). TC voted to cosponsor 3-2-2. Joe needs to get in touch to find the status. TC 5.1 fans is lead.
- WS (RTAR-1752), A guideline for Calculating the Avoided Source Energy Consumption Due to Waste Energy Recovery (WER) AND Heat Pump (HP) Technologies (MTG-ASEC). Jeff will ask mike for Liason when he calls about 1763.
- 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.

Active RP's:

- RP-1588 is complete and the Final Report was submitted (Jeff, PMSC Chair, informed Bass in an Email)

Topics for Discussion (whatever time remains)

- Should TC 4.7 maintain a set of prototypical building models and input files, possibly building on DOE's "Reference Building Models"?
- Any other issues or concerns (does not have to be turned into an RTAR or WS)
- Emphasis and focus of future applications subcommittee meetings and activities

Attachment 1:
Program Schedule for Chicago

For those of you considering making presentations at future meetings, please review the link <https://ashraem.confex.com/ashraem/w18/cfp.cgi> for the next critical dates.

Chicago Jan 20 – 24, 2018:

This is the overall publication schedule for the ASHRAE 2018 Winter Conference, Chicago. For specific details and questions regarding these dates, please contact the appropriate Track Chair.

Wednesday, March 01, 2017	Conference Paper Abstracts, Technical Papers and Paper Session Requests Due
Monday, March 27, 2017	Conference Paper Abstract Accept/Reject Notifications
Friday, June 02, 2017	Website Opens for Seminar, Forum, Debate, Panel and Workshop Proposals
Friday, July 07, 2017	Final Conference Papers Submitted for Review (Includes Bio, Learning Objectives and Methods of Assessment); Request for Conference Paper Sessions Due
Monday, July 24, 2017	Conference Paper accept/reject notifications
Tuesday, August 01, 2017	Seminar, Forum, Workshop and Paper Proposals Due
Monday, August 07, 2017	Revised Conference Papers/Final Technical Papers Due
Monday, August 21, 2017	Conference and Technical Paper Final Accept/Reject Notifications
Wednesday, September 06, 2017	Seminar, Forum, Workshop Accept/Reject Notifications
Friday, December 01, 2017	Upload of PPTs Begin
Monday, January 08, 2018	All PPTs Due Online
Wednesday, January 17, 2018	Final Day for Commercialism Revision Upload prior to on-site
Saturday, January 20, 2018	Speaker's Lounge Opens

Program Schedule for Houston

Monday, August 28, 2017: Conference Paper Abstracts, Technical Papers and Paper Session Requests Due

Thursday, September 28, 2017: Conference Paper Abstract Accept/Reject Notifications

Friday, December 8, 2017: Final Conference Papers Due - Submitted for Review (Includes Bio, Learning Objectives and Methods of Assessment); Request for Conference Paper Sessions Due

Friday, January 2, 2018: Website Opens for Seminar, Workshop, Forum, Debate and Panel Proposals

Monday, January 15, 2018: Conference Paper Accept/Revise/Reject Notifications

Friday, February 9, 2018: Program (Seminar, Forum, Workshop, Debate and Panel) Proposals Due

Friday, February 9, 2018: Revised Conference Papers/Final Technical Papers Due

Monday, February 19, 2018: Conference and Technical Paper Final Accept/Reject Notifications

Tuesday, March 1, 2018: Registration Opens

Monday, March 19, 2018: Seminar, Forum, Workshop Accept/Reject Notifications

Monday, April 30, 2018: Upload of PPTs Begin

Friday, June 1, 2018: All PPTs Due Online

Wednesday, June 20, 2018: Final Day for Commercialism Revision Upload prior to on-site

Saturday, June 23, 2018: Speaker's Lounge Opens

Conference begins (June 23 – 27, 2018)

Attachment 2: Paper and Program Type Definitions

Conference Papers are short overview papers (8 pages or less), undergo single blind review and require 2 reviewers per paper.

Technical Papers are full research papers, undergo double-blind review and require 3 reviewers per paper.

Conference Paper Sessions. These sessions present papers on current applications or procedures, as well as papers reporting on research in process. These papers differ from technical papers in that they are shorter in length and undergo a much less stringent peer review.

Debates. Debates highlight hot-button issues. Experts, either on teams or as individuals, present different sides of an issue in debate format. Each participant presents evidence for or against a specific statement or question such as ‘Is Sustainability Really Sustainable?’.

Forums. Forums are “off-the-record” discussions held to promote a free exchange of ideas. Reporting of forums is limited to allow individuals to speak confidentially without concern of criticism. There are no papers attached to these forums.

Panels. Panel discussions can feature a broad range of subjects and explore different perspectives on issues in the industry. A panel may feature discussions about integrated project delivery among designers, builders and facility management professionals.

Seminars. Seminars feature presentations on subjects of current interest. Papers are not available from the Society; however, seminar PowerPoint presentations with audio descriptions of the presentations are posted online.

Technical Paper Sessions. These sessions present papers on current applications or procedures, as well as papers resulting from research on fundamental concepts and basic theory.

Workshops. Workshops enable technical committees and other ASHRAE committees to provide a series of short presentations on a topic requiring specific expertise. These short presentations are provided with an increased emphasis on audience participation and training in a specific set of skills.



Attachment E Minutes

TC 4.7 Handbook Subcommittee

5:00-6:00 pm, Tuesday, June 27, 2017

ROOM 101A, LONG BEACH CONVENTION CENTER, LEVEL

TC 4.7 Handbook Committee

Agenda:

Started at 6:10 pm

Bass will be chairing the whole handbook fundamentals 2021 committee. Is someone beside Erik interested in taking his role? He (Bass) is not

Erik: We can make edits to Handbook online. We don't have to wait until 2021.

Bass: There are milestones toward the major revision but they don't really start until next year.

- Debrief on our work on Chapter 19 of the 2017 HOF.

Erik: We didn't all of our desired changes in

Any thoughts about the process.?

Tim: Despite our best efforts it was still all the last minute and we didn't get all we wanted in.

Joel and Ron: But we got more in this one than previous rounds

Erik: Food and drink and outside discussion help.

Erik: Does Bass know of any new collaborative/ authoring platform that might be adopted.

Bass: I will go to training meetings in Chicago to find out a lot more.

- Compile wish list of updates for 2021 version.

Primary System Components could use some update.

Low Energy systems could probably use updates

DDM could use update,

Dynamic modeling (short time scale, true simulation of controls)

Model Calibration can probably use an update

Validation and testing could use more than just Joel and Ron giving input

Chip: If the scope expands to include urban modeling, we should have at least a small section on that.

Erik: We also have the building to grid modeling and optimization

Bass: We need to make sure we have the results of RPs (e.g. 1588, 1741 fan coils, chiller plant control strategy, chilled beams)

Tim: The "How to use Energy modeling in design" needs to be better fleshed out

Chip: Are reference buildings covered anywhere? Maybe we should add something.

Ron: I can do something on passive cooling

Neal: Zoning and appropriate simplifications (geometry)

Eric: The higher ups want examples where possible. Maybe simplifications would be a good place for examples.

Tim: we should reference the HVAC toolkits if they get updated.

Adjourned at 7:55 pm

Spend quality time with our handbook friends.



**Attachment F
Draft Agenda and Minutes**

SSPC 140 Committee

Monday, Jun 26 2017,
Delker (Renaissance Hotel, 3rd floor, Long Beach, CA)

AGENDA – SSPC 140

**STANDARD MOT FOR THE EVALUATION OF BUILDING ENERGY ANALYSIS
COMPUTER PROGRAMS**

Monday June 26, 2017; Long Beach

Time: 2:15P – 6:15P

Location: Delker (Renaissance Hotel, 3rd floor)

Chair: Joel Neymark

1. Introductions: Sign-in sheet, participant introductions, quorum (= 6 VMs).
2. Chair Announcements/Communications since last meeting [5 min.]
 - **Current 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) **8 progs (12 vers.) qualified**
 - 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 20Jun2017).
 - **New IRS rules** for projects placed in service on or after Jan 1, 2016. Agenda item below.
 - **RESNET or DOE list 6** (last check 21Jun2017) tools as either accredited for HERS ratings, “45L” tax credit compliance (DOE), or existing home tax credit compliance. Required tests are NREL’s HERS BESTEST (included in Std 140-2011,-2014), 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>).**
 - **ASHRAE 90.1 and 189.1 reference Standard 140;**
 - 90.1-2016, published Fall 2016, references 140-2014 (except Sections 7, 8).
 - **2015 IECC cites 140-2011;** IGCC citation accords with IECC.
 - **ASHRAE 90.2** proposing to reference Standard 140
 - **140-2014 Addendum A, Airside HVAC Equipment:** ASHRAE published/posted May 16, 2017.
 - **140-2017 Continuous Maintenance Revision:** ASHRAE is in progress; agenda item below.
 - **IEA BESTEST Thermal Fabric Tests Update:** Round 2 sim-trial draft distributed Mar 13, 2017; agenda item below.
3. Membership [5 min.]
4. Acceptance of Previous Minutes [5 min.]
5. Adjustments to Agenda (New business or news briefs to include?) [5 min.]
6. SSPC 140 Website (<http://sspc140.ashrae.org/index.html>) [Sturm, 5 min.]

- Updates this cycle + traffic count
7. 140-2017 Continuous Maintenance Revision [*Neymark, 20 min*]
 - Integrates 140-2014 Addendum A (Airside HVAC cases) with current 140-2014
 8. 140-2017-A: Update Section 5.2 (IEA BESTEST thermal fabric, 1995) test spec/example results [*Neymark/Judkoff, 30 min*].
 - Meeting summary, BESTEST Thermal Fabric Working Group
 - Extension cases: weather-driven infiltration, other?
 9. Proposed Work Schedule for Above Items 7, 8 [*Neymark, 5 min.*]
 10. Empirical Validation Activities [*Start ~3:15p to 4:15p (V&U team be there at 3:05p)*]
 - DOE Empirical Validation Projects [*Judkoff, Haves, Muehleisen, New, 60 min.*]
 11. Incentive Programs [*Judkoff/Roth, 10 min*]
 - New IRS Sec 179D rules (commercial building tax deductions under PATH Act) for projects placed in service on or after Jan 1, 2016 require testing against Standard 140-2014 and use of 90.1-2007 as the base case (instead of 90.1-2001) .
 - RESNET Accreditation:
 - HERS Tools; Existing Homes Tax Credit Compliance
 - 45L Tax Credit Compliance is by DOE, references RESNET
 - 12a. References to Std 140-2014 in Std 90.1 [*Neymark/Pegues, 10 min, > 4:15P for JP*]
 - 90.1-2016 cites 140-2014; next 90.1 CM rev likely in 2019
 - 12b. IECC (C407.6.1) Referencing of Standard 140
 - S. Ferguson indicates (6/22/2016) IECC 2018 to ref 140-2014.
 - 12c. ASHRAE 90.2 proposing to reference Standard 140
 - Neymark submitted PR comment, after consultation with P. Fairey (previous 90.2 Chair), explicitly recommending 140's Class II, Tier 1 tests for consistency with RESNET.
 - 12d. Future new language for 90.1 to ref Std 140 [*Judkoff, 10 min*]
 13. Additional or Revised HVAC Equipment Test Suites
 - a. Airside HVAC Volume 2 [*Neymark, 10 min*]
 - b. Empirical Data-Based HVAC BESTEST (unitary equipment) [*Judkoff, 10 min*]
 - c. Other (e.g., revisions to furnace cases, etc) [*All, 10 min*]
 14. SSPC 140 Work Plan (approved by StdsC in Atlanta, June 2015) [*5 min*]
 - Addendum A: ASHRAE RP-865 Airside HVAC Equipment model tests, 2016
 - Addendum B: Update of Building Thermal Fabric Model Tests, 2017 or 2018
 - Addendum C: Adaptation of Multi-Zone (non-airflow) model tests, 2017 or 2018
 - Needs update after publication of 140-2017.
 15. Other Related Activities [*as time permits*]
 - IEA ECBCS Annex 58 task on whole building empirical validation [*Hong, 5 min.*]
 - ASHRAE Handbook of Fundamentals, Validation Methods [*Judkoff, 2 min.*]
 16. Additional Future Test Suites that could be adopted [*Judkoff, 5 min.*]
 - Empirical Validation Data Sets
 - ETNA BESTEST (Electricité de France 2004)
 - IEA-34/43: Shading/Daylighting/Load Interaction by Switz and Iowa Energy Center. Hydronic Equipment by Germany. Double-Skin Façade empirical by Denmark.
 - IEA-58: Twin Houses at Fraunhofer, Holzkirchen, Germany.
 - Tests from FLEXLAB and MAXLAB.

- Empirically based HVAC-BESTEST
- Analytical Verification and Comparative Tests
 - Adaptation of NREL/IEA 34/43 Multi-Zone (MZ) Tests
 - Adaptation of BESTEST-EX Physics cases for Section 7
 - ASHRAE RP 1052 building thermal fabric analytical verification tests
 - IEA 34/43 Airflow Tests by Japan (final report still in progress),
 - RESNET mechanical equipment test cases (RESNET now qualified for ANSI)
 - IEA BCS Annex 42: Testing/Validation of Models for Resl. Cogen Devices
- Other Existing Test Suites and new research

17. New business

18. Adjourn

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

- **Current 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) **8 progs (12 vers.) qualified**
 - 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 20Jun2017).
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- **ASHRAE 90.1 and 189.1 reference Standard 140;**
 - 90.1-2016, published Fall 2016, references 140-2014 (except Sections 7, 8).
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- **ASHRAE 90.2** proposing to reference Standard 140
- **140-2014 Addendum A, Airside HVAC Equipment:** ASHRAE published/posted May 16, 2017.
- **140-2017 Continuous Maintenance Revision:** ASHRAE is in progress; agenda item below.
- **IEA BESTEST Thermal Fabric Tests Update:** Round 2 sim-trial draft distributed Mar 13, 2017; agenda item below.

Addendum A to 140-2014. (ASHRAE RP-865 Airside-Mechanical Equipment tests adaptation):

- Test suite based on ASHRAE RP-865; **first 140 suite based on ASHRAE research.**
- Airside analysis of Fan Coil (FC), Single Zone (SZ), Constant Volume (CV), and Variable Air Volume (VAV) systems.
 - These are steady-state analytical verification tests (compare whole-building simulation results to numerical-solution results outside of whole bldg. models).
- **NREL final report published Mar 2016. Available at <http://www.nrel.gov/docs/fy16osti/66000.pdf>**
- **Standard 140 adaptation as 140-2014 Addendum A.**
 - **Published May 2017.**

Building Thermal Fabric Tests Update (140, Section 5.2)

- **Address advances in modeling state of the art since 1995**
- Iterate on spec revisions and simulation trials. NREL draft final report planned to include updated spec, example results, and supporting information.
- **Revisions to existing test cases and inclusion of additional excursion (parametric sensitivity) test cases continues in collaboration with SSPC 140.**

Test suite progress:

- 2nd round simulation trial revisions
 - **Simulation trial draft distributed Mar 2017.**
 - 50+ topical spec revisions of varying depth, for this round
 - Adds extension cases (low-e and single-pane windows, insulation and diagnostic cases with const combined surf coeffs [intended to alleviate surface heat transfer differences])
 - **8 programs submitted results. In-progress results are treated as sensitive data, for**

internal use only, and program results are presented anonymously.

- **Next steps:**
 - **Address most recent comments and continue with simulation trial iterations.**

Empirical Validation: SSPC 140 is interested in including empirical validation test suites if they are worthy (high quality experimental data, with well vetted test specifications including empirically determined inputs). **Work sponsored by DOE is in progress. Experimental data is being developed and one group has developed *preliminary* simulation results for comparison with empirical data.** The participating labs are LBNL (Haves), ORNL (Im, New), NREL (Judkoff) and ANL (Muehleisen)

Empirical validation (where program results are compared to empirical data) **is much more difficult than comparative testing** (compare 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 specs are more complex** (real experimental facility versus idealized for simplicity of input) **and inputs must be empirically determined** (in addition to the target output results).

References to Standard 140. Standard 140 is referenced by:

- IRS, Standard 90.1
- Standard 189 (High Performance Green Building Design) Appendix D
- IECC, IGCC
- The newly 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;
- RESNET references Section 7 tests (adapted from HERS BESTEST 1995).
- Florida Building Commission
- Various international references.

Full SSPC 140 meeting notes are available at <http://sspc140.ashraepecs.org/index.html>.

Listing of test suites either included in Std 140 or listed in Annex B23 (of Std 140) is included below. (Included per Jan 2010 request by TC 4.7 Chair; a more comprehensive listing requires a literature survey.)

Analytical Verification Tests and Comparative Tests already in Standard 140 (or with addenda in progress)

- NREL/IEA 12/21 “IEA BESTEST” (building thermal envelope fabric load tests)
- NREL/IEA 22 “HVAC BESTEST Volume 1” (analytical verification tests)
- NREL/IEA 22 “HVAC BESTEST Volume 2” (comparative tests)
- NRCan/IEA 22 “Furnace BESTEST” (analytical verification and comparative)
- NREL/HERS Council “HERS BESTEST” (comparative tests, simplified residential)
- NREL/IEA-34/43 “Ground-Coupled Slab-On-Grade In-Depth Tests” (analytical verification)
- NREL/IEA-34/43 “Multi-Zone Non-Airflow” (analytical verification and comparative)
- ASHRAE RP-865 “Air-Side Mechanical Equipment Analytical Verification Tests”

Other Analytical Verification and Comparative Tests

- NREL “BESTEST-EX” (comparative physics and calibration tests, existing homes)
- ASHRAE RP-1052 “Development of an Analytical Verification Test Suite for Whole Building Energy Simulation Programs – Building Thermal Fabric
- “RADTEST Radiant Heating and Cooling Test Cases”
- IEA-34/43 Airflow Tests by Japan (final report still in progress)

Empirical Validation Tests

- “ETNA BESTEST Empirical Validation Test Specification (NREL and Electricite de France)
- IEA-34/43: “Empirical Validations of Shading/Daylighting/Load Interactions in Building Energy Simulation Tools (EMPA, Switzerland)
- IEA-34/43 “Chilled Water and Hot Water Mechanical Equipment and Control Comparative and Empirical Validation Tests (empirical and comparative, TUD, Germany)
- IEA-34/43 “Double-Skin Façade Empirical Validation Tests” (Aalborg U., Denmark).
- IEA 22 “Daylighting/HVAC Interaction Tests for the Empirical Validation of Building Energy Analysis Tools (Iowa ERS, US)
- IEA 22 Economizer Control Tests for the Empirical Validation of Building Energy Analysis Tools (Iowa ERS, US and Spain)
- IEA ECBCS Annex 42: Comparative Testing and Empirical Validation of Annex 42 Models for Residential Cogeneration Devices (NRCan)
 - http://cogen-sim.net/index.php?pg=&download=Annex_42_ST_B_Final_report_on_comparative_testing_and_empirical_validation.pdf
- New Research: There is a possibility of developing a test facility for empirical validation of software used to model retrofits of existing building (i.e., software that is currently the subject of the BESTEST-EX test suite). Such a test facility would be expensive relative to developing comparative and analytical verification tests, but such expense would be well justified if U.S. energy policy moves towards supporting energy efficiency retrofits of energy-inefficient houses that comprise a large portion of the current U.S. housing stock.

