

**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 23, 2018

TC/TG/TRG TITLE: Energy Calculations

DATE OF MEETING: January 23, 2018 LOCATION: Chicago, IL

MEMBERS PRESENT	YEAR	MEMBERS ABSENT	YEAR	EX-OFFICIO MEMBERS &
Bass Abushakra (CHAIR)	2016	Malcom Cook	2018	See attendance sheet additional attendees
Chris Balbach (VICE CHAIR)	2016			
Ralph Muehleisen (Secretary)	2016			
Joel Neymark (Standards Chair)	2017			
John Pruett (Handbook)	2016			
Joshua New (Webmaster)	2013			
Ron Judkoff (Applications)	2017			
Dru Crawley	2015			
Neil Kruis	2014			

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: Motion approved to allow Chair to change the word “buildings” in to TC scope to “the built environment” so the scope will read *Technical Committee 4.7 is concerned with identifying, evaluating, developing, and recommending procedures for calculating energy performance of the built environment*. 10-0-0 with Chair Voting

MOTION: Motion to resubmit updated RTAR 1813, Attic Duct Method of Test which was updated to address TAC concerns. 9-0-0 CNV.

MOTION: Motion to submit new RTAR “Improved simplified methodology for describing and calculating heat conduction through the ground”. 8-0-1, CNV.

MOTION: Motion to Endorse an “Optimization in HVAC&R” track for 2019 meetings. 9-0-0 CNV.

MOTION: Motion to Approve Houston Program. 8-0-0 CNV.

TC/TG/TRG MEETING SCHEDULE				
LOCATION – past 12 months	DATE	LOCATION - planned next 12 months	DATE	
Long Beach Chicago	June 2017 January 23, 2017			
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															Status 01/17
Las Vegas Jan 17	St Louis Jun 16	Orlando Jan 16		Atlanta Jun 15		Chicago Jan 15					Last Name	First Name	Affiliation	E-mail	VM, CM, PCM, Visitor
YEA	Non-YEA	YEA2	Non-YEA	YEA4	Non-YEA	YEA6	Non-YEA	YEA8	Non-YEA						
			X		X		X			Abushakra	Bass	U.S. Military Academy	bass@datadigm.us		VM
		X					X	X		Adams	Mark	ORNL	adamsmb@ornl.gov		
									X	Anderson	JR	Anderson Engineering	JRHazel@BellSouth.net		
					X		X			Armstrong	Peter	Masdar Institute	parustr@mit.edu		
			X						X	Ashukov	Artem	Remak a.s	green.ashukov@gmail.com		
										Bae	Nuri	Univ. of Michigan	nuri@umich.edu		
				X						Baker	Chris	The Weidt Group	chrisb@twgt.com		
										Balaras	Costas	NOA	costas@noa.gr		
X			X						X	Balbach	Chris	Systems Develop.	cbalbach@psdconsulting.com		VM
X							X		X	Baltazar	Juan-Carlos	University	jcbalazar@tamu.edu		
					X					Bannister	Carsen	National Research Council, Canada	carsen.bannister@nrc-carc.gc.ca		
X			X		X		X		X	Baraboy	Chip	cbamaby@gmail.co	chipbamabv@gmail.com		
										Bemsoleil-Morrison	Ian	Carleton University	ian_bemsoleil-Morrison@carleton.ca		
										Berardi	Umberto		uberardi@wpi.edu		
					X		X			Bhandari	Mahabir	ORNL	bhandarims@ornl.gov		
										Bilderbeck	Mike	Pickering Firm	mbilderbeck@pickeringfirm.com		
										Bing	Dong	UTSA	bing.dong@utsa.edu		
										Bosworth	David	BuildLab	bosworth@buildlab.net		
X					X		X		X	Brooks	Alamelu	ICF International	alamelub@gmail.com		
				X					X	Brophy	Andy	SSR	abrophy89@gmail.com		
					X					Bucking	Scott	Carleton University	scott.bucking@carleton.ca		
										Carling	Par	EQUA	par.carling@equa.se		
X			X		X		X		X	Carpenter	Patrick	Fac Perf Engr	facperfeng@comcast.net		
										Chen	Yixing	LBNL	Yixingchen@lbl.gov		
										Cho	Soolyeon	NC State U.	scho3@ncsu.edu		
										Clark	Jordan	UT-Austin	jclark@utexas.edu		
X					X				X	Cockerham	Keith	Loring Engineers	kcockerham@DLBAssociates.com		VM
										Collyer	Breesa	PG&E	brk@pge.com		
					X				X	Cook	Malcolm	Loughborough Univ (UK)	malcolm.cook@lboro.ac.uk		VM
							X		X	Cornick	Steve	Natl Research Council Canada	Steve.Cornick@nrc.ca		
X			X		X		X		X	Crawley	Dru	Bentley	dru.crawley@bentley.com		VM
							X			Cumali	Zulfi	Energy System	zulfi@cumali.com		
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										Degelman	Larry	TAMU	ldegelman@suddenlink.net		
X									X	DeGraw	Jason	Penn State Univ	jason.degraw@nral.gov		PCM
										Deringer	Joseph	Superb	jderinger@su-per-b.org		
			X						X	Dong	Bing	UTSA	bing.dong@utsa.edu		
										Eley	Charles	COMNET	charles@eley.com		
					X		X		X	Ellis	Peter	Big Ladder Software	peter.ellis@bigladdersoftware.com		
							X		X	Fallahi	Ali	Fraunhofer CSE	afallahi@fraunhofer.org		
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X			X				X			Fontanini	Anthony	Iowa State Univ	anthony.fontanini@gmail.com		
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										Gopal	Raj	Gopal Associates	rgopalurn@yahoo.com		
										Gowri	Krishnan	Autodesk	krishnan.gowri@autodesk.com		CM
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										Gu	Living	FSEC	gu@fsec.ucf.edu		
X					X		X		X	Haberl	Jeff	TAMU	jhaberl@tamu.gov		VM
							X			Haddad	Kamel	NRCan	khaddad@nrcan.gc.ca		VM

Present at Meeting														Status 01/17
Las Vegas Jan 17	St Louis Jun 16	Orlando Jan 16		Atlanta Jun 15		Chicago Jan 15				Last Name	First Name	Affiliation	E-mail	VM, CM, PCM, Visitor
YEA	Non-YEA	YEA2	Non-YEA	YEA4	Non-YEA	YEA6	Non-YEA	YEA8	Non-YEA					
										Han	Guiyuan	PSU	GOH5067@psu.edu	
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					X					Hogan	Byron	Nalor	byronhogan@yahoo.com	
									X	Hong	Tianzhen	LBNL	thong@lbl.gov	
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			X		X				X	Huang	Joe	White Box Technologies	yyhuang@whiteboxtechnologies.com	
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X			X							Im	Piljae	ORNL	imp1@ornl.gov	
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										Javed	Hassan	Masdar, Abu Dhabi	hjaved@masdar.ac.ae	
X			X		X		X		X	Judkoff	Ron	NREL	ron.judkoff@nrel.gov	VM
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X			X							Kastl	Brian	AAON	kingkastl@gmail.com	
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										Kennedy	Mike	Mike Kennedy Inc	mikekennedy@energysims.com	
										Kennedy	John	Autodesk	john.kennedy@autodesk.com	
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X					X		X			Kinney	Kris	KECG	kinneyecg@gmail.com	
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										Krarti	Moncef	University of Colorado	krarti@colorado.edu	
		X		X		X			X	Kruis	Neal	Big Ladder Software	neal.kruis@bigladder.com	VM
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			X						X	Lee	Sang Hoon	LBNL	sanghlee@lbl.gov	
			X						X	Li	Zhaoura	UTSA	jlh469@myutsa.edu	
									X	Lin	Cheng-Xian	Florida Int. University	lincw@fiu.edu	
										Liu	Shichao	UT-Austin	liu.shichao@utexas.edu	
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						X				Luflok+P67	Peter	7ACTech		
										Lyons	Peter	Peter Lyons & Assoc.	peter.lyons@fenestralia.com	
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X					X		X		X	Muehleisen	Ralph	Argonne	rmuehleisen@anl.gov	VM
X							X		X	Mukhopadhyay	Jaya	University of Montana	jaya.mukhopadhyay@montana.edu	
										Nelson	Ron	IMT	ron@imt.org	
X			X				X		X	New	Joshua	ORNL	newjr@ornl.gov	VM
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					X					O'Brien	Liam	Carleton University	liam.obrien@carleton.ca	
						X				Oh	Sukjoon	TAMU		
										O'Keefe	Michael	Big Ladder Software	michael.okeefe@bigladdersoftware.com	
X			X		X				X	O'Neill	Zheng	Univ. of Alabama	zhengoneill@gmail.com	CM
										Pang	Xinfeng	LBNL	xpang@lbl.gov	
X						X				Paulus	Mitch	Texas A&M University	paulusm@msoe.edu	CM
								X		Pegues	Jim	Carrier	james.f.pegues@carrier.utc.com	

Present at Meeting														Status 01/17
Las Vegas Jan 17	St Louis Jun 16	Orlando Jan 16	Atlanta Jun 15	Chicago Jan 15										
YEA	Non-YEA	YEA2	Non-YEA	YEA4	Non-YEA	YEA6	Non-YEA	YEA8	Non-YEA	Last Name	First Name	Affiliation	E-mail	VM, CM, PCM, Visitor
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		X							X	Premkumar	Siddarth	Gilbert Mechanical	spremkumar@gilbertmech.com	
X			X		X			X		Pruett	John	ZMM, Inc.	jap@zmm.com	
	X									Reddy	T. Agami	Arizona State Univ	reddyta@asu.edu	
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										Sanyal	Jibo	ORNL	sanyal@ornl.gov	
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				X				X		Shirey	Don	Bentley	don.shirey@bentley.com	
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										Ullah	Tania	NIST	tania.ullah@nist.gov	
										Varela	Ignacio	Heatcraft	ignacio.chaparro@heatcraft.com	
	X		X				X			Wang	Liping	Univ. of Wyoming	lwang@lbl.gov	
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			X							Wessel	Dennis	Section Head		
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										Witte	Mike	GARD Analytics	mjwite@gard.com	
	X		X		X				X	Wong	Edmund	Arup	edmund.wong@arup.com	
										Wray	Craig	LBNL	CPWray@lbl.gov	
			X						X	Wright	John	University of Waterloo	jwright@uwaterloo.ca	
										Xia	Fang	McKinstry	xiaf@mckinstry.com	
										Xiaobing	Liu	ORNL	liuxb@ornl.gov	
		X							X	Xiong	Zeyu	Tendril	zxiong@tendril.com	
						X				Xu	Ke	UTC-BIS		
										Yuan	Jinchau	U. of Idaho	iyuan@uidaho.edu	
			X							Zabra	Sardovei	ULL	ZSX1361@Louisiana.edu	
	X		X		X		X		X	Zuo	Wangda	University of Miami	wzuo@miami.edu	VM

Appendix 1

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

Active projects

#	Title	Joint TC	Cog SC/ Contractor	PMSC	Dates / status
o 1741- RP	Understanding Fan Coil Components and how they relate to Energy Consumption and Energy Modeling	5.3 (lead)	U. of Louisiana - Lafayette	Kruis	Kruis reports that one outcome will be s a Standard 205 representation of fan coil units. Research is going as planned.
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 (Jan 23 2018)

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

PRESENT:

Seminar 10: Building Energy Modeling for Power Grids and Energy Code Compliance
Seminar 27: Urban Scale Energy Modeling, Part 7
Seminar 37: use of Energy Modeling to Support Building Asset Ratings

PLANNED:

Houston Meeting

New advances in fenestration (Haberl)
209 Energy Simulation aid ddesign (Kolderup)
VRF TC 8.7 Cosponsor (Balbach)
Airside HVAC Besttest (seminar) (Ralph)
UBEM part 8 (seminar) TC 1.5 Sponsor. (New)
Service Water Heating (TC 6.6 Forum) (Huang Moderator)

ASHRAE TC 4.7 Energy Calculations – Main Meeting Minutes

RED LACQUER ROOM, TUESDAY, JANUARY 23, 6:00-8:30 PM

1. Roll call and introductions (5 minutes)
Balbach

6:02 PM meeting called to order.
Bass Abushakra read code of ethics
Introductions:

6:04 pm. Chris Balbach call of voting members
Malcom Cook absent.
We have quorum
Jeff Haberl moved to accept minutes. Dru Crawley seconded.
Motion approved 10-0-0 Chair voting.

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

3. Announcements/Liaisons (5 minutes) Abushakra

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

Bass mentioned to TC that we need to do a better job of talking with the chair before submitting and confirming to tracks. Our sessions are often being focused on physics vs new technology, and that may affect declination.

Bass states that CEC does encourage suggestion of track and that if CEC accepts a track it will likely go.
Track submittals for Atlanta are due soon. We need to consider those.
Ralph Muehleisen says speaker ratings and attendance are a criteria.

Dennis Wessel(TC liaison):

Houston already has 125 submissions with 109 (I think those were the numbers) spaces so there will be rejections.
The sooner a program is submitted for Houston the better chance it has of getting accepted.

Roster should have been updated. Things are now done completely online.

The activities form is filled out by the chair and the other committees use these to acknowledge activities.

The TC MOP (how to conduct a TC) is available online

PCM members are dropped after no activities in two years. If they are active we should contact them and see if they want to become CM.

ASHRAE was asked to have sessions on resiliency. Talk to TC 2.1 (HVAC security) and TC 2.8 (sustainability) if there is interest.

If you are an officer and not getting emails, check your aliases and email address in

Minutes are due to membership 60 days after meeting not 60 days before the next meeting.

Jeff: The electronic version of the book has no page numbers and no dates. It makes it very difficult to use the electronic version. In the seminar listings the floor is not listed like it is for the TC and SSPC meetings.

Bass: towards the very end, there used to be an alphabetical list of speakers with the seminar

Dennis: there also used to be listings by TC which were useful.

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

- TC should vote on continuing operations under the current scope. The Vote should be put in the TC Activity Sheet, and in the Minutes. Both documents should be sent as usual to the Section Head. Current Scope says the following:

“Technical Committee 4.7 is concerned with identifying, evaluating, developing, and recommending procedures for calculating energy performance of buildings”.

Abushakra then began discussion of TC scope change to reflect that we don't just do energy calculations for isolated buildings but groups of buildings and urban scale. He would like to consider changing the word “buildings” to “Built Environment” in anticipation of bringing in urban scale BEM to the TC.

Ralph moved, Joshua seconded. Minor discussion and Ralph agreed to change the motion to state change “buildings” to “the built environment”

Committee approved. Vote: 10-0-0 Chair voting.

- 125th History in a couple of years (Historical Committee). TC's can organize or sponsor a program session for the 2019-2020 meetings.

Jeff mentioned that there have been a number of articles that have been recommended for the ASHRAE journal. There will be a technical session at the meeting before for transactions papers.

- Emergency Rosters can be submitted anytime during the year so that changes in subcommittees or other positions can be made official on the rosters (instead of waiting till after July 1).

Bass mentioned that the purpose for emergency roster changes is for things like people resigning positions mid-term when you need to deal with important positions or voting membership.

Jeff then mentioned that TC 4.7 has made very many contributions and should have more fellows. He's going to work with current Fellows to identify potential new fellows and he thinks that there are more committee members deserving of the honor.

4. Membership (5 minutes)

Abushakra

- By the Manual of Procedures, the maximum number of voting members on a committee is 18. However, the drawback of a high number of VM would be the quorum in meetings.
- We currently have 11 Voting Members.
- Neil Kruis will roll off on July 1 2018 (after Houston)
- Joe Huang and Keith Cockerham will roll on, on July 1 2018, bringing the Voting Members number to 12.

Bass discussed voting member changes. Joe is SCM chair and Keith is Chair of programs and will roll on when Neal rolls off. Phil asked for qualification if 12 includes chair (it does). Joel suggests that odd number is better for meeting quorum.

- Provisional Corresponding Members should go to: Onebuilding.org, to Subscribe to the TC4.7 Mailing List (TC47-L). Once subscribed, PCM, will stay up-to-date with the TC4.7 business.

Bass noted that PCM should subscribe to the TC4.7 mailing list because we do not use the ASHRAE system. He also noted that a PCM drops off after 2 years. Bass, Ralph and Chris will go through the PCM to convert any PCM that have attended any TC meeting over the last two years and convert them to CM. There is no limit to how long you can be a CM.

Neal says he thinks he (Neal) should not be rolling off.

5. Subcommittee reports

5.1 Applications (10 minutes)

Judkoff

Ron Judkoff: Applications meeting was today. The most important discussion we had was around including urban scale modeling as a topical area and a rename. Pros and cons were discussed and the attendees were generally in favor. It was noted that the topic area might outgrow the subcommittee but that can be dealt with later. Ron also noted that the Bass has full discretion to rename the subcommittee and so it does not need a TC vote. Some suggested names Building, Urban, and Multi Scale apps but Ron noted that the acronym becomes BUMS Apps so we need to find another name.

For research, Ron reminded us of RTAR 1813, the attic duct MOT that RAC had rejected. He noted that Mini Malhotra had addressed the concerns and the TC was resent the corrected and updated RTAR and asked for a vote.

Ron moves that we approve resubmission of the RTAR with Mini's changes, Joshua second. Committee approved
Vote: 9-0-0 CNV

5.2 Data-Driven Modeling (10 minutes)

Fontanini

Anthony: we met 7:30-9 with 12 attendees.

Update from WS 1763, development for a new toolkit (inverse model update). This was submitted to RAC as an RTAR and Mike Vaughn noted it was really a WS and not an RTAR. It's now back at RAC as an WS.

Fontanini, Balbach, Muehleisen are willing to serve on PES. [At SCM meeting Mitch Paulus also volunteered]

Joshua asked if there was a co-sponsoring TC. There is not.

Data Driven Models to inform Forward models was discussed

Calibration and Forecasting was discussed. A forecasting shootout was suggested or a data Kaggle competition

[Kaggle is a website/organization that helps support data science competitions].

Suggest working with MTG OBD for updating dynamic schedules for simulation

RTAR with 7.6 to develop model for EUI

For programming: Track for Houston. "Are you Normal?" explores non-gaussian residuals for DDM

Using DDM to inform Forward Models

New Business:

DDM is in favor of adding HVAC Optimization track to Atlanta meeting.

5.3 Simulation and Component Models (10 minutes)

Huang

Joe: Met Monday 6-7:30 pm Monday.

Draft RTAR 1748 Ventilation in whole building simulation is still gestating. Tony (author) will work with Jeff to find out the Status. There is confusion as to the time required for response – was it 2017 (in which case the date has passed) or 2018?.

Draft RTAR for Ground calculation Neal and Tim. subcommittee recommends that the full committee approve.

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

Jeff: There is a potential mashup of HVAC01 and HVAC02 RTAR. Keep it on the list.

Chris Balbach: VRM modeling?

Joe: Water modeling with TC 6.6

Subcommittee is also in favor that the TC expresses support for the Optimization in building simulations track:

5.4 Research (15 minutes)

Haberl

5.4.1 Research Projects

- Completed Projects
 - Update of any.

Bass: No projects completed since last time.

- 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 Krus is a member of the PMSC. Latest status on progress report.

Neal: This project was awarded to U-LA Lafayette + collaborator at Baylor. One of the outcomes is a Standard 205 representation of fan coil units. Things are going along fine.

- 1661-RP Development of Near-Optimal Control Sequence for Chiller Plants with Water Side Economizer using Dynamic Models (PES Report). Project moved from U. of Miami to Colorado. PMSC met on Sunday afternoon for about an hour and a half with a full attendance from the reviewers and the

contractor was resent with two people. They reviewed progress to date including reviewing an updated report sent to PMSC late last year. They reviewed the technical issues surrounding the 5 tasks identified for their project. The contractor is making good progress. Their next review of the report is scheduled for late February 2018, with a conference call / web meeting right after this.

Keith: 1661 is making good progress. Contract with U. of Colorado – Boulder with move of PI from U. Miami.. Everything on track after move.

- Approved RTAR
 - 1763-RTAR, “Development of an Improved Inverse Model Toolkit (RP1050) and Diversity Factor Toolkit (RP1093) for Analyzing Bldg Energy Savings from Time Series Data” (RTAR accepted July 29, 2015). Author (Haberl). A WS was written taking into consideration the comments the authors received on the RTAR. Sent to ASHRAE and was added to the draft agenda for the RAC 2018 Spring Meeting for consideration by the RAC Chair for inclusion.

Updated and sent back to RAC as discussed above in SCM report.

- 1816-RTAR, “Reporting the Energy Use and Heat Gain from Imaging Equipment”. Responsible Committee: TC 9.6 (Healthcare Facilities); Co-Sponsors: None; Status: Accepted with comments. Developed into a WS. Contact Glenn Friedman (gfriedman@taylor-engineering.com) if interested in serving on the project evaluation and project monitoring committees once the WS is approved by RAC.

We are cosponsoring..

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

Discussed in SCM report

- 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.

Approved for resubmission by TC vote as discussed in HVAC apps report.

- WS, RTAR, Requests for Co-sponsorship
 - Update if any.
- New RTAR
 - Xxxx-RTAR “Improved simplified methodology for describing and calculating heat conduction through the ground”. McDowell and Kruis.

No number yet. Apps and SCM had some comments and recommended that it get submitted with those changes. Balbach, moves to approve with changes. Seconded by Jeff

Motion: 8-0-1, CNV, Kruis abstains. Neal wants this to have a home in applications and Ron agrees. Joe suggests that the best home is in SCM. Ron says we should do what the main author wants to do.

- 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.
-

Update from Jeff: They have thought about it and not done much but we want to keep it on the docket.

- 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. Update on progress toward an RTAR.

Update from Jeff. Thought about it not much progress, keep on docket.

- 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. (D. Crawly).

No one speaking for it, we remove from the docket.

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

Jeff: This was discussed in MTG OBB. Rob Hitchcock has one that was approved and this needs to be considered to avoid conflict But, this should be kept on the docket.

Michael Pouchak, Section 4 research liaison. Any RTAR to be submitted to RAC should also be emailed to Michael rl4@ashrae.net. All project committee minutes (like for 1661-RP) should also be copied to Michael. Keith will send the minutes for the current projects.

- Xxxx-RTAR: “Baseline Modification when a Building Behavior Changes”. Carlos B., and Bass A. from DDM, and 2 members of MTG-OBB will write the RTAR.

5.5 Handbook (10 minutes)

Pruett

John Pruett is new chair for Handbook committee. John mentioned the subcommittee did meet 5-6 pm this meeting. Much of the meeting was discussing using the new portal which has some major limitations for Mac users. Anyone contributing can use portal or edit offline and email to John.

There was discussion of new items to review and add to the handbook. These included Thorough update of references/citations, added info for standard 205 and 209, and other project data. John challenges TC members to review the chapter and suggest additions.

Ralph noted that you can access the site without IE using chrome extensions that make your browser say its IE. [In particular, Chrome users can install the User-Agent Switcher extension and with it you can access the portal with Chrome.]

5.6 Program (15 minutes)

Cockerham

Endorsement of Optimization in HVAC&R Track for 2019 (added item).

Zheng Oneal, requested. DDM and SCM both support the track.

Ralph move, Chris seconded

9-0-0 CNV

Chicago, January 2018

1. Tuesday 8AM – 9:30AM, Seminar 37, Use of Energy Modeling Tools to Support Building Asset Ratings: Screening Analysis, Simplified Modeling and Retrofit Analysis. Sponsor: 4.7 Energy Calculations. Chair: Chris Balbach.

Chris: Almost full room with 65 attendees.

2. Monday 9:45 AM - 10:45 AM, Seminar 27, Urban-Scale Energy Modeling, Part 7. Sponsor: 1.5 Computer Applications, 9.12 Tall Buildings, 4.7 Energy Calculations. Chair: Joshua New.

Joshua: 1 through 6 were all accepted. This session had two speakers Luke Leung spoke on weather , Duncan Phillips who have applied CFD for microclimates on tall building. 80 People.

Joshua withdrew **Urban Scale modeling part 8 but plans to resubmit in future.**

3. Sunday 1:30 – 3 PM, Building Energy Modeling for Power Grids and Energy Code Compliance. Sponsor: 4.7 Energy Calculations. Chair: Ralph Muehleisen.

Ralph: 100+ people at peak

Houston, June 2018, and beyond

Chris Balbach: We have 3 speakers for VRF modeling of components.

Tony: Are you Normal? (discussed earlier). Ralph with Chair, Tony and Qi Li (Ralph's postdoc will speak).

Perhaps a 3rd speaker.

Ron: Erik Kolderup will do a session on 209 in Houston.

Joel and Ron will do a session on 140 in Houston. Ralph will chair and submit.

Jeff will chair New advances in simulating fenestrations. Layer by layer window modeling.

Surface water heating co with TC 6.6. Jim Lutz (jdLutz@hotwaterresearch.net) from TC 6.6 who was speaking.: This is to spur a discussion between modelers and the people who use design systems that use them. How do we validate a model. We should try to get a program in Houston. We should start this discussion now even if the program doesn't go

Ron: Why isn't this going through research? Jim: we are just starting a conversation. We don't know that there is a research need yet. Jeff: this is definitely becoming important as envelope loads are being reduced. Maybe we can do a Forum. Bass and Jeff: This is definitely a good thing for a forum. Joe will work with Jim to submit a Forum. Neal and Tim volunteer to participate the Forum.

1. SPC 205 (Seminar. Standards Subcom. Barnaby, McDowell)??

Drop in future. They did one before, no more interest

2. Historical Committee (Seminar. Haber)??

This is not a planned submission for Houston, discussed earlier.

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

Moved to future.

4. New Advances in Simulating Fenestration Systems (Seminar. SCM Subcom. Haber)??

See note above

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

See note above

6. Data Visualization (Seminar. Application Subcom. Balbach)??

Chris will wait until later.

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

Will discuss again in Houston

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

Postpone because Houston is full

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

Bass: Chris mentioned that Cornell has large data sets.

Phil: what is special about this that it notes a seminar? Will this be attractive?

Ralph: This needs to be fleshed out before we submit

Jeff: Houston is already nearly full. We need to prioritize our program.

Decision to postpone

Houston: Program for Vote

1. New advances in fenestration (Haberl)
2. 209 Energy Simulation aid ddesign (Kolderup)
3. VRF TC 8.7 Cosponsor (Balbach)
4. Airside HVAC Besttest (seminar) (Ralph)
5. UBEM part 8 (seminar) TC 1.5 Sponsor. (New)
6. Service Water Heating (TC 6.6 Forum) (Huang Moderator)

Ralph moved, Jeff, second
8-0-0 CNV

Future:

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

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

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

Joel and Ron will do a session on 140 in Houston. Ralph will chair and submit.

1. Other Ideas??

5.7 Historical (5 minutes)

Haberl

- Historical Committee - 125 Anniversary.

5.8 Standards (15 minutes)

Neymark

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

Neymark

Neymark: Completed continuous maintenance revision. This merges updates from 2014. ASHRAE has sent this to printer so publication will come in a few weeks. Look for it on the bookshelves. This standard is cited by 90.1, 189.1, IECC, and others reference it. Updating thermal fabric tests. The range of disagreements is reducing as engines get better and people get better at modeling the tests. Ron: We had a briefing from the validation and uncertainty project at LBL, NREL, and ORNL, we are 4 months into the final year of the project. LBL has created a draft specification, ORNL has done same and will also deliver draft specification. NREL has performance maps for very high performance RTU. SEER 17 and IEER 23 6 ton, fully variable everything and very interesting controls that are hard to represent in the standard mapping tables.

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

Judkoff

We are not sure if the tax deductions will survive. But, people want to be on the list because they want to be qualified.

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

Barnaby

Advisory draft with 65 comments and committee has plans to address all and hope to have something to publish soon.

- SPC 209P Energy Simulation Aided Design

Kolderup

Went to 3rd public review with no comments to it's DONE!

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

New

Up to date when we add this agenda and minutes.

We have the longest running list of minutes going back to 1995.

6. Related activities reports (10 minutes)

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

Jim Lutz: Out for public review with comments address and should be for 2nd public review before next meeting

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

No one to speak – Bass to follow up and suggest removal.

MTG OBB Occupant Behavior in Buildings

Bass: This has been very active. Jim Lutz. This has lots of TCs involved and might become its own TC. Handbook committee has approved a new chapter.

MTG.BIM Building Information Modeling

Chip: Longest lived MTG. They have permission to do lots of activities. There is a new standard 224, application of BIM procedures. To standardized BIM data so it is more useful Joint with NIBS

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

No one to update. Bass will confirm status.

TC 2.8 Building Environmental Impacts and Sustainability

No one this time.

TC 4.1 Load Calculation Data and Procedures

Nothing new to report.

TC 4.2 Climatic Information

Huang: New project 1745 to look at reanalysis data to see if it can be used for ASHRAE

WS for approval for periodic update of tables

One other new RTAR

TC 4.3 Infiltration & Ventilation Requirements

None

TC 4.5 Fenestration

None

TC 6.5 Radiant Heating and Cooling

None

TC 7.5 Smart Building Systems

None. Jeff: This is well attended and very active. A lot of grid related activities.

TC 7.6 Building Energy Performance

Balbach: Finally published SPC 211 defining 1, 2, 3 level audit. Also the committee for BEQ products is now including an operations rating. Will launch an envelope "as designed" rating

BuildingSMART (formerly IAI International Alliance for Interoperability)

None

IBPSA: USA, Canada, World

Erik: Had a meeting Sat evening (as usual). Simbuild in Chicago Sep 24-27. ASHRAE/IBPSA Modeling and SimBuild. 400 abstract about 250 papers accepted. Seminars submissions still open.

Chip: BS2017 in San Francisco. Papers are now all up for download.

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

Remove from list (this will be in Guideline 14)

Guideline 14

Jeff Actively revising. A lot of discussion of just first page of definitions

Bass: RP1404 came from 2.7 and would be useful to add some results to Guideline 14

IEA Annex 60 Modelica for Building Simulations

Wangda : Officially concluded. Final project report due out soon.

IBPSA Project 1 to continue research. Second meeting in Feb .

First american modelica conference at MIT Oct 9-10. Submission deadline is May 1. There will be many workshops.

Remove Annex 60 and add IBPSA Project 1 report.

IEA Annex 66 Occupant Patterns

Jim Lutz. He says they are finished and will finalize final report. They are proposing a follow-on project.

7. Awards Nomination

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

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

Bass: Also talk with Jeff about Fellows.

8. Old Business

Abushakra

9. New business

Abushakra

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

We discussed this and have decided to merge this with applications. Bass will continue to ponder the name.

Looking at conferences, most conferences have lots of papers. This is not abating. TC 1.5 wants to see this move to another subcommittee and see 4.7 as the natural spot. Joshua likes the name Urban Scale Building Energy

Modeling. He is hoping for something solid to present to 1.5 in Houston. Bass will work on a name. Erik: wasn't the consensus "BUMS"?

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

Jeff suggest we contact Jason Glaser to discuss this.

10. Adjourn

Abushakra

Neal moves, Jeff seconded. 10-0-0 in favor, Chair voting.

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



ATTACHMENT A AGENDA
ASHRAE TC 4.7 ENERGY CALCULATIONS – MAIN MEETING
CAESARS, ROMAN II, LAS VEGAS, NV
TUESDAY, JANUARY 31, 6:00-8:30 PM

-
1. Roll call and introductions (5 minutes) Balbach
2. Accept agenda & approve minutes of previous meeting (10 minutes) Abushakra
3. Announcements/Liaisons (5 minutes) Abushakra
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 - 5.2 Data-Driven Modeling (10 minutes) Fontanini
 - 5.3 Simulation and Component Models (10 minutes) Huang
 - 5.4 Research (15 minutes) Haberl
 - 5.4.2 Research Projects
 - Completed Projects
 - o Update of any.
 - Awarded Projects
 - o 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.
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- Approved RTAR

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 - Update if any.
- Returned WS with Comments
 - 1748-WS, “Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations - Phase 2”. Authors (Huang and Fontanini) DDM Update.
- 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.
- WS, RTAR, Requests for Co-sponsorship
 - Update if any.
- New RTAR
 - Xxxx-RTAR “Improved simplified methodology for describing and calculating heat conduction through the ground”. McDowell and Kruis.
 - 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. Update on progress toward an RTAR.
 - 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. (D. Crawly).
 - Xxxx-RTAR “Occupancy-based thermostats”. Hyojin Kim has some ideas towards a useful RTAR from some recent work done in D.C.
 - Xxxx-RTAR: “Baseline Modification when a Building Behavior Changes”. Carlos B., and Bass A. from DDM, and 2 members of MTG-OBB will write the RTAR.

5.5 Handbook (10 minutes)

Pruett

5.6 Program (15 minutes)

Cockerham

Endorsement of Optimization in HVAC&R Track for 2019 (added item).

Chicago, January 2018

4. Tuesday 8AM – 9:30AM, Seminar 37, Use of Energy Modeling Tools to Support Building Asset Ratings: Screening Analysis, Simplified Modeling and Retrofit Analysis. Sponsor: 4.7 Energy Calculations. Chair: Chris Balbach.
5. Monday 9:45 AM - 10:45 AM, Seminar 27, Urban-Scale Energy Modeling, Part 7. Sponsor: 1.5 Computer Applications, 9.12 Tall Buildings, 4.7 Energy Calculations. Chair: Joshua New.
6. Sunday 1:30 – 3 PM, Building Energy Modeling for Power Grids and Energy Code Compliance. Sponsor: 4.7 Energy Calculations. Chair: Ralph Muehleisen.

Houston, June 2018, and beyond

10. SPC 205 (Seminar. Standards Subcom. Barnaby, McDowell)??

11. Historical Committee (Seminar. Haberl)??
12. Aging Grid and Power Lines Reaching Normal Rating Capacity – Load Growth Projection Modeling (Seminar. DDM Subcom. Abushakra)??
13. New Advances in Simulating Fenestration Systems (Seminar. SCM Subcom. Haberl)??
14. SPC 209 Energy Simulation Aided Design (Seminar. Standards Subcom. Kolderup)??
15. Data Visualization (Seminar. Application Subcom. Balbach)??
16. What does the difference between data driven models and measurements mean? (Seminar. DDM Subcom. Chair)??.
17. So you think you're Gaussian Normal? Many regression models assume normal distributions (Seminar. DDM Subcom. Fontanini)??
18. How to remove outliers from data before using DDM (Seminar. DDM Subcom. Chair. Potential Speakers: Bass, Chris B., Carlos B., using data from Cornell U.)??
19. Other Ideas??

5.7 Historical (5 minutes) Haberl

- Historical Committee - 125 Anniversary.

5.8 Standards (15 minutes) Neymark

- SSPC 140 SMOT for Evaluation of Building Energy Analysis Computer Programs Neymark
 - 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
 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
 2018-2019 Hightower Award: Nominations due to Section head by September 1, 2018
 2018-2019 Service to ASHRAE Research Award: Nominations to RAC Liaison by September 1, 2018

8. Old Business Abushakra

9. New business Abushakra
 - Results of Discussion on 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

2018 ASHRAE Annual Conference in Houston, TX:

- August 28, 2017: Conference Paper Abstracts due Monday
- December 8, 2017: Conference Papers due Friday
- Thursday, January 11, 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, 2018)**

Houston, June 2018 Tracks

Track 1: HVAC&R Systems and Equipment

Track Chair: Frank Schambach

Email: frankschambach@mindspring.com

Track 2: Fundamentals and Applications

Track Chair: Dennis Alejandro

Email: denzjac@yahoo.com

Track 3: District Energy and Cogeneration Plants

Track Chair: Kimberly Piersonj

Email: kdpwildcat@gmail.com

Track 4: Safeguarding your HVAC&R System

Track Chair: Rich Rose

Email: richr@mticontrols.com

Track 5: Residential - Modern Buildings in Hot and Humid Climates

Track Chair: Dimitris Charalambopoulos

Email: dimitris@ashrae.gr

Track 6: Professional Skills

Track Chair: Kevin Marple

Email: kmarple@benzco.com

Track 7: Research Summit

Track Chair: Melanie Derby

Email: derbym@ksu.edu

Track 8: HVAC&R Control Freaks

Track Chair: Gary C. Debes

Email: gcdebes@verizon.net

Track 9: HVAC&R Analytics
Track Chair: Vikrant Aute
Email: vikrant@umd.edu

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.



Attachment B :
Draft Agenda in Black and Minutes in Red

TC 4.7 Simulation and Component Models Subcommittee

6:00-7:30 pm, Monday, 22 January 2018

Monroe, 6th Floor, Palmer House

Chicago, Illinois

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

6:15 **Research Projects**

- **1741-WS** Understanding Fan Coil Components and How They Relate to Energy Consumption and Energy Modeling (TC 5.3, TC 7.7, requesting TC 4.7 co-sponsor) Kruis
- **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 according to ASHRAE Fall Research Plan: underway
Zuo

6:25 **Draft Work Statements/RTARs**

- **1748-WS** Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations – Phase 2 (TC 4.7 / TC 4.10) **Status according to ASHRAE Fall Research Plan:** not yet approved, must be approved by Oct 1, 08 Fontanini
- **Xxxx-RTAR** Ground calculations **Status:** New RTAR
McDowell, Kruis
- **Xxxx-RTAR** Improved Submodels of Air to Air Energy Recovery Exchangers for Use in Building Energy Modeling Software **Status:** No RTAR has been received from sponsoring TC 5.5 as of Dec. 2016
Dieckmann (from TC 5.5)

-
- **1769-RTAR** Experimental Evaluation of the Efficiency of Belt Drives for Fans (Request for co-sponsorship from TC 5.1 Fans. **Status:** TC voted 3-2-2 in St. Louis to co-sponsor.
Anyone with knowledge
 - **17xx-WS** Development of a Reference Building Information Model (BIM) for Daylighting Optimization (TC 1.5 / TC 4.7)
Haberl

7:00 **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 recent meetings:
 - Research on coils, higher latent loads not covered by current coil models. RTAR to be circulated (PC Thomas)

7:20 **Program Ideas**

- 2018 Annual (Houston), 2019 Winter (Atlanta), 2019 Annual (Kansas City)

7:25 **New Business**

7:30 **Adjourn**

Next Meeting: Monday, June 25, 2018 Houston, TX

MEETING MINUTES

TC 4.7 45 Simulation & Component Models SC Meeting Minutes
Chicago Palmer House Monroe
January 22, 2018 6:00-7:30

- * Agendas were distributed and Joe Huang opened the meeting with introductions.
- * Ralph reminded Joe that the minutes from Las Angeles were sent out.
- * Discussion then moved to WS and RTARs

- * Joe suggested that several of the RTARs be dropped due to a lack of attention.
- * 1741-RP Fan coil components.
 - * Neal discussed the progress on this project. This supports Standard 205, transfer of performance info to modelers. Neal's role on the committee
 - * is to track the progress of the items of value to TC 4.7. Subcontractor is on track.
- * 1661-WS Validation of models for near optimal control
 - * Tim McDowell informed the committee that they had their first meeting. Modelica has been selected as the platform for the work.
 - * Otherwise, the project is underway.
- * Joe then asked the committee to move discussion to draft WS and RTARs
 - * 1748-WS was returned by RAC to Tony Fontanini. Toni will review the comments from RAC.
- * XXXX-RTAR ground calculations.

Neal has been working on this RTAR. He mentioned that many of the current methods are not using the best algorithms and have shortcomings.

This RTAR would come up with a unified method for ground calculation that would fill the void between detailed calculations and simplified methods. In addition, this would be useful to 90.1 since the "F-factor and C-factor" used in 90.1 is limited in how it can be used.

This proposal would seek to improve such a method. Neal said the method would cover both heating penalties as well as cooling "benefits" from ground coupling.

 - * Ralph asked whether the RTAR would look at "static" and/or "dynamic" calculations?
 - * Comment on the RTAR suggested that it needed a better argument about how this would be an improvement over what's available.
 - * Joe said that the TC 4.1 Committee felt this was needed.
 - * Ron Judkopf said that he also agreed that this was needed. However, he said this RTAR needed to be explicit about how it would "improve"
 - * the current calculations. How would it handle a solar variable on the slab, wind, snow cover, etc.
 - * Comment from member of 90.1 envelope committee. He said that one criteria that 90.1 uses is an economic analysis...and that the foundation
 - * calculation was starting to draw more attention. He felt that the F-factor was not accurate but no obvious replacement was available.
 - * He also mentioned there was a vote count in favor of this.
 - * Joe asked Neal about whether or not 90.1 would really want to have a detailed analysis.
 - * Neal mentioned he was familiar with this it was part of his dissertation. He said that there are tools out there that can provide better results.
 - * Ron thought that perhaps the title of the RTAR needed to be more expressive
 - * Comment from 90.1 member: asked about whether or not this would incorporate in-slab heating systems or not?

- * Neal said that this would be considered in the RTAR.
 - * Joe suggested that the subcommittee read the RTAR and comment.
 - * Jeff Haberl suggested that the RTAR be further developed and put to a letter ballot before March 1st.
 - * Neal said that the RTAR would probably not require experimental validation work.
 - * Joe reminded the committee that the RTAR seeks to have a method that better predicts results from more accurate models.
 - * 90.1 member: mentioned that there were existing datasets that could be used to test the model.
 - * Ron said that Standard 140 did have a SMOT for ground-coupled heat transfer that could also serve as a test case.
- * 17XX-RTAR on Daylighting/thermal and BIM.
- * Jeff mentioned that no progress had been made on drafting this RTAR. However, it seeks to better inform modelers about the implications of the use of a daylighting model when chosen together with a thermal model.
 - * Ron suggested that this RTAR might fit better in applications.
 - * Joe suggested that the discussion on this continue in applications.
- * Joe then moved discussion to new topics for research
- * Joe mentioned that high latent load models for cooling coils...that this was previously discussed but has not had discussion since.
 - * Joe asked the subcommittee to submit their new ideas for consideration for RTARs.
- * Joe then moved discussion to Program.
- * Joe mentioned that there was a possible Seminar for modeling DHW together with TC 6.6. Tim McDowell said that he would be able to speak about this.
 - He had useful information about models for residential and commercial, tank type, circulating systems, etc.
 - * Joe mentioned that there was a need for modeling instantaneous water heaters.
 - * Neal said he would be willing to help with a presentation or paper on this.
 - * Chris said that he would like to see more program on methods for modeling VRF. There was a lot of pressure on modeling VRF, but not much consensus on how to model this. Neal thought that Roger Henrick might be willing to speak on this....Chris said he would be willing to chair such a seminar.
 - One question about VRF was whether or not there was a MTG or TC on VRF.
 - * Joe suggested a program item to discuss areas where models and reality did not agree.
 - * Ralph said that there was a proposed "track" for optimization in HVAC design.
 - * Bass agreed with this. He said that there has been a dearth of program from TC 4.7, and that having a track would help get program accepted.
 - * Joe wanted to get the sense of the subcommittee about having their own track. The committee agreed.
 - * Bass said that he discussed this with David Claridge, Chair of CEC, where it was mentioned that one person makes the decision about the priorities of sessions to be accepted.

- * Joe then moved the discussion to new ideas or new business.
- * Joe suggested one area for new ideas was in areas of modeling where there was lots of disagreement.
- * Ron suggested ground models, attic models,
- * Joe mentioned night sky radiation models were quite often not what they should be.
- * Bass mentioned that Joshua has been very successful about the topic of urban modeling. Therefore, this was something that needed further thought.
- He suggested that Urban Modeling might be something that TC 4.7 might take responsibility for.
- * The committee was also reminded that Urban Scale modeling was the most popular modeling topic at the IBPSA conference.
- * Ron said that there were benefits and challenges to starting a new sub-committee, that it might start in the applications subcommittee.
- * Chris reminded the committee that the difference between S&C and applications was clear, but that where the boundary was on urban scale modeling and applications was less clear.
- * Tony thought that the tools needed for urban scale modeling were very different than the sorts of tools that TC 4.7 was using. He used EP as an example.
- He said that one needs more other tools that are faster to run but give good results.
- * Commenter worked on urban scale and building level, but there was a need to move between them.
- * Tony mentioned that district heating/cooling scale modeling would be helpful for some decision makers.
- * Ron said that NREL has a program called UrbanOpt that was created for urban scale modeling. That EP+ was part of this modeling if one was modeling in a forward model. BES were a large part of this. There were efforts to use an assemble of models and then scale the results.
- * Joe asked whether or not the urban modelers needed to be part of an existing TC or something on their own. It was also mentioned that IBPSA-USA had a working group looking into urban scale modeling.
- * Bass suggested that perhaps the applications subcommittee might be applications and large scale modeling.
- * Comment from new member working on multi-scale applications.
- * Chris said that this would be helpful to get the urban scale modelers into applications, but that there might be logistic issues in doing this.
- * Ron said that one would need to watch it, allowing things to flow where the interests were.
- * Ron thought that TC 4.7 applications could easily be renamed to incorporate urban scale or multiscale applications.
- * End-of-meeting.



Attachment C
Draft Agenda in Black and Minutes in Red

TC 4.7 Data Driven Models Subcommittee Meeting

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, Tues January 23, 2018
Salon 1, Palmer House, Chicago, IL

Introductions and Agenda Review (5 minutes)

- Sign-up sheet
- Around Room
- Agenda Mods

Attendees: Mark Adams, Bass Abushakra, Chris Balbach, Chip Barnaby, Anthony Fontanini, Jeff Haberl, Joe Huang, Piljae Im, Ron Judkoff, Erik Kolderup, Neal Kruijs, Tim McDowell, Ralph Muehleisen, Joel Neymark, Alex Nutkewicz, Jim Pegues, John Pruett, Wangda Zou

Announcements (5 minutes)

- ASHRAE Calls for Papers
 - Houston: Papers closed. Forums, Panels, etc., are open. (see Schedule Attachment 1)

Program (15 Minutes)(Keith Cockerham)

- 2018 Winter (Chicago) Status
 - For Houston **Houston**.
 - SSPC-140 Addendum A, (4.7) “Airside HVAC BESTEST” (Joel & Ron). **Joel had submitted for Chicago, but was rejected. Ralph M. will chair and talk to Standards track chair and submit for Houston.**
 - Window Layering from Simple Description (4.7) (Joe Huang, Jeff Haberl, Neil Kruijs, Chip Barnaby). Neil will talk to Joe Huang to see if this should be in Chicago or Houston. There will be a technical presentation associated with the paper that is being written. Haberl will chair and work with Joe Huang on organizing. **Jeff H will submit for Houston.**
 - Large Scale Modelling for the Power Grid and Code Compliance (4.7) (Bass, Haberl, Ralph M., Midwest Alliance,) **Done in Chicago. Seminar 12, About 100 people.**
 - Urban Scale Modelling 7 (1.5 & 4.7) (New, Luke Long, C. Rheinhardt, K. Gowri) **Done in Chicago.**
 - Urban Scale Modelling 8 (1.5 & 4.7) (New, Cyber City 3D, City Zenith, Symbiotic Technology and Ecology) **Didn't happen in Chicago. A speaker dropped out and Josh N thought it was too weak so withdrew.**
 - Building Performance Ratings and Measured Performance for Existing Buildings (TC 4.7) (Chris Balbach) **Done in Chicago. Seminar 37 this morning. About 65 people. Jeff H says that these were good papers. Asked Chris to talk to Authors and see if they would submit a conference paper or full paper.**
- 2018 Summer (Houston) Status
 - Validation and Uncertainty Session (Ralph M., Ron J., Piljae Im, Phil H.) This is the DOE project attempting to use measured data at LBNL FLEXLAB, ORNL FRP, and NREL HVAC Test Loop for empirical validation of building energy simulation programs. Judkoff is the liaison between the project and ASHRAE SSPC-140. Amir Roth leads the project for DOE and Haves leads the multi-lab effort. **Would be good to create a session with papers by the project participants (Judkoff, Im, Ralph M, Haves, etc.. (Most likely in Atlanta or KC.)**
 - Demand Side Management/Load Prediction (Joshua and Bass to organize session). (?)
 - **Chris B. I would chair a seminar on VRF modeling. It was discussed in SCM. In SCM, they had proposed Roger Hedrick and Tianzhen H. to give performance mapping methods for VRF and Supriya giving a talk on simplifying them. Chris also wants a set of talks also on whole system design on the VRF topic. He wants help in looking for speakers.**
-
- 2019 Winter (Atlanta)

- Atlanta schedule not published at time of meeting

Research (65 minutes)

Status

- APPS: 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. Mini Mulhotra re-wrote answering all of RAC's comments. Mini passed around a written WS and also explained the comments from RAC and her responses. RJ will send the WS, RAC comments, and Mini's answers to RAC to TC4.7 listserv. TC4.7 will conduct an email ballot after people have had time to read the materials. **TC-4.7 voted in Chicago to resubmit RTAR.**

Potential RTARS/Work Statements (15 minutes each max)

- New RTAR) Neil Kruis and Tim McDowell: Improved simplified methodology for describing and calculating heat conduction through the ground. **TC-4.7 voted to submit this to RAC with edits suggested by SCM, Applications, and TC-4.7. This will be run through Applications Subcommittee (Bass left it up to the authors to choose their preferred SC). Neil: This was also discussed at SCM. 4.7 and 4.1 chapters of Handbook that discussed ground heat transfer are inconsistent and 90.1 says that the 4.7 and 4.1 methods should not be used in commercial buildings. This RTAR is to develop a consistent approach for all the use cases and be applicable to 90.1. Scope of work would likely involve comparison with high resolution 2d/3d simulation like Trnsys or Kiva. With many aspect ratio, many insulation configuration, etc. Jeff: the RTAR needs to be clear that the end product has to be useable by 90.1 and uses their standards for presentation. This has been circulated to TC 4.1, and 90.1, along with some of 4.4. The 90.1 envelope committee supports this unanimously. Chip: 4.1 is interested in being formally involved because it covers stuff in their chapter. Erik: This should also include actively heated slabs. Neil agrees and RTAR will be modified to include this. Jeff says this needs to be somewhat specific and sufficiently vague. Ron: This is very important, it's a bit disappointing if the research is "forced" to limit itself because of 90.1. Ralph: if the RTAR is written to emphasize handbook material and 90.1 is a secondary output, then this might not have to be limited. Erik is wondering what is uncertain, limiting problems? Neil, the biggest uncertainty is water table height and how that interacts with the heat transfer. Erik; That isn't in the current methods is it? Ron: those data don't exist. Neil: In response to 4.1 we are specifically shying away from experimentation in this one. Jeff: asking to compare to existing data sets might be okay. Ron: Any objections to recommending this to the full TC with acknowledge of the response to comments at this meeting. Chip suggests we might want the full TC to email vote because the submission is not needed until March.**
- APPS: WS (RTAR-1730), "Research to Determine the Mass Flow Rate Correlations for Standard Venting Strategies & Components in Attic Spaces with Sloped Roofs". This WS was rejected by RAC. TC-4.4 has not yet re-worked the WS and responded to RAC's comments. TC-4.4 is seeking co-sponsorship from TC-4.7. Anthony Fontanini and others from 4.4 are re-working this WS. This work is trying to develop good input data for whole building simulations like EnergyPlus. Once TC4.7 has reviewed the updated WS then there can be a vote on co-sponsorship. **There are still hang-ups with other co-sponsor reviews. This will die if not submitted to RAC by July. Fontanini will try to make that deadline. Anthony Fontanini: 4.4 is still not sure that it's complete enough. He's trying to get 4.4 to do a vote over email. No action from applications now. He will send it out to listserv once he gets an approved version.**
- 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.**

Updates on related activities (10 minutes each)

- Update on SPC 209P, *Energy Simulation Aided Design for Buildings Except Low-Rise Residential* (Jason Glazer). **3rd public review completed with no comments. Going to publication.**

- Update on SPC 205, *Standard Representation of Performance Simulation Data for HVAC&R...* (Neil Kruis) **Advisory public review yielded 65 comments that are being responded to by SPC.**
- .IBPSA Project: BIM/GIS and Modelica Framework for building and community energy systems design and operation has 3 tasks, MODELICA Libraries, Building and City Models, **Dissemination. Kickoff meeting at San Francisco IBPSA. High interest with 40 participating orgs. Modelica conference planned Oct 9 & 10 at MIT.**
- IBPSA Project “STASIO”, Standardized Simulation Input & Output. Contact IBPSA if interested.

Topics for Discussion

- Bass Abushakra: Urban Scale Modeling: Change name of Applications to **Multiscale Applications**. **Consensus was to adopt Urban Scale modeling into Applications SC and rename SC. Bass will choose name of new subcommittee.**
- Zheng O’Neill seeking TC-4.7 endorsement of a Track on Optimization in Atlanta or KC (discuss and straw vote). **Item withdrawn because already had support of SCM and DDM. TC-4.7 voted to support this in Chicago.**
- Phil Haves cited a study he did where different modelers got very different results on the same problem using the same tool. **He suggested developing an MOT for Building Energy Simulations.**
- 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 Houston

- Thursday, January 11, 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)**

Program Schedule for Atlanta

Couldn’t find anything on Atlanta?

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
Draft Agenda and Minutes**

TC 4.7 Handbook Subcommittee
5:00-6:00 pm, Tuesday, January 31, 2017
Caesars Palace, Roman II, Las Vegas, NV

- 1) Introductions and Agenda Review (5 minutes)
- 2) Schedule for 2017 Fundamentals Handbook Revision
 - a. August 31, 2016 approved chapter completed
 - b. Early 2017, review galley prints
 - c. June 2017, publication
- 3) Handbook Online opportunities
 - a. Spreadsheets, color images, software, databases, etc.
 - b. Any items need TC approval
- 4) List of items to consider for future revisions
- 5) Next meeting

Resources:

- Dropbox folder:
<https://www.dropbox.com/sh/9vnz7g99u6xyev2/AABXxiIB9OOM1nyvAVLoiU6Ha?dl=0>.
- Description of target audience. Google Doc:
https://docs.google.com/document/d/174pP_sNyLISMAldZTMTToMwh9wiUibwTdl7i4EY7nBrE/edit?usp=sharing

Handbook Committee Minutes – Chicago Meeting

Editing for 2021 will be done through the ashrae portal that only works in IE.

It can be done the old fashioned way but ASHRAE discourages it.

Joel: I'm not in favor, I've had problems when using it in the past.

John: Asking Bass (overall handbook chair). Is ASHRAE forcing us to use this?

Bass: I don't see why you would have to use the portal. He's just looking for the committee to send a clear, up-to-date document.

Erik: we need to organize a training.

Joel: How onerous was it to do it using Word and word tools in the last revision.?

Eric: not too bad.

John: If we change the TC scope and subcommittee to Urban, we'll need to do some additions.

Erik: standard 205 will be on the todo list. Standard 209 will be published too and that should get a shout out.

Jeff: we need to update references and citations.

Erik: we did check that everything cited in text had a reference. And that all references are cited.

Erik: We need to have a place for exchanging information about minutes and new material for sharing while we are hashing it out.

Tianzhen: We need to add more info about occupancy. It might be time to propose a new chapter.

Tim: we need to make sure we are concise and do better with referencing.

Jeff: A new chapter is hard. Get a good page in our chapter first.

Tianzhen: the MTG is proposing to become a TC. With that a separate chapter might make sense but until then, keep it within chapter 19.

Jeff: this version has red and green highlighting:

Erik: that is for the SI and IP units.

Jeff: you need to explain that in instructions.

Jeff: can we get the 2 column galley that came from framemaker.

John: he's had graduate level engineers review and it really read well.

Jeff: ask the handbook committee to ask a college of fellows to review.



**Attachment F
Draft Agenda and Minutes**

SSPC 140 Committee

Monday, Jan 22, 2018,
LaSalle 3, Palmer House Hilton, Chicago, IL

AGENDA – SSPC 140

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

Monday January 22, 2018; Chicago

Time: 2:15P – 6:15P

Location: LaSalle 3 (7th floor)

Chair: Joel Neymark

1. Introductions: Sign-in sheet, participant introductions, quorum (= 7 VMs).
2. Chair Announcements/Communications since last meeting [5 min.]
 - **140-2017 CM revision is published; integrates airside HVAC cases with 140-2014 test suites.**
 - **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) **9 progs (16 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 18Jan2018).**
 - **RESNET or DOE list 6** (last check 18Jan2018) 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
 - **IEA BESTEST Thermal Fabric Tests Update:** Round 3 sim-trial draft distributed Sep 13, 2017, 8 participants submitted results thru Dec 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. 140-2017 Continuous Maintenance Revision [*Neymark, 5 min*]
 - Integrates 140-2014 Addendum A (Airside HVAC cases) with current 140-2014
 - Questions?
7. 140-2017-A: Update Section 5.2 (IEA BESTEST thermal fabric, 1995) test spec/example results [*Neymark/Judkoff, 20 min*].
 - Meeting summary, BESTEST Thermal Fabric Working Group
 - Discussion, if needed: e.g., extension test case(s) for weather data
 - Proposed work schedule
8. Empirical Validation Activities [*Start ~2:45p, (V&U team arrive 2:30p)*]
 - DOE Empirical Validation and Discussion [*Judkoff, Haves, Im, Muehleisen, 90 min.*]
9. Prioritization of Possible Test Suites and Discussion [*Neymark/Judkoff, 60 min.*]
10. SSPC 140 Website (<http://sspc140.ashraepcs.org/index.html>) [*Sturm, 5 min.*]
 - Updates this cycle + traffic count
- 11a. 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
- 11b. IECC (C407.6.1) Referencing of Standard 140
 - S. Ferguson indicates (6/22/2016) IECC 2018 to ref 140-2014.
- 11c. 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.
12. 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
13. SSPC 140 Work Plan for StdsC (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.*
14. Other Related Activities [*as time permits*]
 - IEA ECBCS Annex 71 task on whole building empirical validation [*Hong, 5 min.*]
 - *ASHRAE Handbook of Fundamentals, Validation Methods* [*Judkoff, 2 min.*]
15. Additional or Revised Test Suites
 - a. Airside HVAC Volume 2 [*Neymark, 5 min*]
 - b. Weather-Driven infiltration [*Neymark, 5 min*]
 - c. Other (e.g., revisions to furnace cases, shading cases, etc) [*All, 10 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

DRAFT MINUTES
SSPC-140 SMOT FOR BUILDING ENERGY ANALYSIS COMPUTER PROGRAMS
Jan 22, 2018 (submitted to ASHRAE MOS Jan 31, 2018)

Chair: J. Neymark

[These draft minutes are not the official minutes until approved by this committee.]

ATTACHMENTS

- A. Agenda for the meeting
- B. Previous meeting minutes voted for acceptance at this meeting
- C. .ppt slides displayed for selected agenda items
- D. Building Thermal Fabric Working Group minutes

ATTENDANCE

VOTING MEMBERS / OFFICERS PRESENT	YEAR APPTD	VOTING MEMBERS / OFFICERS ABSENT	YEAR APPT D
Joel Neymark (C)	2014		
Dru Crawley	2014		
Krishnan Gowri	2017		
Tianzhen Hong	2014		
Neal Kruis	2017	David Knebel	2014
		Michaël Kummert	2017
Tim McDowell	2016		
Jim Pegues	2016		
Amir Roth	2017		
Eric Sturm	2015		
Michael Witte	2017		
		Da Yan	2016

CORRESPONDANCE SINCE LAST MEETING

See chair announcements below.

Attendance

This is a complete listing of attendees at this and the prior four meetings. It includes the voting members of the committee listed on the first page of the minutes.

Present at SSPC 140 meeting?					Last name	First name	Email
Chicago Jun 2018	Long Beach Jun 2017	Las Vegas Jan 2017	St. Louis Jun 2016	Orlando Jan 2016			
		X	X	X	Antretter	Florian	
		X			Baden	Steve	
				X	Bhandari	Mahabir	
				X	Bohnert	Caitlin	
			X		Chude	Ricson	
X	X		X	X	Crawley	Dru	
				X	Cumali	Zulfikar	
	X	X	X	X	Emerson	Keith	
X	X	X	X	X	Gowri	Krishnan	
X					Guo	Siyue	
X				X	Haberl	Jeff	
		X			Haddad	Kamel	
X	X	X		X	Haves	Phil	
X	X	X	X	X	Hong	Tianzhen	
X	X	X	X		Im	Piljae	
X	X	X	X	X	Judkoff	Ron	
X	X				Kouma	Larry	
				X	Kozubal	Eric	
			X	X	Knebel	David	
X	X	X	X	X	Kruis	Neal	
					Kummert	Michael	
			X		Lamberts	Roberto	
X					Li	Qi	
			X		Malhotra	Mini	
X	X	X	X	X	McDowell	Tim	
X	X	X	X	X	Muehleisen	Ralph	
X					Mukhopadhy	Jaya	
	X	X	X	X	New	Joshua	
X	X	X	X	X	Neymark	Joel	
				X	Ono	Eikichi	
X	X	X	X	X	Pegues	Jim	
			X		Rees	Simon	
	X				Reyes	Mayra	
	X				Rogers	Steven	
X	X	X	X		Roth	Amir	
		X			Smith	Amanda	
X	X		X		Sturm	Eric	
	X	X			Tosh	Megan	

Present at SSPC 140 meeting?					Last name	First name	Email
Chicago Jun 2018	Long Beach Jun 2017	Las Vegas Jan 2017	St. Louis Jun 2016	Orlando Jan 2016			
			X		Vallejo	Marianna	
X					Wheeler	Grant	
X	X	X	X	X	Witte	Mike	
			X		Wu	Tiegun	
	X		X		Yan	Da	

MEETING SUMMARY

The primary purposes of the meeting were to report on the following activities:

- 140-2017 continuous maintenance revision publication.
- Progress on Section 5.2 (building thermal fabric tests) specification and results update
- Progress on DOE's empirical validation activities

Note: Agenda template is in black. Recorded minutes at meeting are in blue (mainly recorded by Witte with edits by Neymark), or other colors where noted.

1. Introductions: Sign-in sheet, participant introductions, quorum (= 7 VMs).
2. Chair Announcements/Communications since last meeting [5 min.]
 - **140-2017 CM revision is published; integrates airside HVAC cases with 140-2014 test suites.**
 - **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:
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 - **ASHRAE 90.2** proposing to reference Standard 140
 - **IEA BESTEST Thermal Fabric Tests Update:** Round 3 sim-trial draft distributed Sep 13, 2017, 8 participants submitted results thru Dec 2017; agenda item below.
3. Membership [5 min.]
4. Acceptance of Previous Minutes [5 min.]

Motion: Witte/Gowri 8-0-0 approved.
5. Adjustments to Agenda (New business or news briefs to include?) [5 min.]

None
6. 140-2017 Continuous Maintenance Revision [Neymark, 5 min]
 - Integrates 140-2014 Addendum A (Airside HVAC cases) with current 140-2014
 - Questions? *None*
7. 140-2017-A: Update Section 5.2 (IEA BESTEST thermal fabric, 1995) test spec/example results [Neymark/Judkoff, 20 min].
 - Meeting summary, BESTEST Thermal Fabric Working Group

- Discussion, if needed: e.g., extension test case(s) for weather data
- Proposed work schedule
- Questions/Comments: None.

8. Empirical Validation Activities [*Start ~2:45p, (V&U team arrive 2:30p)*]

- DOE Empirical Validation and Discussion [*Judkoff, Haves, Im, Muehleisen, 90 min.*]
 - [*Witte's notes in blue; Neymark's notes in green; RJ's notes in purple*]
 - *Judkoff presentation*
5ton SEER 17 testing complete, data in TPEX
6ton IEER23 testing in progress This very advanced unit challenges the paradigm of completely tabular performance map data because of the complexity of the controls and many modes of operation possible. Either extremely large tables will need to be generated (which is impractical from an experimental standpoint) or some combination of tabular data and modeled control logic will need to be used. NREL is still discussing these issues internally and with reps from SPC 205 (Kruis and Barnaby)
Originally planned 5ton SEER 20 couldn't be purchased
JN: How was part-load testing done? – RJ: Ran stage 1 across a bunch of points, including dry and wet, then repeat with both stages
SEER 17 is 2-speed with variable fan
NK: What about altitude? RJ: Data has been corrected to sea-level, method has been validated years ago by comparing mile-high data with tests from labs at sea-level. Test spec can also be for local altitude [Golden, Colo./NREL site].

Haves presentation

Early comments on documentation package – could use some restructuring from simple to detailed
As LBNL refines their documentation package – seeking feedback from Std140 committee – looking for gaps etc.
Haves asked: Regarding as-built walls with columns, should LBNL provide details of 2-D to 1-D conversions or just let modelers run with the architectural drawings?
Haves asked: What are the criteria of adequacy of data sets? [These are questions SSPC 140 to consider going forward.]
Legal issues regarding distribution of architectural drawings which are the property of the architect. Must return signed letter to receive a copy of the drawings for review
Are the datasets good enough? – length, cleanliness, etc

[Judkoff's notes]

Phil Haves presented the FLEX-LAB effort. Phil was most concerned with getting feedback on the specs he had sent out about a week prior to the meeting. Tim was concerned that the specs left too much for interpretation and that the test would be more a test of the simulationist rather than the internal workings of the model. Tim was also concerned that the tests would take too long for modelers to perform. Qi indicated that it took him less than a week coming in with no prior knowledge of FLEXLAB. RJ made his usual comments about uncertainty control especially the uncertainty of the inputs modelers are given in the specs. Phil

indicated that uncertainty for experimental measurement was about 5% for energy and .1 °K. However, he did not [indicate specifics] on model input uncertainty. He was concerned about capacitance of drywall, and concrete, and the complexity of mullions on the South Wall.

Muehleisen presentation

Complex Static Discrepancy Metric.

Qi Li will be doing the analysis re: characterizing uncertainty, validation uncertainty measurements, and simulating the experiments with EnergyPlus. Ralph described uncertainty metrics to be applied: Uncertainty Ratio and CRPS (direct metric of relative uncertainty), and an easy to read graphic of measured output uncertainty compared to expanded distribution (applying monte carlo) of simulation uncertainty.

Ralph indicated that time alignment for simulations vs. experiment is something to be careful about. Simulation modelers must address implementation of time step alignment to match the experiment.

Up until now [Ralph] had difficulty staffing this project, however now he has Qi Li working on it and he also thinks he has a student interested in modeling the test suites with IESVE. The uncertainty analysis method proposed by Qi Li and stemming from his PhD Thesis incorporates the Uncertainty Ratio concept, but applies statistics that are more suited to the shape of probability distributions associated with modeling. Qi will try to have his uncertainty analysis of FLEXLAB and FRP completed by May 1.

Im presentation

5 of 9 tests complete, remaining planned for summer 2018. Has architectural drawings, material specs, etc. Noted future discussion issues in his slide presentation.

[Im] has not yet sent out any specs, but said he would do so shortly. He showed results with good agreement between EnergyPlus and the experiment, but these results may contain compensating errors because he does not have good zonal information on infiltration and air flow from the HVAC.

General Q&A

Ron asked the experimenters if they feel that the uncertainty is sufficiently controlled on the experimental and simulation input side: NREL feels because they are in a lab situation that their uncertainty is minimal; LBNL feels that on a good day measuring sensible loads to 5% and other uncertainties are spatially averaged air temperature as input to simulation tstat, questions whether weather data as recorded represents actual weather, physical characteristics – which materials should be sampled and tested for properties?; Re uncertainty of thermal fabric inputs, characterizing windows is difficult, wall exposed to natural climate below window is R-13. PH proposing to send material samples to a lab for property determination – discussion about uniformity of sheet rock [and generally the issue of as-built performance of wall system as a whole is not covered by a lab sample material measurement].

JH: Would be helpful to have weather data for days preceeding the test for use in simulation warmup.

KG: Is there access to any BIM data to generate simulation files – another question for the architect

KG: Suggests that 90.1 scorecard format may be useful an example for building description data to give users

ANL: will do a first pass of using the information from the labs to build simulation models for the uncertainty analysis.

TMc: Discussions about level of detail and starting point and time to build models; need several levels of detail; the reality of this is that the user's interpretation of the data will impact the test of the software;

MJW: Architectural drawings are not the right starting point for empirical validation.

TMc: Needs a perfect geometry description to test his model's building physics

RJ: Provide both – a simplified [amenable to software inputs] description and an appendix with details.

TMc: Don't test user interpretation. And concerned about the time SSPC 140 is spending.

NK: Agrees re defining clear inputs, and to keep interpretation out; SSPC 140 determine interpretation guidelines.

PH: Requests criteria to decide if measurements are good enough or not [this comes back to Argonne's uncertainty evaluation work]

(side note – Dru always has to leave at 4:15, Krishnan just has a conflict this meeting)

9. Prioritization of Possible Test Suites and Discussion [Neymark/Judkoff, 60 min.]

Joel presented material to refresh everyone's memory on the list of potential future test suites. SSPC-140 then went through a preliminary prioritization exercise to begin the process of selecting the next test suite to be worked after completion of the Thermal Fabric Update. Voting exercise reduced the working lists to less than half -- 2 slides with voting results follow.

The numbers along the left column of the following slides indicate number of votes for a test suite. The top three were:

16 votes) NREL HVAC BESTEST 1& 2 using empirical data collected in V&U project

14 votes) FLEXLAB empirical tests

14 votes) FRP empirical tests

A very large caveat for the above three test suites is that the uncertainty analysis to be completed by Argonne shows sufficiently minimized uncertainty such that SSPC-140 judges a suite(s) to be definitive, robust, and worthwhile in the context of Standard 140 (doable by simulationists with a reasonable amount of effort).

#9. Prioritization of Test Suites Empirical Validation Candidates

[Blue = proposed new or in progress; black = published tests]

- 14 LBNL/Flexlab test cases
- 14 ORNL test cases
- 16 NREL HVAC BESTEST 1 & 2 with empirical-basis performance maps
- 10 ETNA BESTEST – EdF (Fr.)/JNA/NREL
- 10 NREL “i-Unit” Lab

#9. Prioritization of Test Suites Analytical Ver. And Comparative Test Candidates

[Blue = proposed new; black = published tests; red = current test suite in progress]

- Building Thermal Fabric Tests Update – finish work in progress
- 11 IEA 34/43 Multi-Zone Test Suite – NREL
 - Previously approved by SSPC 140 for Standard-140 adaptation
- 13 Airside HVAC BESTEST Volume 2
- 12 Weather-Driven Infiltration
 - Could draw on IEA 34/43 Japan (unpublished) Airflow Tests
- 13 weather drivers
- 11 more ground coupling

ANL ACTION (on empirical validation assessment): will do a first pass of using the information from the labs to build simulation models for the uncertainty analysis. Deadline for Argonne to provide analysis to SSPC 140 is May 1. Preliminary analysis descriptions to SSPC 140 by Feb 1.

ACTION (McDowell, Jun 1, 2018): Present weather driver test cases ideas.

10. SSPC 140 Website (<http://sspc140.ashraeaps.org/index.html>) [Sturm, 5 min.]

- Updates this cycle + traffic count
- Member password has changed
- **JN ACTION: check new password works, and distribute access info to PC Members**

11a. 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
- **JN Action: Contact Glazer (90.1 ECB Chair) re CMProposal and presenting about updates for 140-2017 to 90.1 ECB (in Houston or Atlanta)**

11b. IECC (C407.6.1) Referencing of Standard 140

- S. Ferguson indicates (6/22/2016) IECC 2018 to ref 140-2014.

11c. 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.

JN Actions: Follow up on 11b and 11c.

12. 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).
 - **Status of 179D tax credit is uncertain, continuing as far as we know**
 - **Software list is useful even if 179D tax credits are not extended.**
- RESNET Accreditation:
 - HERS Tools; Existing Homes Tax Credit Compliance
 - 45L Tax Credit Compliance is by DOE, references RESNET
 - **RJ: RESNET wanted an EnergyPlus engine, but there were objections to this path. Committee formed to look at consistency issues. Leaning towards forcing hourly simulations. This is all work in progress.**

13. SSPC 140 Work Plan for StdsC (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.*

14. Other Related Activities [*as time permits*]

- IEA ECBCS Annex 71 task on whole building empirical validation [*Hong, 5 min.*]
 - **This is follow-on to Annex 58, and just began 6 months ago. No news to share yet.**
- *ASHRAE Handbook of Fundamentals, Validation Methods [Judkoff, 2 min.]*

15. Additional or Revised Test Suites

- d. *Airside HVAC Volume 2 [Neymark, 5 min]*
- e. *Weather-Driven infiltration [Neymark, 5 min]*
- f. *Other (e.g., revisions to furnace cases, shading cases, etc) [All, 10 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 - none

18. Adjourn

Motion: Kruis/Pegues, adjourned at 5:29pm CST

ATTACHMENT A.

AGENDA – SSPC 140

STANDARD MOT FOR THE EVALUATION OF BUILDING ENERGY ANALYSIS COMPUTER PROGRAMS

Monday January 22, 2018; Chicago

Time: 2:15P – 6:15P

Location: LaSalle 3 (7th floor)

Chair: Joel Neymark

1. Introductions: Sign-in sheet, participant introductions, quorum (= 7 VMs).
2. Chair Announcements/Communications since last meeting [*5 min.*]
 - **140-2017 CM revision is published; integrates airside HVAC cases with 140-2014 test suites.**
 - **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) **9 progs (16 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 18Jan2018).
 - **RESNET or DOE list 6** (last check 18Jan2018) 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
 - **IEA BESTEST Thermal Fabric Tests Update:** Round 3 sim-trial draft distributed Sep 13, 2017, 8 participants submitted results thru Dec 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. 140-2017 Continuous Maintenance Revision [*Neymark, 5 min*]
 - Integrates 140-2014 Addendum A (Airside HVAC cases) with current 140-2014
 - Questions?

7. 140-2017-A: Update Section 5.2 (IEA BESTEST thermal fabric, 1995) test spec/example results [*Neymark/Judkoff, 20 min.*]
 - Meeting summary, BESTEST Thermal Fabric Working Group
 - Discussion, if needed: e.g., extension test case(s) for weather data
 - Proposed work schedule
8. Empirical Validation Activities [*Start ~2:45p, (V&U team arrive 2:30p)*]
 - DOE Empirical Validation and Discussion [*Judkoff, Haves, Im, Muehleisen, 90 min.*]
9. Prioritization of Possible Test Suites and Discussion [*Neymark/Judkoff, 60 min.*]
10. SSPC 140 Website (<http://sspc140.ashraepcs.org/index.html>) [*Sturm, 5 min.*]
 - Updates this cycle + traffic count
- 11a. 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
- 11b. IECC (C407.6.1) Referencing of Standard 140
 - S. Ferguson indicates (6/22/2016) IECC 2018 to ref 140-2014.
- 11c. 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.
12. 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:
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13. SSPC 140 Work Plan for StdsC (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
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 - *Needs update after publication of 140-2017.*
14. Other Related Activities [*as time permits*]
 - IEA ECBCS Annex 71 task on whole building empirical validation [*Hong, 5 min.*]
 - *ASHRAE Handbook of Fundamentals, Validation Methods* [*Judkoff, 2 min.*]
15. Additional or Revised Test Suites
 - g. Airside HVAC Volume 2 [*Neymark, 5 min*]
 - h. Weather-Driven infiltration [*Neymark, 5 min*]
 - i. Other (e.g., revisions to furnace cases, shading cases, etc) [*All, 10 min*]
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- Other Existing Test Suites and new research

17. New business

18. Adjourn

Attachment B. SSPC140minutes-26Jun2017-012218-approved.pdf: SSPC 140 Long Beach minutes approved in Chicago, available upon request.

Attachment C.

- **C1. SSPC140-Agenda_Items-012218a.ppt:** .ppt slides displayed for selected agenda items, available upon request.
- **C2. V&U NREL SSPC140 Pres 20171215 RJ.ppt (Judkoff)**
- **C3. DOE_V+U_FLEXLAB_Illustrative_Results_20180119 .ppt (Haves)**
- **C4. ORNL-sspc140_01222018.pdf (Im)**
- **C5. ANL SSPC 140 22-Jan-2017.ppt (Muehleisen)**

Attachment D. BESTEST-Thermal-Fabric-WG-Minutes-22Jan2018-013118.doc: Building Thermal Fabric Working Group minutes, available upon request.