

**AMERICAN 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: January 27, 2015

TC/TG/TRG TITLE: Energy Calculations

DATE OF MEETING: January 27, 2015 LOCATION: Chicago

MEMBERS PRESENT	YEAR	MEMBERS ABSENT	YEAR	EX-OFFICIO MEMBERS &
Joe Huang (CHAIR)	2012	Bass Abushakra (VICE	2012	See attendance sheet additional attendees
Chris Balbach (SEC)	2013	Michael Wetter	2011	
Jeff Haberl (Research Chair)	2015	Dr Daniel E Fisher,	2011	
Joe Neymark (Standards Chair)	2011	Dr Kamel Haddad,	2013	
Dr Wangda Zuo	2013			
Keith Cockerham (Programs)	2013			
Erik Kolderup (Handbook)	2013			
Joshua New (Webmaster)	2015			
Dru Crawley (SCM)	2015			
Ralph Muehleisen (DDM)	2013			
Ron Judkoff (Applications)	2013			

Total attendance of voting members: 11 present, 3 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
RAC RESEARCH LIAISON	
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	Kolderup/Yuill

These draft minutes have not been approved and are not the official, approved record until approved by this committee.

**ASHRAE TC 4.7 Energy Calculations
Chicago Meeting**

MOTIONS AND ACTION ITEMS

MOTION: A motion passed to review the minutes from the Seattle meeting; 9-0-0 CNV.

MOTION: A motion passed to approve the no-cost extension till February of 2016 for 1588-RP (co-sponsored with TC 4.5); 6-0-0 CNV, Kruis abstaining.

MOTION: Atlanta Program: A motion passed to co-sponsor (with SPC205P) a seminar updating membership on SPC205 developments for Atlanta; 6-0-0 CNV.

MOTION: Atlanta Program: A motion passed to approve the program for Atlanta; 3 seminars; 7-0-0 CNV.

MOTION: A motion for TC 4.7 to support the presentation of "XXXX-RTAR Development of an Improved Inverse Model Toolkit (RP1050) and Diversity Factor Toolkit" to RAC. 7-0-0 CNV

Atlanta Program: A motion passed to approve the program for Atlanta; 3 seminars; 7-0-0 CNV.

TC/TG/TRG MEETING SCHEDULE					
LOCATION – past 12 months		DATE	LOCATION - planned next 12 months		DATE
New York		January 21 2014	Atlanta		June 30, 2015
Chicago York		January 27 2015	Orlando		January 2016
TC/TG/TRG SUBCOMMITTEES					
Function			Chair		
Program			Keith Cockerham		
Research			Jeff Haberl		
Handbook			Erik Kolderup		
Standards			Joel Neymark		
Data Driven Models			Ralph Muelensien		
Simulation and Component Models			Drury Crawley		
Applications			Joe Huang		
RESEARCH PROJECTS – Current			Monitoring	Report Mode	
Project Title		Contractor	Comm.Chm.	At Meeting	
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	
2017 Fundamentals	Energy Estimating Methods	19	June 2016	Kolderup/Yuill	
STANDARDS ACTIVITIES - List and Describe Subjects					
SPC 140 Standard Method of Test for Building Energy Software 6 Ronald Judkoff					
SPC 205 Data Exchange Protocols for Energy Simulation of HVAC&R Equipment Performance - Chip Barnaby					
SPC 209 Energy Simulation Aided Design 6 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. It includes the voting members of the committee listed on the first page

Atlanta Jan 15		Seattle Jun'14		Present at Meeting				Dallas Jan'13	Last Name	First Name	Affiliation	Status 01/14
YEA	Non-YEA	YEA	Non-YEA	YEA	Non-YEA	YEA	Non-YEA	YEA				VM Voting CM Corres., V Visitor
			X		X		X	X	Abushakra	Bass	Milwaukee School of Eng	VM
X		X		X	X				Adams	Mark	ORNL	V
	X		X		X				Anderson	JR	Anderson Engineering	V
			X		X		X		Armstrong	Peter	Masdar Institute	V
	X								Ashukov	Artem	Remak a.s	Guest
									Bae	Nuri	Univ. of Michigan	V
			X						Balaras	Costas	NOA	V
	X				X		X	X	Balbach	Chris	Performance Systems De	VM
	X		X				X	X	Baltazar	Juan-Carlos	Texas A&M University	V
				X		X		X	Baker	Chris	The Weidt Group	V
	X		X		X		X	X	Barnaby	Chip	Wrightsoft	VM
									Beausoleil-Morrison	Ian	Carleton University	CM
				X				X	Berardi	Umberto		V
									Bhandari	Mahabir	ORNL	V
								X	Bilderbeck	Mike	Pickering Firm	V
							X		Bing	Dong	UTSA	V
					X			X	Bosworth	David	BuildLab	V
	X						X		Brooks	Alamelu	-	V
							X		Carling	Par	EQUA	V
	X		X		X				Carpenter	Patrick	Fac Per Feng	CM
									Clark	Jordan	UT-Austin	V
	X				X		X	X	Cockerham	Keith	DLB Associates	VM
								X	Collyer	Breesa	PG&E	V
	X		X				X	X	Cook	Malcolm	Loughborough Univ (UK	VM
	X		X		X		X	X	Cornick	Steve	Nat'l Research Council C	V
	X		X		X		X	X	Crawley	Dru	Bentley	CM
			X					X	Cumali	Zulfi	Energy System	
									Davidson	Tom	DLB Associates	V
				X	X		X	X	Degelman	Larry	TAMU	CM
	X		X		X		X	X	DeGraw	Jason	Penn State Univ	V
					X				Deringer	Joseph	Superb	V
	X								Dong	Bing	UTSA	Guest
									Eley	Charles	COMNET	V
	X		X		X			X	Ellis	Peter	Big Ladder Software	CM
	X		X		X		X		Fallahi	Ali	Fraunhofer CSE	
							X		Feng	Wei	LBNL	V
						X			Firrantello	Joseph	PSU	V
			X				X	X	Fisher	Dan	Oklahoma State Univ	VM
						X			Fontanini	Anthony	Iowa State Univ	V
									Frame	Sara	Eaton's Energy Solutions	V
									Franconi	Ellen	Rocky Mountain Institut	V
									Friedman	Glenn	Taylor Engineering	V
									Glazer	Jason	GARD Analytics	
									Gmitter	Nick	DLB Associates	V
									Gopal	Raj	Gopal Associates	V
					X				Griffin	David	Etc Group, LLC	V
					X				Gu	Lixing	FSEC	V
	X				X		X	X	Haberl	Jeff	TAMU	CM
					X			X	Haddad	Kamel	NRCAN	VM
					X				Han	Guiyuan	PSU	V
									Hartley	Doug	Working Buildings	V
					X		X		Haves	Philip	LBNL	CM
	X						X		Hong	Tianzhen	LBNL	
								X	Howard	Jeff	Kwhours Inc	V
	X		X		X		X	X	Huang	Joe	White Box Technologies	CM
						X			Huizar	Antonio	KW Engineering	CM
									Im	Piljae	ORNL	V
								X	Jain	Semant	Goodman Mfg	V
					X				Javed	Hassan	Masdar, Abu Dhabi	V
	X		X		X		X	X	Judkoff	Ron	NREL	VM
			X						Jump	David	QUEST	CM
									Karava	Panagioton	Purdue	
			X						Kelsey	Jim	KW Engineering	
					X		X		Kennedy	Mike	Mike Kennedy Inc	
									Kennedy	John	Autodesk	
			X						Kim	Hyojin	TAMU	V
					X				Kinney	Kris	SCLenergy	CM

	X		X		X		X	X	Kolderup	Erik	Kolderup Consulting	VM
			X						Koran	Bill	Northwrite	V
	X		X						Kosny	Jan	Fraunhofer CSE	V
									Kota	Sandeep	Texas A&M University	
									Krarti	Moncef	University of Colorado	CM
	X		X				X	X	Kruis	Neal	NREL	V
	X								Kummert	Michael	Polytechnique Montreal	Guest
	X								Lee	Sang Hoon	LBNL	Guest
	X								Li	Zhaoura	UTSA	Guest
	X		X				X	X	Lin	Cheng-Xian	Florida Int. University	CM
									Liu	Shichao	UT-Austin	
	X								Liu	Xoabing	ORNL	Guest
						X			Long	Nicholas	NREL	
						X			Lyons	Peter	Peter Lyons & Assoc.	V
									MacDonald	Iain	NRC Canada	CM
						X		X	Malherk	Elyse	McQuay	V
	X		X			X			Malhotra	Mini	ORNL	CM
	X		X			X		X	McDowell	Tim	TESS	VM
	X								McFadden	Galen	UTSA	Guest
									McHugh	Jonathan	MEC	V
									McNeill	James	Affiliated Engineers	
								X	Miura	Mayumi	Azbil Co.	
	X					X		X	Muehleisen	Ralph	Argonne	CM
	X					X			Mukhopadhyay	Jaya	ESL, TAMU	V
						X		X	Nelson	Ron	IMT	CM
						X		X	New	Joshua	ORNL	CM
	X					X		X	Neymark	Joel	J. Neymark & Assoc	CM
									Ng	Lisa	NIST	
									O'Keefe	Michael	Big Ladder Software	V
						X		X	O'Neill	Zheng	Univ. of Alabama	CM
						X		X	Pang	Xiufeng	LBNL	CM
		X				X			Paulus	Mitch	Texas A&M University	PCM
						X		X	Pegues	Jim	Carrier	V
									Phelan	Jerry	Bayer Material Science	V
									Porst	Kinga	GSA	V
	X								Premkumar	Siddarth	Gilbert Mechanical	Guest
	X					X		X	Pruett	John	ZMM, Inc.	V
						X		X	Reddy	T. Agami	Arizona State Univ	V
									Reilly	Sue	Group 14 Eng.	CM
	X								Roth	Amir	DOE	V
								X	Sahlin	Per	EQUA	V
		X				X		X	Sanyal	Jibo	ORNL	V
								X	Selin	Markus	EQUA	V
									Sharma	Chandan	FSEC	V
								X	Shrestra	Som	ORNL	CM
									Sheinman	Harris	CTT Liaison	
	X					X		X	Shirey	Don	Bentley	
									Smith	Jeremy	OSU	V
		X				X		X	Snyder	Steven	Johnson Controls	
								X	Sobrevilla	Andres	Munters	
						X			Sonderegger	Robert	Itron, Inc.	CM
									Stovall	Therese	Oak Ridge National Labo	V
						X			Studer	Eric	TNZ Energy Consulting	V
	X							X	Subbarao	Kris	PNNL	V
	X								Swartz	Keith	Energy Center of Wisconsin	V
						X			Swenka	Matt	The Weidt Group	V
						X		X	Tabares	Paulo	NREL	
	X					X		X	Taylor	Russ	UTRC	CM
								X	Trcka	Marija	UTRC	
									Ullah	Tania	NIST	
								X	Varela	Ignacio	Heatcraft	V
									Wang	Liping	LBNL	V
						X			Werner	Luke	ERI	V
									West	Scott	Jacobs Engineering	V
						X		X	Wetter	Michael	LBNL	VM
								X	Witte	Mike	GARD Analytics	V
	X								Wong	Edmund	Arup	Guest
									Wray	Craig	LBNL	
	X								Wright	John	University of Waterloo	Guest
	x								Xiong	Zeyu	Oklahoma State Univ	V
	X					X		X	Zuo	Wangda	University of Miami	VM

Appendix 1

TC 4.7 RESEARCH PROJECTS STATUS

ASHRAE
Technical Committee 4.7 Energy Calculations
(January 2, 2015)

Active projects

#	Title	Joint TC	Cog SC/ Contractor	PMSC	Dates / status
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	Haberl reported. Contractor doing well and proceeding Motion for no cost extension for February 2016 approved 7-0-0
1629-RP	Testing and Modeling Energy Performance of Active Chilled Beam Systems	5.3	Applications/		PMS meeting held in Chicago but no PMS or project member present at TC 4.7 main meeting.

Completed projects

#	Title	Joint TC	Cog SC/ Contractor	PMSC	Dates / status
1416-RP	Development of Internal Surface Convection Correlations for Energy and Load Calculations	4.1	SCM,, Univ of Texas	Dan Fisher (Chair), Steve Bruning, Jan Kosny	Completed. Final report approved by Full Committee in Chicago Jan 24, 2012.
1404-RP	Modeling, Analysis, and Reporting Protocols for Predicting Annual Energy Performance from Short-Term Building Energy Monitoring		DDM, Milwaukee School of Engineering	R. Sonderegger (Chair) J. Haberl, V. Smith	Completed. Report approved by Full Committee in Chicago Jan 24, 2012.
1413-RP	Developing standard procedures for filing missing weather data	4.2 (lead)	Oklahoma State University		Completed.

Appendix 2
RESEARCH PLAN

ASHRAE
Technical Committee 4.7 Energy Calculations
Research Plan (July 1, 2014)

Title	Society status	TC 4.7 Status	Actors or TC 4.7 Prime Contact	Subcommittee*
Active co-sponsored projects led by another TC				
1413-RP Developing standard procedures for filing missing weather data (TC 4.2 lead)	Completed	Completed.	Chip Barnaby (member TC 4.2)	DDM
1588-RP Representative layer-by-layer descriptions for fenestration systems with specified bulk properties such as U-factor and SHGC (Co-sponsor TC 4.5)	In Progress	In Progress		SCM
1629-RP Testing and Modeling Energy Performance of Active Chilled Beam Systems (Co-sponsor tc 5.3)	In Progress	In Progress		Applications
WSs approved by TC				
WS under development				
1748-RP Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations (Phase Two)	RTAR unnecessary for Phase Two	Dru discussed status - WS under development	Joe Huang , Simon Rees, Eric Kolderup, Malcolm Cook, Iain MacDonald	SCM
1661-RTAR Modelica Models for the Evaluation of Supervisory Control Strategies in the ASHRAE Handbook.	Sent back to authors, expect revised RTAR in Atlanta	WS under development, now includes referenced to Open Source Modelica software	Wetter, Zuo	SCM
1666-WS Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Beams	Work Statement needs to be presented to TC4.7	Request for TC 4.7 to co-sponsor (Generated by TC 5.3) 6 no vote taken	Fred Bauman	SCM
XXXX-RTAR Development of an Improved Inverse Model Toolkit (RP1050) and Diversity Factor Toolkit	Will be presented to RAC in February 2015	Request motion from TC to support. Motion passed 7-0-0 CNV.	Jeff Haberl	DDM
Work Statement for Energy Modeling of Commercial	BEQ MTG may present to RAC	MTG looking for co-sponsorship. TC 4.7	M. Brandemuehl	APP

Buildings in Support of the ASHRAE BEQ Rating Program	in February 2015	Consensus that need for WS is there, but poorly defined and under budgeted for scope as written. No support vote taken.		

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 öPredicting Annual Energy Use in Buildings Using Short-Term Monitoring and Utility Bills: The Hybrid Inverse Model Using Daily Data (HIM-D)ö
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 öPredicting Annual Energy Use in Buildings Using Short-Term Monitoring: The Dry-Bulb Temperature Analysis (DBTA) Methodö
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 ó 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 ó 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 ó 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 ó 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 ó 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 ó 377 (February).

Appendix 4

Chicago Winter Meeting TC/TG/TRG SPONSORED SEMINARS

PRESENT:

Tuesday 11:00 AM ó 12:30 PM

Seminar 46: Energy Modeling of Tall and Very-Tall Buildings

Room: Adams

Wednesday 8:00 AM-9:30 AM

Seminar 55: Simulation Calibration

Room: Monroe

PLANNED:

Atlanta

- Seminar (Co-sponsor): SCP205 status workshop (Chip Barnaby)
- Seminar: Predictive Controls Case Studies (Phil Haves)
- Forum - Software licensing issues (Chris Balbach / Co-sponsor with TC 1.5 via Joshua New)
- Seminar . Standard Method of Test for inverse and forward software (Ralph M, Ron J, David J)

MINUTES
ASHRAE TC 4.7 Energy Calculations – Main Meeting
Metropolitan Ballroom A (3,Sheraton)
Chicago, IL
Tuesday, January 27, 2015, 6:00-8:30 pm

Minutes (*recorded by Chris Balbach*)

1. Roll call and introductions (5 minutes) Haung
(see the roster)

2. Accept agenda & approve minutes of previous meeting (10 minutes) Haung
Cockerham moved to accept the agenda, seconded by Kruis 6-0-0 CNV

3. Announcements/Liaisons (5 minutes) Haung

Huang mentioned that he saw a lot of other getting awards and thought that TC 47 needed to do a better job to cover this. Huang mentioned that TC 4.3 did very well . they won the Hightower Award as well as the 2014-2015 Service to ASHRAE Research Award. Huang mentions the deadline for Hightower Award is September 1, 2015, and that there is now a new Top TC award.

Huang discussed if TC 4.7 may need to create honors and awards committee. Jeff Haberl agreed to act as %historian+subcommittee chair, with a goal of acknowledging e simulation %pioneers+, similar to IBPSA

Huang discussed upcoming Workshops and Conferences, including the 2015 ASHRAE Energy Modeling Conference, to be held in Atlanta on Sept 30 . Oct 2. Call for presenters is open.

4. Membership (5 minutes) Huang

Rolling off: None
Rolling on: Haberl, Crawley

Huang then reviewed the TC 47 EXCO members and sub-committee chairs.

5. Subcommittee reports

5.1 Applications (10 minutes) Huang

Applications Subcommittee met earlier in the day from 3:30 to 5:00. There was active program discussion with some leaders identified. In additions, an offier from BEQ MTG to co sponsor a work statement whose scope involves reconciling CBECS EUI to prototypical models generated much discussion, and agreement. The subcommittee recommended to BEQ MTG that they consider the topic interesting and ambitious but work statement has serious problems. BEQ MTG Position is such that they will take to RAC in March, if TC 7.6 supports with co-sponsorchp (and not TC 4.7). Else they will not.take the WAS to RAC.

5.2 Data-Driven Modeling (10 minutes) Muehleisen

DDM Subcommittee met from 7:30 . 8:50 on Monday evening. They had discussion of program, including the Calibration Seminar scheduled for Wednesday @ 0800 (Seminar 55). Haberl discussed a new RTAR for updating the ASHRAE IMT. The group discussed a potential Method of Test for Inverse Models (David Jump). Jump not Present. Ron and Ralph to contact David for updates. David Bosworth discussed an potential RTAR for developing a parametric inverse model for occupancy / lighting and plug load schedules. Balbach discussed the nexusqof Energy and Water . the idea of energy and water relationships. The meeting concluded with a discussion on Handbook updates for DDM related topics

5.3 Simulation and Component Models (10 minutes) Crawley

5.4 Research (15 minutes) Haberl

5.4.1 Research Projects

1588-RP Representative Layer-by-Layer Descriptions for Fenestration Systems with Specified Bulk Properties Such as U-factor and SHGC (co-sponsored with TC 4.5)

A GOOD PROGRESS on range of windows, and range of parameters, and a progress on the algorithms to be used.

A NO COST EXTENSION was REQUESTED TILL March 1 2015. McDowell moved and Kolderup seconded to approve the no cost extension 9-0-0 CNV.

1629-RP Testing and Modeling Energy Performance of Active Chilled Beam Systems (co-sponsored with TC 5.3) Request for TC 5.3 for an update on the progress

5.4.2 Work Statements, RTARs, Requests for Co-sponsorship

1661-RTAR Modelica Models for the Evaluation of Supervisory Control Strategies in the ASHRAE Handbook (sent back to Authors) . SCM

The RTAR was submitted to ASHRAE and implemented the comment from RAC, and a WS will be prepared for Chicago.

An RTAR was developed last night by Huang, after the SCM meeting, with Toni Fantonini, to assess the validity of natural ventilation models. A real building comparison came out inconclusive in phase 1 of this work. General approach is to start with data collection (existing data sets, or find a building that is instrumented and collect data), and use a simulation software that has the capability of flow dynamics and air flow thermal performance, thus Create this building model. Finally, give guidance for setting up the simulations and an analysis technique for the output data. Huang noted that a Letter ballot before the August 15 deadline would be great.. Comments were sought to improve this RTAR. Haves noted that we need a clear high level objectives of any RTAR. Reddy suggested that RTAR be shown to the Research Liaison. McDowell noted that it needs a TC4.10 co-sponsorship. Section 4 Liaison: A new TRG is formed to discuss the IAQ path for standard 62.

1666-WS Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Beams . (request for co-sponsorship by TC 5.3)

Requests for co-sponsorship

5.5 Handbook (10 minutes) Kolderup

Handbook committee met from 5:00PM to 6:00 PM on Tuesday evening. Our Handbook of Fundamentals responsibility is Chapter 19, and we are working on 2017 version. The draft needs to be completed by June of 2016. Progress is a little behind, one new section has been drafted. During the meeting, the group discussed the overall outline and made assignments for specific tasks. Anyone interested in reviewing the existing chapter or participating in drafting new content . contact Erik. Haung noted that anyone can join the TC 4.7 e-mail list at onebuilding.org . and handbook announcements will be published there.

5.6 Program (15 minutes) Cockerham

Cockerham noted program Session Chairs here for Atlanta . (Wangda, Malcolm and Chris). The website for both Atlanta and Orlando Programs submissions are open. The deadline for submitting Seminars, Forums and Workshops for Atlanta is Feb 9th. Cockerham noted that for any program submission, it is important to contact the specific Track Chair to advise suitability. For the Atlanta Conference, we have a track titled %Modeling for the Building Life Cycle+. with a Track Chair of Jeff Spitler and Michael Collarin. Cockerham reported that CEC will now begin require the use of Standard ppt (PowerPoint) Templates at the Orlando winter conference (not yet in Atlanta). Cokckerham reported that ASHRAE CEC seeks reviewers for conference papers . if interested contact Keith or go directly to the speakers lounge. Cokckerham reported on program ideas generated by the subcommittee (see above), and a successful motion was made to support the slate vote was taken to support.

5.7 Standards (15 minutes) Neymark

SSPC 140: Neymark reported that SSPC 140 is now available as a new Continuous Maintenance revision of Standard 140 (5th revision). The document is cited by several authorities, such as current IRS tax deductions for listing approved software. Neymark reported that new SSPC 140 (voluntary) submittals go to Ron Judkoff, and DOE maintains the listing of qualified programs. Other authorities referencing SSPC 140 include ASHRAE 90.1, ASHRAE 189.1, RESNET, 2015 IECC, and the ANSI Roadmap for Action and Coordination for recommendations. Neymark reported that during peer reviews at DOE in April 2014, 4 out of 5 reviewers rated the SSPC 140 work as outstanding. Neymark reported the Airside HVAC systems modeling (fan coil, single zone, constant volume etc). simulation tests are winding down, with an expectation that Addendum A would be completed in 2016. In addition, the SSPC- 140 2001 BESTEST thermal Fabric cases are being upgraded, with a 1st round of simulation trials ongoing. A test spec for this was released in July of 2014. The first round of results were received from September . November of 2014. The initial round received 7 software participants from 7 different countries. The 2nd round will address comments from 1st round reviews and will add additional cases to the test suite as time and budget allows.

Empirical Validation: Judkoff reported on the Empirical Validation Roadmap effort. DOE, in conjunction with ORNL and LBNL, is funding the development of an empirical validation roadmap document. Currently Standard 140 has NO empirical tests, thus this is an opportunity to get the pre-work completed to eventually incorporate into the standard 140. A workshop to be held in 1/2015 will be limited to 30 participants; with the results will go into the roadmap publication. . .

SPC 205 . Std. Representation of Perf. Sim. Data for HVAC&R & Other Facility Equipment Barnaby

Chip Barnaby updated the TC, since we are the cognizant committee . the Intent of this Standard is to develop Standard Performance Map data about HVAC Equipment . The initial approach will cover three components for standardizing 1) unitary cooling equipment, 2) fans and 3) liquid chillers. A draft document has been assembled, and the committee plans to go to APR (Advisory Public Review) in a couple of months. TC 4.7 members are encouraged to participate in the public review. The Subcommittee met in Chicago to discuss the 2nd round of equipment to be supported - with much interest in VRF, pumps, cooling towers and air-cooled chillers

SPC 209 Energy Simulation Aided Design Kolderup

Kolderup provided an update . The standard remains under development, and is still working to reach consensus on the minimum standard for the use of simulation during design, construction, and operation of a building. There will be minimum procedures for each phase . Design phase, construction phase, and Operations phase. Modeling is to be mandated at the Schematic Design phase, and perhaps earlier, The committee still has quite a bit of work to do. The goal is to be referenced by USGBC and LEED, with a main motivation to get energy modeling to occur earlier in the design process.

5.8 Web Site (5 minutes) New

Haug provided an update. New is our new webmaster.

6. Related activities reports (15 minutes)

SPC 191 Water Conservation - None reported.

MTG.EAS Energy Efficiency of AHU Systems - Haberl reported the MTG Has been disbanded

SGPC 20 Documenting HVAC&R Work Process and Data Exchange Requirements - Barnaby reported the committee continues to capturing use cases and identify information that needs to be exchanged to implement automation of HVAC/R processes. Later this year there will be an Addendum for new use cases including records related to operations and maintenance.

TC 2.8 Building Environmental Impacts and Sustainability - None reported.

TC 4.1 Load Calculation Data and Procedures - Barnaby talked about updating the HOF chapter. Barnaby reported that a research project on heat gain from LED lighting is ongoing. A new ASHRAE Loads Calculation Manual is now available in the bookstore.

TC 4.2 Climatic Information - Crawley reported that Standard 169 was subject of an addendum to ASHRAE 90.1 for the adoption of new weather data..

TC 4.3 Infiltration & Ventilation Requirements - None reported.

TC 4.5 Fenestration . John Wright reported he was unable to make any TC 4.5 related meetings.

TC 6.5 Radiant Heating and Cooling - None reported.

TC 7.5 Smart Building Systems (now includes TC 7.4) - Haberl provided an update . The 7.5 subcommittee on Smartgrid is looking at how to calculate energy savings using smartgrid data. Clearly IMT requires upgrade, Current IMT algorithms cannot handle well data from building and coincident weather file and there is not a method for determining a time delay/response from a building. The current IMT has a tendency to over predict energy since there is no maximum (chop) of the model at excessive temperatures.

TC 7.6 Building Energy Performance - Update by (name not noted). The 7.6 committee was discussing the BEQ RTAR. The scope, deliverable, effort was ambitious. TC 7.6 expressed interest in co-sponsoring but not the way it was written and with the limited clarity.

BuildingSMART (formerly IAI International Alliance for Interoperability) - None reported.

IBPSA USA . Barnaby provided an update. The group met on the previous Saturday, and elected a new Board of Directors. The group has a new Executive Director and support staff. A new website (www.unmethours.com) is being hosted by the group and currently has ~500 users. The website supports questions related to simulation software and software use. IBPSA USA is also hosting the Building Energy Software Tools (BEST) directory. The group will be letting an RFP for developing a daylighting course in the near future. .IBPSA-USA is planning for the International IBPSA Conference in 2017 to be held in San Francisco, with Phil Haves as the conference chair. There is an active steering committee, and a hotel has been booked, the conference will be in August of 2017. Haberl reported that IBPSA USA is continuing effort to scan historical documentation from Henry Amastadi and to make available this data. ~ 70 boxes of stuff. Larry Degleman has also donated an original copy of the Post Office program proceedings from 1970. This will be scanned and OCR and included in the library. Also a 1971 National Standards proceeding with ~ 70 papers, one from CSIRO, who originally studied the original , 1st complete simulation program was written by Larry Dengleman, while at Penn State. Haberl led discussion of a possible nomination of Larry to an IPBSA world fellow+.

IPBSA Canada . No report

IPBSA World . Also has new elections and officer. 2015 international conference to be held in Hyderabad, in India

IBPSA England . Malcolm Cook provided an update - IBPSA . England is holding a conference from Sept 14 -16, 2015 in New Castle. A formal announcement will be made in May of 2015

BPI-2400-S-2011 Standardization Qualification of Whole-house Energy Savings Est - None reported.

Guideline 14 - Update provided by Jeff Haberl. Guideline 14 was officially released by ASHRAE in December of 2014. It is available with an informative appendix which includes examples and instructions, some which come from analysis of ASHRAE Headquarters building data. Guideline 14 also includes the RP1093 diversity factor toolkit and sample files. A new method of delivery, when one purchases the guideline, the also receive a link to download software from an ASHRAE repository.

IEA Annex 60 - Wangda Zou provided a report. When the Annex last met in Berkeley, they defined a next generation building simulation tool based on Modelica. Project will be open source. The project team is working with LBNL and others to create a common component library. They are creating python scripts to automate (pre and post processing) many of the tedious tasks. The goal is to develop an interface for co-simulation with different tools. Project is now in project execution phase. The next team meeting is in April. Progress is going well.

IEA Annex 66 - Tianzhen Hong provided an update. The team is now one year into the project. Twenty researchers are participating from twenty different countries. The work has led to seminars and presentations at the last two ASHRAE conferences. The team is developing models of occupant behavior that can be used with co-simulation techniques to improve the error of occupant behavior. LBNL is hosting a three day meeting at end of March . search the LBNL website for more information.

ASHRAE Historical Committee - Haberl provided an update. ASHRAE is planning for the organization's 125th anniversary (2019). Efforts include updating the heat/cool book and but there is a need for need information on (simulation related) heating and cooling estimating methods. The committee seems to be more interested in the history of physical components (chillers, coils, etc.) There may be a seminar in Atlanta on %How did we get to the heating/cooling methods that are used today?+The ASHRAE Historical committee typically goes out and videotapes/record the memories of ASHRAE members before they pass away.

7. **Old Business** Haug - None reported.

8. **New business** Haug - None reported.

9. **Executive Session** Haug - No executive session

10. **Adjourn** Haug - A motion to adjourn by Kruis, seconded by Judkoff. Meeting adjourned at 8:04 pm.

Attachments

- A. 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

Attachment A

Agenda ASHRAE TC 4.7 Energy Calculations – Main Meeting

Agenda ASHRAE TC 4.7 Energy Calculations – Main Meeting Empire Ballroom Palmer House Chicago, Illinois Tuesday, January 29, 2015, 6:00-8:30 pm

- | | |
|---|------------|
| 1. Roll call and introductions (5 minutes) | Balbach |
| 2. Accept agenda & approve minutes of previous meeting (10 minutes) | Huang |
| 3. Announcements/Liaisons (5 minutes) | Huang |
| 4. Membership (5 minutes) | Huang |
| 5. Subcommittee reports | |
| 5.1 Applications (10 minutes) | Huang |
| 5.2 Data-Driven Modeling (10 minutes) | Muehliesen |
| 5.3 Simulation and Component Models (10 minutes) | Crawley |
| 5.4 Research (15 minutes) | Haberl |
| 5.4.1 Research Projects | |
| • 1588-RP Representative Layer-by-Layer Descriptions for Fenestration Systems with Specified Bulk Properties Such as U-factor and SHGC (co-sponsored with TC 4.5) | |
| • 1629-RP Testing and Modeling Energy Performance of Active Chilled Beam Systems (co-sponsored with TC 5.3) | |
| 5.4.2 Workstatements, RTARs, Requests for Co-sponsorship | |
| • 1661-RTAR Modelica Models for the Evaluation of Supervisory Control Strategies in the ASHRAE Handbook (sent back to Authors) – SCM | |
| • 1748-RTAR Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations (Phase 2) - SCM | |
| • 1666-WS Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Beams – (request for co-sponsorship by TC 5 3) | |
| • Requests for co-sponsorship | |
| 5.5 Handbook (10 minutes) | Kolderup |
| 5.6 Program (15 minutes) | Cockerham |
| 5.7 Standards (15 minutes) | Neymark |
| SSPC 140 SMOT for Eval Bldg Energy Analysis Computer Programs | Judkoff |
| SPC 205 – Std. Representation of Perf. Sim. Data for HVAC&R & Other Fac'l Equipment | Barnaby |
| SPC 209 Energy Simulation Aided Design | Glazer |
| 5.8 Web Site (5 minutes) | New |
| 6. Related activities reports (15 minutes) | |
| SPC 191 Water Conservation | |
| MTG.EAS Energy Eff AHU Systems | |
| SGPC 20 Documenting HVAC&R Work Process and Data Exchange Requirements | |
| 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 (now includes TC 7.4) | |
| 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 | |
| IEA Annex 66 | |
| ASHRAE Historical Committee | |
| 7. Old Business | Huang |
| 8. New business | Huang |
| 9. Executive Session | Huang |
| 10. Adjourn | Huang |

Note TC 4.7 Email list hosted at onebuilding.org

Attachment B



Draft Agenda

TC 4.7 Simulation and Component Models Subcommittee

6:00-7:30 pm, Monday, 26 January 2015

Monroe, 6th Floor, Palmer House

Chicago, Illinois

-
- 6:00 Call to order / introductions / changes to the agenda Crawley
- 6:10 **Research Projects**
- **1629-RP** Testing and Modeling Energy Performance of Active Chilled Beam Systems (TC 5.3 / TC 4.7)
- 6:20 **Draft Work Statements/RTARs**
- **1666-WS** Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Beams (TC 5.3 Room Air Distribution, requesting TC 4.7 co-sponsor) Bauman, Zimmerman
 - **17xx-WS** Development of Improved and Integrated Energy Modeling Software for Data Centers (TC 9.9 / SPC 90.4P / TC 4.7) Davidson, Haves
 - **17xx-WS** Development of a Reference Building Information Model (BIM) for Daylighting Optimization (TC 1.5 / TC 4.7) Haberl
 - **1661-RTAR** Development of Modelica Models for the Evaluation of Supervisory Control Strategies in the ASHRAE Handbook Wetter
 - **17xx-RTAR** (Phase 2 of 1456-RP Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations) (TC 4.10 / TC 4.7) Huang
- 6:50 **New Research Topics/Research Plan**
- New Research Topics (RTARs and WSs can be submitted 4 times a year—six weeks before Winter and Annual meetings and 1 March/1 August.)
 - Several new research topics at last meeting:
 - Research for new ground heat transfer tables in the HOF (Kruis)
 - Research for better simulations for occupants (Hong)
 - Better hygrothermal modeling for highly efficient buildings, including VOC issues, etc. Current project supported by the IEA (Rode).
 - Research in support of ASHRAE bEQ building rating system (Brandemuehl)
- 7:20 **Program Ideas**
- 2015 Annual (Atlanta), 2016 Winter (Orlando), 2016 Annual (St. Louis)
- 7:25 **New Business**
- 7:30 **Adjourn**
-

Next Meeting: Monday, June 29, 2015 Atlanta, Georgia

TC 4.7 Simulation and Component Model Subcommittee Meeting Minutes

- 6:05 Call to order
introductions
changes to the agenda - None Crawley
- 6:10 **Research Projects**
- **1629-RP** Testing and Modeling Energy Performance of Active Chilled Beam Systems (TC 5.3 / TC 4.7)
- No report
- 6:20 **Draft Work Statements/RTARs**
- **1666-WS** Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Beams (TC 5.3 Room Air Distribution, requesting TC 4.7 co-sponsor) Bauman, Zimmerman
- No report
- **17xx-WS** Development of Improved and Integrated Energy Modeling Software for Data Centers (TC 9.9 / SPC 90.4P / TC 4.7) Davidson, Haves
- Phil reported – there was a seminar held on 1/26/15 for modeling data center. No one present attended. No new progress on this Work Statement
- **17xx-WS** Development of a Reference Building Information Model (BIM) for Daylighting Optimization (TC 1.5 / TC 4.7) Haberl
- Report from Jeff Haberl (no progress made since Seattle)
- **1661-RTAR** Development of Modelica Models for the Evaluation of Supervisory Control Strategies in the ASHRAE Handbook Wetter
- Report from Wanda Zou – Previous WS required a commercial compiler (DYMOLA) to complete. WS revised to use free Modelica tools instead. Deliverables also need to be able to run on a free modelica tool. Wanda asked this subcommittee for a motion to recommend up to Main TC. Discussion. Recommendation to further revise WS before submitting.
- **1748-RTAR** (Phase 2 of 1456-RP Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations) (TC 4.10 / TC 4.7) Huang
- Report from Joe, debate by subcommittee. Discussion on scope. Action items – propose to have a rewritten RTAR to circulate to the TC by April 1 ready by May 15

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 last meeting:
 - Research for new ground heat transfer tables in the HOF (Kruis)
 - Research for better simulations for occupants (Hong)
 - Better hygrothermal modeling for highly efficient buildings, including VOC issues, etc. Current project supported by the IEA (Rode).

7:20 **Program Ideas**

- 2015 Annual (Atlanta), 2016 Winter (Orlando), 2016 Annual (St. Louis)

KCockerham - Track 7 – Atlanta – Modeling throughout the Building LifeCycle

Phil Haves - Model Predictive Control (Central Plant, Radiant Slab, Annapolis military facility),
Chair identified

AEDG – case studies with design and reuse. No chair identified.

7:25 **New Business**

7:30 **Adjourn**

Adjourn ~ 7:20

Next Meeting: Monday, June 29, 2015 Atlanta, Georgia



Attachment C Draft Agenda and Minutes

TC 4.7 Data Driven Models Subcommittee Meeting

6:00 . 7:30 pm, Monday, January 26, 2015

Monroe, 6th Floor,, Palmer House
Chicago, IL

Agenda:

- 7:30 Call to order / Introductions / Changes to the agenda
- 7:40 Discussion of Program (10 minutes)
- Winter Meeting 2015 (Chicago) Review (Calibration Seminar)
 - Summer Meeting 2015 (Atlanta)
 - Winter Meeting 2016 (Orlando)

 - 2015 ASHRAE Energy Modeling Conference (Atlanta)
(no program discussion – just info/announcement)
- 7:55: Work Statements / RTAR's (50 minutes)
- Existing WS and RTAR's
 - Haberl: Inverse Modeling Tool Update RTAR "Development of an Improved Inverse Model Toolkit (IMT) for Analyzing Building Energy Savings from Time Series Data"

 - Ideas previously discussed:
 - David Jump idea from NY: Develop and test a methodology to validate public domain and proprietary energy baseline modeling capabilities well as savings estimation using inverse modeling methods on whole building data. The goal is to create a method of test of inverse models
 - AI for data-driven modeling
 - In-situ procedures for energy savings from renewable projects
 - In-situ procedures for actual energy performance of LEED-Certified buildings
 - Electricity demand savings
 - Water use in a facility

 - New ideas?
- 8:40 Discussion on: (15)
- Better ways to digest past research
 - Disseminate research results
 - What from DDM SC is in handbook?
 - Coordinate research and results with allied TC and SC (co-sponsoring RTAR's)
 - TC 7.5 Smart Buildings?
 - TC 7.6 Energy Performance?
 - Maintain expertise within SC even when membership changes.
- 8:50 Old Business
- 8:55 New Business
- 9:00 Adjourn

Minutes:

- 7:30 Call to order / Introductions / Changes to the agenda
- 7:40 Discussion of Program (10 minutes)
- Summer Meeting 2014 (Seattle)
 - Winter Meeting 2015 (Chicago)
 - The request for ideas for Seminars, Workshops and Forums went out.
 - It was mentioned that there is one TC4.7 sponsored seminar to be held on Wednesday and one TC 4.7 co-sponsored seminar also to be held on Wednesday.
 - We received notice from Mr. David Jump is looking to resubmit an abstract that he completed before for a recent meeting, but was not accepted, for the upcoming Seminar in Seattle.
- 7:50: Work Statements / RTAR's (50 minutes)
- Existing WS and RTAR's
 1. Update to 1404 – According to Bass Abushakra, the RTAR was submitted today. There have been two papers presented and three more papers that will be based upon the RTAR research performed.
 - Ideas for new RTAR's
 1. The Draft RTAR "Development of an Improved Inverse Model Toolkit (IMT) for Analyzing Building Energy Savings from Time Series Data (An Enhancement to the RP-1050 Inverse Modeling Toolkit)" was brought to the floor by Jeff Haberl. Discussion of this new RTAR was held. Jeff received some good feedback and will resubmit the draft in Seattle.
 - Jeff Haberl made a quick five minute presentation of what is an RTAR and how does the work statement actually work.
 - David Jump discussed a potential RTAR to develop and test a methodology to validate public domain and proprietary energy baseline modeling capabilities well as savings estimation using inverse modeling methods on whole building data. The goal is to create a method of test fo inverse models.
 - An idea put forward by Ralph Muehleisen, who may not have time to continue pushing it forward, is to analyze databases of government retrofits to develop a large set of retrofit data to use for comparison in various modeling projections. The reason for using that data is very detailed data are available because it is federal buildings
 - A second idea from Ralph Muehleisen is that there are private companies working with DOE labs right now, to develop a work flow to use 3D GIS data along with IR satellite data to generate building prototype building models. The plan is to then automatically calibrate the model to utility data (this workflow is being developed). This is not an inverse method, but a calibrated forward method as it involves creation of building models.
- New / updated Guideline 14 was discussed by Jeff Haberl. There were a number of comments that are being addressed.
- 8:50 Old Business
- None
- 8:55 New Business
- Joe Huang asked what people are using for Data Visualization for large quantities of data.
- 9:00 Adjourn
- Meeting Adjourned at 8:59 PM



**Attachment D
Draft Agenda and Minutes**

TC 4.7 Applications Subcommittee Meeting
6:00 . 7:30 pm, Monday, January 26, 2015
Monroe, 6th Floor,, Palmer House
Chicago, IL

**TC 4.7 Applications Subcommittee
Draft Agenda
Chicago
Tuesday, 27 January 2015
3:30-5:00pm Empire Ballroom Palmer House**

- 1) Introductions and Agenda Review (5 minutes)
- 2) Announcements (1 minute)
 - a. new Subcommittee Chair (!)
- 3) Program (15 minutes) (Keith Cockerham)
 - a. 2015 Winter (Chicago)
 - b. 2015 Summer (Atlanta)
 - c. 2016 Winter (Orlando)
- 4) Research (65 minutes)
 - a. Updates on related activities (10 minutes each)
 - Update on BEMBook and other COMNET-related activities (Ellen Franconi)
 - Update on SPC209P, *Energy Simulation Aided Design for Buildings Except Low-Rise Residential Buildings* (Jason Glazer, if available)
 - Ideas for new RTARS (15 minutes each)
 - Guidelines on simulating tall buildings (Joe Huang)
 - Reconciling differences between simulation results and actual energy use (Ron Judkoff)
 - How to process, convert, or modify weather files for use in energy simulations (Jeff Haberl)
 - 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).

TC 4.7 Applications Subcommittee Meeting Minutes

TC 4.7 Applications subcommittee

3:33 – Joe Huang call to order

Agenda circulated a few days ago

Joe Huang relinquishing chair of the application subcommittee at the end of the meeting

1) Introductions

23 attendees (not all listed here):

Malcolm Cook

Anothony Fontaninni

Ralph Muehlheisne

Chris Balbach

John Burns

Colin Embache

Rick Sentury

Mini Malhotra

Mahabir Bhandari

Joshua New

John Prui

Krishnan Gowri

John Write

John Grimwold

Tim McDowell

Daniel Dragon

Emilia Cargaska

Late: Keith Cockerham

Mark Adams

2) Announcements – Ron Judkoff will take over as subcommittee chair

3) Program (Keith Cockerham)

a) Winter 2015 (Chicago)

b) 2015 Summer (Atlanta) – papers due Feb. 9, presentations June 15

c) 2016 Winter (Orlando) – plenty of time, submissions due March 23

Ron vouches that he will be taking over as chair

Keith shares information from this morning's meeting. Tech papers, conference papers, seminars/forum/workshops/mini conferences. Track 7 – Modeling throughout the building life cycle is an open question as to whether we have content to provide for that track.

Question as to whether we have a definition of mini conference.

TC training – Atlanta templates can be used or use your own; in Orlando must use ASHRAE provided templates; there may be ~3 templates for Orlando

Conference paper reviewers are needed – request for people to sign up by contacting Keith or by signing up at the presenter's room.

Potential seminars for Atlanta: Model-predictive controls (Phil) – 3 applications (Naval Academy, Mian Hotel)

Adaptive strategy for model re-use

Old ideas for programs: Natural Ventilation (Wangda), Standard 205 (Chip Barnaby), Data Visualization techniques for identifying fraudulent or tainted data, BIM to BEM (Jeff Haberl), turning simulation into commodities (Jeff Haberl), Standard MOT for calibration (Ron Judkoff)

New programs: presentation at session called methods of testing calibration methods; David Jump (DDM type of calibration), Ron Judkoff, and Joshua New; Keith recommends submitting to track 7; ralf volunteers to chair, Ron Judkoff and Joshua New will give presentations (maybe papers next time)

ASHRAE Energy Modeling Conference 9/30-10/2 in Atlanta still have call for presenters through 3/2 (presentations only)

IBPSA meeting using simulation for demand response controls, day-ahead strategies, speakers who might fit into this: gregor hans (in Spain on sabbatical now), Jim Bruhn recommendations; question whether this predicts with model-predictive control; Jim will take lead and see where it goes

Malcolm asks about plan for natural ventilation – program chair of natural ventilation, no seminar dedicated to that, Malcolm might be able to communicate if this is still going on

Chris Balbach – presentation review has commercialization policy for software; misunderstandings within CEC about what words mean regarding legal; forum or seminar to educate membership; co-

sponsorship from other TCs 1.5 has forum is not recorded so can talk about other things; good questions and then let it go (no speakers), need moderator; Joshua New will take to 1.5 to see if we could co-sponsor

4a) New RTARs

Ellen and Jason (Comnet, bimbook, spc209p) almost bypassed. Bimbook library put together by Rocky Mountain Institute, moving over to IBPSA, the BIM library is being hosted for a series of best practices (led by Ellen franconi)

209p about energy simulation aided design for commercial buildings – idea to specify minimum requirements, some modeling cycles required within the design phase (pre-design, schematic design, design and construction phase).

4b) Mike Brandenmuehl RTAR, looking for co-sponsorship with TC4.7; Building quotient is meant to rate building type to median building of that type to describe energy performance based on CBECS existing data. Energy models to predict real building performance couched in rating language. Objectives reviewed.

Ralph Muehlheisen recommends looking at England's large-scale study which isn't referenced

Ron Judkoff verifies they cited their work

Jeff Haberl thinks it's too big (multi-million dollar effort), that CBECS doesn't apply to mixed-use non-mall items, and that too vague...recommends cracking off one building and do it then scale

Joe Huang does not agree, may not calibrate all buildings, but that there's still value if it's ok on average.

Plan to address Jeff's feedback with current step 1 of the RTAR will identify the distributions to see what's realistic and what scope should be dropped.

2 asks: helpful feedback and sponsorship for submitting RTAR in next month. ASHRAE 7.6 also asked.

Jeff Haberl recommends doing it on 1 building type for 1 zone; Joe points out they could calibrate DOE reference buildings on CBECS EUI and be done; Jeff Haberl thinks it's way too ambitious

Ron Judkoff raises need to reproduce methodology from previous study bc couldn't find a way to do it any easier

Ralph Muehlheisen raises that CBECS is bringing new data online that make it tractable

Joshua New raises that new algorithms and capabilities may make it possible. Joe Huang pointed out calibrating DOE reference buildings to CBECS EUI and that there have been rumors of a funded project to do exactly that.

Phil Haves recommends that the investigation should be clearly defined in the scope so that RAC can clearly say whether a bidder is going to meet the requirements

Plan is to write a short paragraph saying that TC4.7 thinks it should be done, but that the scope and methods may need some work

4c) Jeff Haberl – How to process, convert, or modify weather files for use in energy simulations; Jeff talks a bit about it, thinks more of 4.2 thing than 4.7 things

Could ASHRAE take over the static commercial reference buildings; no danger of them not being available but not being worked on. They will be in OpenStudio.



Attachment E Draft Agenda and Minutes

TC 4.7 Handbook Subcommittee
5:00-6:00 pm, Tuesday, January 27, 2015
Empire Ballroom (Lobby), Palmer House
Chicago, IL

TC 4.7 Handbook Subcommittee Agenda Chicago

**Tuesday, January 27, 2015
5:00-6:00pm,**

Room: Empire Ballroom (Lobby), Palmer House, Chicago, Illinois

- 1) Introductions and Agenda Review (5 minutes)
- 2) Schedule for 2017 Fundamentals Handbook Revision
 - a. January 2015, 25% draft
 - b. June 2015, 50% draft
 - c. January 2016, 95% draft to TC for review
 - d. June 2016, TC approves revised chapter (final due June 21, 2016)
 - e. Early 2017, review galley prints
 - f. June 2017, publication
- 3) Reminder of target audience description
 - a. See doc link below
- 4) Editing process
 - a. 2013 Chapter 19 doc in Dropbox folder. See link below
 - b. Use track changes to add notes and edits. Otherwise changes will not make it into the 2017 version.
 - c. Files with tracked changes may be emailed to Erik Kolderup, erik@kolderupconsulting.com
 - d. Source files and references may be uploaded to the Dropbox folder.
- 5) Review potential chapter outline changes. Assign responsible committee members.
 - a. See 2013 Outline link below for reference.
- 6) Assign action items

Resources:

- Word version of 2013 Chapter 19 for review and markup. In Dropbox folder: <https://www.dropbox.com/s/h9vnz7e99u6xvev2/Uv3Nv8LdaI>
- Outline of all 2013 Chapter 19 sections. In Dropbox folder: <https://www.dropbox.com/s/h9vnz7e99u6xvev2/Uv3Nv8LdaI>
- Description of target audience. Google Doc: https://docs.google.com/document/d/174pP_sNvLlSMAlDZTMTcMvh9wiU;ibwTdl7i4EY7nBrE/edit?usp=sharing
- Working list of potential updates and assignments: <https://docs.google.com/document/d/1xMb-wnU5erA-xUoGqgePb508X0hD1vZ0LhlWKEmkKnl/edit?usp=sharing>

**TC 4.7 Handbook Subcommittee
Meeting Minutes**

Chicago

Tuesday, January 27, 2015

5:00-6:00pm,

Room: Empire Ballroom (Lobby), Palmer House, Chicago, Illinois

Name	Email	Interest	Initials
Erik Kolderup, chair	erik@kolderupconsulting.com		X
Agami Reddy	reddyta@asu.edu	Data driven modeling	
Alamelu Brooks	Alamelu.brooks@icti.com	Validation, calibration	X
Andy Brophy	Abrophy89@gmail.com	Calibration, occ beh	X
Anthony Fontanini	fontania@iastate.edu	DDM, sim components	X
Artem Zkukov	Green.azkukov@gmail.com	MPC, param. studies	X
Bass Abushakra	abushakr@msoe.edu	DDM	
Charlie Curcija	dccurcija@lbl.gov	Calibration	
Cheng Xian Lin	lincx@fiu.edu	Data centers	X
Chip Barnaby	chipbarnaby@gmail.com	Loads	X
Chris Baker	chrisb@twgi.com		
Chris Balbach	cbalbach@psdconsulting.com		X
Craig Wray	cpwray@lbl.gov		
Dan Fisher	dfisher@okstate.edu		
Dru Crawley	Dru.crawley@bentley.com		X
Edmund Wong	Edmund.wong@arup.com	Calibration, DDM	X
Hyojin Kim	kiml@cua.edu	DD, calibration, occ beh	
J. Patrick Carpenter	facperfeng@comcast.net		X
Jeff Haberl	jhaberl@tamu.edu	DD, calibration	X
Joe Huang	yijhuang@whiteboxtechnologies.com		X
Joel Neymark	neymarkj@msn.com	Validation	
John Pruett	jap@zmm.com	Calibration	X
Larry Degelman	ldegelman@suddenlink.net		
Liam Buckley	Liam.buckley@iesve.com	Nat vent/mixed mode	X
Mahabir Bhandari	bhandarims@ornl.gov	Calibration	X
Malcolm Cook	Malcolm.cook@lboro.ac.uk	Airflow modeling	X
Mark Adams	adamsmb@ornl.gov		X
Mark Seymour	Mark.Seymour@futurefacilities.com		X
Michelle Sadegny	msadeghy@group14eng.com		X
Mini Malhotra	malhotram@ornl.gov	DDM, calibration	X
Mitch Paulus	mitchpaulus@tees.tamus.edu	Data driven modeling	
Neal Krus	Neal.krus@bigladdersoftware.com	Ground heat transfer	X

Patrick Carpenter	facperfeng@comcast.net	DD	
Peter Armstrong	parmstr@mit.edu	MPC, CRFT, Perf maps	
Ralph Muehleisen	rmuehleisen@anl.gov	Uncert., occ behav, cal.	X
Ron Judkoff	Ron.judkoff@nrel.gov	Validation	X
Russell Taylor	tailored@utcc.utc.com	Calibration	
Sam Brunswick	sbrunswick@taylor-engineering.com	Nat vent, mixed mode	
Sam Brunswick	sbrunswick@taylor-engineering.com	Nat vent, mix mode, occ beh	X
Samira Elkhamlichi	selkhamlichi@worldbank.org	DDM, occ behav	X
San Hoon Lee	sanhlee@lbl.gov	Calibration, occ behav.	X
Siddharth P	spremkumar@gilbertmech.com	HVAC sys design	X
Taylor Roberts	troberts@group14eng.com	DDM	X
Tianzhen Hong	thong@lbl.gov	Occupant behavior	X
Tim McDowell	mcdowell@tess-inc.com		X
Umberto Berardi	uberardi@wpi.edu	Calibration	
Vern Smith	Vernon.a.smith@gmail.com		

1. Reviewed the schedule for the 2017 Fundamentals Handbook Revision
 - a. January 2015, 25% draft
 - b. June 2015, 50% draft
 - c. January 2016, 95% draft to TC for review
 - d. June 2016, TC approves revised chapter (final due June 21, 2016)
 - e. Early 2017, review galley prints
 - f. June 2017, publication
2. Briefly review the target audience definition
 - a. The definition is in a Google doc:
 - (https://docs.google.com/document/d/174pP_sNvLISMAldZTMTToMwh9wiUibwTdl7i4EY7nBrE/edit?usp=sharing)
- 2) Reviewed the editing process
 - a. Get the 2013 chapter Word version from the Dropbox.
 - <https://www.dropbox.com/sh/9vnz7e99u6xvev2/Uv3Nv8LdeJ>
 - b. Add comments and/or use Track Changes for edits and save as a separate version.
 - c. New contributions and Online Handbook content (spreadsheets, color graphics, etc) may be provided as separate documents
 - d. Email your document(s) to Erik Kolderup, erik@kolderupconsulting.com.
- 3) Reviewed the 2013 chapter 19 outline with some proposed changes and discussed roles for committee members

- a. (See the doc "HOF Chapter 19 Outline 2013+2017 Changes_01-27-2015.docx" in the Dropbox)
- b. General Considerations section. Tim McDowell to review the chapter to see if he wants to take lead on this section.
- c. New section for History of Simulation Development. Jeff Haberl needs a word count.
- d. New section on next-generation modeling methods. Get in touch with Michael Wetter.
- e. New section on using energy models. Needs a lead author.
- f. New section on Uncertainty in Modeling. Ralph Muehleisen interested.
- g. Reorganized section on Loads Modeling (separated from component modeling). Should also address latent loads. Needs champion. Neal Krus will look at potential more logical reorganization of sections.
- h. New subsection on Inputs to Loads Model. Tianzhen Hong interested.
- i. Component Modeling. Needs a leader.
 - New terminal system component section
 - Secondary system component section
 - Primary system components section
- j. Renewable Energy Systems Modeling. Consensus is this is out of scope.
- k. Data-Driven Modeling. Ralph M. and Jeff H. will take a look to review for need for update.
- l. Model Validation and Testing. Ron Judkoff to lead.
- m. Misc. Issues
 - Add modeling of phase change materials. Lot of work in this area. Need to figure out where it belongs.
 - Natural ventilation/mixed mode left out of outline. Malcolm Cook can help.
 - Calibration should be elevated to a higher level section.

4) Next steps

- a. All. Provide any additional comments on the outline by Feb 27.
- b. Erik to establish a conference call schedule for preparation of June 2015 50% draft
- c. Erik to provide guidance regarding the online handbook content

5) Adjourn 5:55 pm

Resources:

- Word version of 2013 Chapter 19 for review and markup. In Dropbox folder: <https://www.dropbox.com/sh/9vnz7g99u6xvev2/Uv3Nv8LdeJ>
- Outline of all 2013 Chapter 19 sections. In Dropbox folder: <https://www.dropbox.com/sh/9vnz7g99u6xvev2/Uv3Nv8LdeJ>
- Description of target audience. Google Doc: https://docs.google.com/document/d/174pP_sNvLlSMAlDZTMT0Mwh9wiUibwTdl7i4EY7nBrE/edit?usp=sharing
- Working list of potential updates and assignments: <https://docs.google.com/document/d/1xMb-wnU5erA-xUoGqeePb508X0hDlvZ0LhWKEmkKnI/edit?usp=sharing>



Attachment F Draft Agenda

SSPC 140 Committee

AGENDA – SSPC 140 Standard MOT for the Evaluation of Building Energy Analysis Computer Programs Monday Jan 26, 2015; Chicago

Time: 2:15P – 6:15P

Location: Clark 9 (7th Floor)

Chair: Joel Neymark

1. Introductions: Sign-in sheet, participant introductions, quorum (= 6 VMs).
2. Chair Announcements/Communications since last meeting [10 min.]
 - **Publication of 140-2014 Continuous Maintenance Revision**, see agenda below.
 - **Current IRS rules** (IRS notice 2008-40, published Apr 2008) relating to the deduction for energy efficient **commercial buildings** require software used for assessing tax credits be tested to Standard 140-2007. Currently **13 programs are qualified**; 8 programs qualified updated versions. (Last check 22Jan2015). **New submittals** ron.judkoff@nrel.gov
Qualified programs listed at <http://energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions>
 - ASHRAE 90.1 and 189.1 reference Standard 140;
 - 90.1-2013, published Fall 2013 updated their reference to 140-2011.
 - RESNET lists **6** (last check 2Jan2015) tools as either accredited for HERS ratings, tax credit compliance, IECC performance verification, or existing home tax credit compliance. Required tests include NREL's HERS BESTEST (included in Std 140-2011, -2014), along with equipment modeling and other modeling tests developed by RESNET. **New submittals to RESNET** (<http://www.resnet.us/professional/programs/software>).
 - **2015 IECC cite** 140-2011; IGCC citation accords with IECC.
 - **ANSI EESCC Roadmap**: National framework for action and coordination on energy efficiency standardization (125 recommendations); chapter on simulation includes Std 140; **agen. item later.**
 - **Airside HVAC Equipment simulation trials**: Final round of updates to test spec and quasi-analytical solution and its documentation, distributed Oct 9; further discussion per agenda below.
 - **IEA BESTEST Update simulation trial**: Revised test specification distributed for first round sim trial July 22; 7 results sets received; further discussion per agenda item below.
3. Membership [5 min.]
 - VMs scheduled to roll off Jul 1, 2015: Sturm. Has agreed to re-up.
4. Acceptance of Previous Minutes [5 min.]
5. Adjustments to Agenda [5 min.]
 - New business or news briefs to include?
6. 140-2014 CM Revision [5 min.]
 - Published hardcopy and with full standards set CD
 - o PC received announcement from ASHRAE, Jan 8.
 - Content: 140-2011 + 140-2011-A Ground Coupled (GC) Slab-on-Grade Tests
 - o N. Krus present recent work on GC algorithms, if time; agenda item below.
- 7a. 140-2014-A: Adaptation of ASHRAE/RP-865 (air-side mechanical equipment):
Modifications and Simulation Trials [Neymark, 60 min.]
 - Progress report, Discussion, Next Steps/Action Items
 - o Future Volume 2 discussion later on agenda, if time.

- 8a. 140-2014-B: Update Section 5.2 (IEA BESTEST envelope, 1995) test spec/example results [Judkoff/Neymark, 60 min.]
- Meeting summary, BESTEST Thermal Fabric Working Group:
 - Status Report: anonymous results, surfcoeffs, comments, and next steps
 - Prioritize extension cases (weather driven infiltration, windows)
 - Discuss other extension cases later on agenda, if time.
9. Proposed Work Schedule (2013/14) for Above Addenda (Items 7, 8) [Neymark, 10 min.]
10. References to Std 140-2014 in Std 90.1 [Pegues, 10 min – hold until 4:15P for JP]
- GC test cases part of Section 5.2 (as 5.2.4). Is that ok for future referencing by 90.1 and others? Plan meeting with 90.1 ECB.
11. SSPC 140 Website Update Volunteer Recruitment [5 min.]
- <http://sspc140.ashrae.org/index.html>; Not updated since 2010; multiple emails to JN
 - Who will volunteer to update/maintain?
12. DOE Empirical Validation Roadmap [Judkoff/Roth 20 min.]
13. Recent work using 140-2014 to test GC algorithms. [Kruis, 10 min.]
14. Other Related Activities [as time permits]
- IEA ECBCS Annex 58 task on whole building empirical validation (fyi) [Hong, 5 min.]
 - ANSI EESCC Roadmap [Roth, 5 minutes]
 - Incentives Programs [Judkoff, 5 min]
 - Comml: Sec 179
 - RESNET, Tax Credit/Supplemental Cases, IECC Section 404, Homestar Gold
 - COMNET and ASHRAE Building Energy Quotient (EQ) Ref. of Std 140 [Haber, 5 min]
 - ASHRAE Handbook of Fundamentals, Validation Methods [Judkoff, 2 min.]
 - ANSI/RESNET Calibration SMOT (fyi) [Judkoff, 2 minutes]
 - Residential empirical-data based tests [Neymark, 2 minutes]
 - RTAR: Assess and implement natural and hybrid ventilation models in whole-building energy simulations [Judkoff?, ? minutes]
15. Addl. discussion, Airside HVAC Vol 2 or BESTEST Thermal Fabric cases [Chair discretion]
- 7b. Airside HVAC tests Volume 2: Possible additional test cases
- 8b. BESTEST thermal fabric: Possible additional test cases.
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. Hydronic Equipment by Germany, Double-Skin Façade empirical by Denmark.
 - 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