

**AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING  
ENGINEERS, INC.**

1791 Tullie Circle, NE / Atlanta, GA 30329  
404-636-8400

TC/TG/TRG MINUTES COVER SHEET

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

TC/TG/TRG No. TC 4.7 DATE: October 20, 2011

TC/TG/TRG TITLE: Energy Calculations

DATE OF MEETING: June 28, 2011 LOCATION: Montreal

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS & ADD'L ATTENDANCE
Jeff Haberl (CHAIR)	2010	Russ Taylor	2010	See attendance list for additional attendees.
Tim McDowell (V CHAIR)	2010			
Joe Huang (SEC & APP SC CHR)	2010			
Chip Barnaby (HDBKSC CHR)	2010			
Chris Balbach (PRGM SC CHR)	2010			
Bass Abushakra (RES & DDM SC CHR, Non-Voting)	2011			
Joel Neymark (STDS SC CHR)	2007			
Iain Macdonald (SCM SC CHR)	2009			
Jan Hensen	2008			
Robert Sonderegger	2008			
Moncef Krarti	2007			
Klaus Sommer (INT'L)	2007			

Total attendance of voting members: 12 present, 1 absent.

DISTRIBUTION

**ALL MEMBERS OF THE TC/TG/TRG**

TAC CHAIR	Michael Bilderbeck , Charles Culp
TAC SECTION HEAD	
SPECIAL PUBLICATIONS LIAISON	William Fleming
STANDARDS LIAISON	James Tauby
HANDBOOK LIAISON	Peter Simmonds
RAC RESEARCH LIAISON	Srinivas Garimella
PROF DEV COMM LIAISON	John Nix
CHAP TECH TRANSFER LIAISON	Harris Sheinman
STAFF LIAISON (RESEARCH)	Michael Vaughn
STAFF LIAISON (TECH SERVICES)	Michael Vaughn
STAFF LIAISON (STANDARDS)	Stephanie Reiniche

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

**ASHRAE TC 4.7 Energy Calculations  
MONTREAL MEETING**

**MOTIONS AND ACTION ITEMS**

MOTION: "Accept agenda for meeting" Neymark/Balbach (8-0-0 CNV)

MOTION: "Approve minutes from meeting in Las Vegas" Neymark/Balbach (8-0-0 CNV)

MOTION: "Four-month No Cost Extension (NCX) to February 28 for RP-1404 " Macdonald/McDowell (9-0-1 CNV)

MOTION: "Approve Program Plan for Chicago proposed by Program Subcommittee Chair" Balbach/Neymark (9-0-1 CNV)

MOTION: "Recommend that ASHRAE form a Standards Project Committee with the following title, "Energy Simulation Aided Design for High Performance Buildings" Barnaby/Crawley 6-3-1 CNV

MOTION: "Recommend Jason Glazer as chairman for the preceding proposed standards project committee" Crawley/McDowell 10-0-0 CNV

ACTION ITEM: Huang to revise RP-1588 by end of July to respond to RAC comments and submit it for vote by TC 4.7 for approval and TC 4.5 for co-sponsorship.

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DATE OF MEETING: June 28, 2011 LOCATION: Montreal

<b>TC/TG/TRG MEETING SCHEDULE</b>					
<b>LOCATION – past 12 months</b>		<b>DATE</b>	<b>LOCATION - planned next 12 months</b>		<b>DATE</b>
Las Vegas		Feb. 1, 2011	Chicago		January 24, 2012
Albuquerque		June 29, 2010	San Antonio		June 26, 2012
<b>TC/TG/TRG SUBCOMMITTEES</b>					
<b>Function</b>			<b>Chair</b>		
Program			Chris Balbach		
Research			Bass Abushakra		
Handbook			Chip Barnaby		
<b>RESEARCH PROJECTS – Current</b>			<b>Monitoring</b>	<b>Report Mode</b>	
<b>Project Title</b>	<b>Contractor</b>		<b>Comm.Chm.</b>	<b>At Meeting</b>	
Appendix 1					
<b>LONG RANGE RESEARCH PLAN</b>					
Rank	Title	W/S Written	Approved	To R & T	
	Appendix 2				
<b>HANDBOOK RESPONSIBILITIES</b>					
<b>Year &amp; Volume</b>	Chapter Title	<b>No.</b>	Deadline	<b>Handbook Subcom. Chair/Liaison</b>	
2009 Fundamentals	Energy Estimating Methods	19	June 2012	Barnaby/Simmonds	
<b>STANDARDS ACTIVITIES - List and Describe Subjects</b>					
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					
<b>TECHNICAL PAPERS from Sponsored Research - Title, when presented (past 3 yrs. present &amp; planned)</b>					
Appendix 3					
<b>TC/TC/TRG Sponsored Symposia - Title, when presented (past 3 yrs. present &amp; planned)</b>					
Appendix 4					
<b>TC/TG/TRG Sponsored Seminars - Title, when presented (past 3 yrs. present &amp; planned)</b>					
Appendix 5					
<b>TC/TG/TRG Sponsored Forums - Title, when presented (past 3 yrs. present &amp; planned)</b>					
Appendix 6					
<b>JOURNAL PUBLICATIONS - Title, when published (past 3 yrs. present &amp; planned)</b>					
None					

**Attendance**

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

Present at Meeting				Last Name	First Name	Affiliation	Status 07/01
Mon treal Jun'11	Las Vegas Jan '11	Albu querque Jun'10	Orlando Jan'10				VM Voting CM Corres. V Visitor
X	X	X	X	Abushakra	Bass	Milwaukee School of Eng.	VM
X				Anderson	JR	Anderson Eng	V
X				Askildsen	Bernt	Lloyds Systems	V
X	X	X	X	Balbach	Chris	Performance Systems Develop.	VM
X	X	X	X	Barnaby	Chip	Wrightsoft	VM
X	X	X	X	Basarkar	Mangesh	LBNL	CM
	X			Bosworth	David	Cornell	V
	X			Boyd	Matthew	NIST	V
	X	X		Brandemuehl	Mike	Univ. of Colorado	CM
	X	X	X	Carpenter	J Patrick	Facility Performance Engineer	CM
	X			Cho	Heejin	PNNL	CM
	X		X	Cho	Soolyeon	Catholic Univ. of America	V
			X	Claridge	David	TAMU	CM
	X			Cockerham	Keith	DLB Associates	CM
	X			Cook	Malcolm	Loughborough Univ (UK)	V
X	X	X	X	Cornick	Steve	Nat'l Research Council Canada	V
X	X	X	X	Crawley	Dru	Bentley Systems	CM
	X			Cumali	Zulfi	Energy Systems Consultant	CM
X		X	X	Degelman	Larry	TAMU	CM
	X			DeGraw	Jason	Penn State	V
	X			Djunaedy	Ery	Univ. of Idaho	V
	X			Dong	Bing	UTRC	V
X	X	X	X	Eldridge	David	Grumman/Butlas Associ.	V
	X			Feng	Jingjuan	UC Berkeley	V
X	X	X		Fisher	Dan	Oklahoma State Univ	VM
	X			Gardner	Carol	Cobalt Engineering	CM
X				Glazer	Jason	GARD Analytics	V
X		X	X	Goldstein	Rhys	Autodesk Research	V
X	X	X	X	Haberl	Jeff	TAMU	VM
X	X		X	Haddad	Kamel	NR Canada	V
X				Hallman	Mark	RWDI	V
	X			Harleman	Sean	KW Engineering	V
	X	X	X	Haves	Philip	LBNL	CM
X				Hensen	Jan	TUIE	VM
X	X			Hong	Tianzhen	LBNL	V
X		X		Howe	Bob	Carrier	V
X	X	X	X	Huang	Joe	White Box Technologies	VM
	X			Im	Piljae	ORNL	V
X		X	X	Judkoff	Ron	NREL	CM
X				Kegel	Nathan	IES, Ltd.	V
X	X		X	Kennedy	Mike	Mike D Kennedy, Inc.	V

Present at Meeting				Last Name	First Name	Affiliation	Status 07/01
Mon treal Jun '11	Las Vegas Jan '11	Albu querque Jun '10	Orlando Jan '10				VM Voting CM Corres. V Visitor
	X			Kim	Hyojin	TAMU	V
X	X	X	X	Kolderup	Erik	Kolderup Consulting	V
X	X		X	Koran	Bill	Quest	V
			X	Kosny	Jan	Fraunhofer Inst	CM
X	X		X	Krarti	Moncef	University of Colorado	CM
X	X	X		Kruis	Neal	NREL	CM
X			X	Kummert	Michael	Ecole Polytechnique Montreal	V
	X	X		Laouadi	Aziz	NRC Canada	V
	X	X		Lee	Kwang Ho	UC Berkeley	V
	X			Lin	Hongwen	LBNL	V
	X			Liu	Xiaobing	ORNL	V
X	X	X		Macdonald	Iain	NRC	VM
X	X	X	X	McDowell	Tim	TESS	VM
	X			Mendez	Charlene	ASU	V
X	X	X	X	Neymark	Joel	J. Neymark & Assoc	CM
X				Ng	Lisa	NIST	V
	X			Novoselac	Atila	Univ. of Texas at Austin	V
X	X		X	O'Neill	Zheng	UTRC	V
	X	X		Pang	Xiufeng	LBNL	CM
X	X	X	X	Pappas	Aleka	Group 14 Eng.	V
X	X			Paulus	Mitch	Milwaukee School of Eng.	V
X	X	X	X	Pedersen	Curtis	Univ. of Illinois	CM
	X			Peeters	Leen	Univ. of Brussels (VUB)	V
X	X	X	X	Pegues	Jim	Carrier	V
X	X			Reddy	T. Agami	Arizona State Univ	V
	X	X		Rees	Simon	De Montfort Univ	CM
	X			Reilly	Sue	Group 14 Eng.	CM
	X			Ruch	Jennifer	PG&E	V
	X			Settlemyre	Kevin	LBNL	V
X	X	X	X	Shirey	Don	Bentley Systems	V
	X			Sleiti	Ahmad	UNC Charlotte	V
X	X	X		Shrestha	Som	ORNL	CM
	X		X	Sommer	Klaus	Koln Univ of Applied Sciences	CM
X	X		X	Sonderegger	Robert	Itron, Inc.	VM
X	X			Stafford	Stanton	Newcomb&Boyd	V
	X			Veronica	Dan	NIST	V
	X			Wang	Lei	TAMU	V
	X			Wang	Liping	LBNL	V
X	X	X	X	Wetter	Michael	LBNL	VM
X				Wray	Craig	LBNL	CM
	X			Wright	Jonathan	Loughborough Univ (UK)	CM
	X	X		Zuo	Wangda	LBNL	CM

**Appendix 1****TC 4.7 RESEARCH PROJECTS STATUS****ASHRAE  
Technical Committee 4.7 Energy Calculations  
(June 28, 2011)****Active projects**

<b>#</b>	<b>Title</b>	<b>Joint TC</b>	<b>Cog SC/ Contractor</b>	<b>PMSC</b>	<b>Dates / status</b>
1416-RP	Development of Internal Surface Convection Correlations for Energy and Load Calculations	4.1	Sim/Comp, Univ of Texas	Dan Fisher (Chair), Steve Bruning, Jan Kosny	NCX to Feb 2012 recommended by PMS in Montreal, but no record of vote by Full Committee .
1404-RP	Modeling, Analysis, and Reporting Protocols for Predicting Annual Energy Performance from Short-Term Building Energy Monitoring		DDM, Milwaukee School of Engineering	R. Sonderegger (Chair) J. Haberl, V. Smith	NCX to Feb 2012 approved by Full Committee in Montreal

**Appendix 2**  
**RESEARCH PLAN**

**ASHRAE**  
**Technical Committee 4.7 Energy Calculations**  
**2011 Research Plan (June 28, 2011)**

Title	Society status	TC 4.7 Status	Actors or TC 4.7 Prime Contact	Subcommittee*
<b>Active projects</b>				
1416-RP Development of Internal Surface Convection Correlations for Energy and Load Calculations	project underway	Sixth PMS meeting held in Montreal Jun '11, <b>NCX recommended by PMS thru Feb 2012</b>	Contractor: UTexas PMS: Dan Fisher (chair), Steve Bruning, Jan Kosny	SCM
1404-RP Modeling, analysis, and reporting protocols for predicting annual energy performance from short-term building energy monitoring	project underway	Third PMS meeting held in Montreal Jun'11. Project. NCX granted thru Feb 2012	Contractor: Milwaukee School of Engineering PMS: Robert Sonderegger (chair), Jeff Haberl, Vern Smith	DDM
<b>WSs approved by TC</b>				
1588-WS Procedure to create hypothetical layer-by-layer fenestration descriptions when only the bulk properties such as U-factor and SHGC have been defined	WS returned to committee Jun'10	WS authors to revise WS in response to RAC comments, and resubmit to TC 4.7 for revote, TC4.5 c-sponsorship also needs to be revoted	Joe Huang (WS author), proposed PES Jeff Haberl (chair), Chip Barnaby, Tim McDowell, + TC4.5 rep to be determined	A
<b>WS under development</b>				
1456-RP Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations (Phase Two)	RTAR unnecessary for Phase Two	WS under development	Joe Huang , Simon Rees, Eric Kolderup, Malcolm Cook, Iain Macdonald	SCM
<b>co-sponsored WS led by other TC</b>				
WS-1413 Developing standard procedures for filing missing weather data (TC 4.2 lead)	Contractor selected June'11	Co-sponsorship approved by full committee Jun'08	Didier Thevenard (TC 4.2 chair)	DDM

**Appendix 3**  
**TECHNICAL PAPERS FROM SPONSORED RESEARCH**

RP	Title	Contractor	Approved	Paper
<b>Anything new ?</b>				
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.
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**  
**TC/TG/TRG SPONSORED TRANSACTIONS SESSIONS**

**Current as of July 2011**

**PRESENT:**

**PLANNED:**

**PAST:**

Louisville, June 20-24, 2009

Transaction “Improving Load Calculations for Fenestrations with Shading Devices”

Chicago, January 24-28, 2009

HVAC&R Research Seminar “Synthesis of Optimum HVAC System Configurations”

New York City/January 2008

How Low Can You Go?

Recent Advances in Energy Simulation (Chair: Dan Fisher)

How Low Can You Go? Low-Energy Buildings Through Integrated Design (Chair: Dru Crawley)

Application of Inverse Models (Chair: Jeff Haberl)

**Appendix 5**  
**TC/TG/TRG SPONSORED SEMINARS**  
**Current as of July 2011**

**PRESENT:****Montreal, June 25-29, 2011**

"Modeling Protocols for Building Energy Simulations for Code Compliance and Other Regulatory Programs"

Chair: Joe Huang

Speakers: Charles Eley, Jason Glazer, Aleka Pappas

"Building Simulation 103: Inverse Modeling Tools"

Chair : Chris Balbach

Speakers: Bill Koran, Bass Abushakra, John Shonder

"Operation-oriented Flexible Building Systems Modeling"

Chair: Wangda Zuo

Speakers: Michael Wetter, Zheng ONiel, Wangda Zuo

"Simulation Quality Assurance"

Chair : Carol Gardner

Speakers: Joel Neymark, Maria Karpman, Nick Long

**PLANNED:****Chicago, January 21-25, 2012**

"Integrated Multi-domain Simulations for Innovative Building Design and Operation"

Chair: Wangda Zuo:

Speakers: Jan Hensen, Michael Wetter, Yao-Jung Wen, John Zhai, Christoph Van Treeck

"Reasons or Causes for Uncertainty in Building Energy Simulations"

Chair: Joe Huang

Speakers: Iain Macdonald, NREL (?), LBNL (?), Jan Hansen

"Building Simulation 104 Analysis of uncertainty"

Chair TBD

Speakers: Phil Haves, Nick Long, Ron Judkoff

"STD 205 :Standard Representation of Performance data for HVAC"

Chair TBD

Speakers: Mike Brandamuel, Chip Barnaby, Mark Hydemann

"How to Assess the Performance of Sustainable Buildings"

Chair: Moncef Krarti

Speakers: B. Koran, Bass Abushakra, David Claridge

**PAST:****Las Vegas, Jan 29-Feb 2, 2011**

Building Energy Simulation 102 (Chair: Keith Cockerham)

Energy Modeling of Existing Buildings (Chair: Sue Reilly)

**Appendix 5 (continued)**  
**TC/TG/TRG SPONSORED SEMINARS**

Albuquerque, June 26-30, 2010

Building Energy Simulation 101 (Chair: Tim McDowell)  
Simulation of HVAC/R equipment and systems using the limited data published by manufacturer  
(Chair: Michael Wetter)

Orlando, January 23-27, 2010

Web-based Programs for Calculating Energy Code-Compliance (Chair: Larry Degelman)  
How to Assess the Performance of Sustainable Buildings (Chair: Moncef Krarti)

Louisville, June 20-24, 2009

Energy modeling of large buildings systems

Salt Lake City June 21-25, 2008

Use of Equation Solvers for Simulation (Chair: Michael Wetter)

New York City/January 2008

How to model nothing – Energy Modeling for Zero Net Energy Buildings: Parts 1 & 2 (Chair: Jan Kosny)

Long Beach/June 2007

Simulation Support for the 2007 Solar Decathlon (Chair: Kamel Haddad)

Dallas/January 2007

Use of Equation Solvers for Simulation (Chairs: Jean Lebrun/Mike Wetter)  
Applications of Computer Simulation in High Performance Buildings (Chair: Martha Brook)

Québec City/June 2006

None

Chicago/January 2006

How and Why to Calibrate a Simulation to Measured Data (Chair: Robert Sonderegger)  
Application and Experiences with the New Simulation Software (Chair: Dan Fisher)

Denver/June 2005

Neglected Topics in Building Simulation (Chair: Ian Beausoleil-Morrison).

Orlando/January 2005

What to do When Data Misbehave (Chair: Agami Reddy)

**Appendix 6**  
**TC/TG/TRG SPONSORED FORUMS**

**Current as of July 2011**

**PRESENT:**

**June 26-30, 2011 – Montreal, PQ**

None

**PLANNED (w/priorities):**

None

**PAST:**

Chicago, January 24-28, 2009

“Limitation of Energy Simulations for NZEB” (Chair: Tim McDowell)

Chicago/January 2006

“What Controls Modeling Capabilities are Needed for Energy Simulations?” (Chair: Philip Haves)

**ASHRAE TC 4.7 Energy Calculations**

Tuesday, June 28, 2010, 6:00-8:30 p.m.

Montreal

**Minutes of TC 4.7 Full meeting**

Meeting called to order 6:11 by Chair Jeff Haberl

Roll call by Tim McDowell

Introductions

Review of agenda and minutes (Haberl)

MOTION: Joel Neymark moved, Chris Balbach seconded, to accept agenda (8/0/0 CNV)

MOTION: Neymark moved, Balbach seconded, to accept minutes (8/0/0 CNV)

**Announcements** (all by Haberl ,unless indicated otherwise):

- There are various upcoming conferences, e.g., Heat Pump, IBPSA Sydney, etc.. that relate to building energy simulations. ASHRAE is getting better in pointing out upcoming events and conferences.
- At the TC Chair Breakfast, it was announced that (1) ASHRAE members can now propose programs outside of the TCs, (2) new MTGs (“Multidisciplinary Task Groups”) are being formed to span across the TCs with the intent to better coordinate between them; there are already two in existence, one on BIM and another on Building Performance Metrics, and two more, one on Energy Targets and another (unclear name), in July.
- Craig Wray says he wants to propose an Air & Water Systems Interactions MTG.
- CEC is proposing changes to improve the program at ASHRAE, and will take seriously speaker’s ratings. If a speaker’s rating is low, he/she may be not allowed to be a future speaker.
- Ian Macdonald heard a CEC member say that a speaker with ratings below 2.5 for three times will be barred, i.e., one has to be very bad to be eliminated.
- Chris Balback said that they may require training before such a speaker is allowed to speak again.
- TCs are encouraged to submit list of reviewers for ASHRAE papers.
- TCs are also encouraged to use Google Groups for their web site, but Haberl goes on to say that he’s comfortable right now with keeping the current TC 4.7 web site, where is not on Google and being maintained by Kris Kenney.
- ASHRAE will be having another high performance building conference, to be held in San Diego.

**Liaisons**

- Haberl asked whether were any liaisons present at the meeting.
- Agami Reddy, who is the Section 4 Research Liaison, pointed out there were some discrepancies in the agenda pertaining to a ongoing project. Further discussion on this issue will be discussed under Research.

**Membership** (Haberl)

- The following will be rolling off as voting members after this meeting : Joel Neymark, Klaus Sommers, and Moncef Krarti.
- The following will be rolling on as voting members after this meeting: Michael Wetter, Dan Fisher, and Bass Abushakra
- Those interested in becoming a Corresponding Member can do so directly on the ASHRAE website, which is much better than telling the TC 4.7 officers.

**Minutes of TC 4.7 Full meeting** (continued)***Subcommittee reports****Applications:* (Huang)*Data-Driven Models* (Abushakra)

- Two RTARs were proposed: one on “Data-driven Building Models for Smart Meters“, and one on “In-situ Procedures For Actual Performance Of LEED-Certified Buildings“.
- Extended discussion on whether TC 4.7 should keep the DOE reference buildings alive.
- Dru Crawley said that the Energy Targets Implementation Planning Committee (ETI) has recently approved a WS to maintain the reference buildings and expand them to high-performance reference buildings for ASHRAE. They have already found 50K co-funding and hopes to find the entire funding (100K?) .

*Simulations and Component Models* (Macdonald)

- Now that Phase One of 1456-RP (“Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations”) has been completed, how should the TC proceed with Phase Two?
- Huang, who is chairing a Task Group on this topic, said that he’s been told by Michael Vaughn the TC can skip the RTAR step and go directly to a WS.
- Reddy (Section 4 Research Liaison) said that with the turnovers in RAC, it would be safer to still do a RTAR. Huang said that the Task Group will accept this recommendation, and aim to follow up with a technical discussion during the IBPSA Sydney conference in November.

*Research* (Abushakra)

- At the Research Subcommittee Chairs’ breakfast, the following reasons were given why RTARs and WSs get returned to the TCc
  - For RTARs: (1) idea not appropriate for ASHRAE funding, (2) not clear how project will advance the state of the art, (3) budget does not seem to line with the proposed task, (4) scope not clear
  - For WSs: (1) scope of the project not clear, (2) budget does not line up with proposed tasks, (3) not enough detail on the administrative aspects (4) too incomplete to receive appropriate bids
- Reddy said that any negative vote within the TC would be a stumbling block, so make sure the votes are unanimous.
- When RTARs and WSs are returned, the comments should be responded to point-by-point, i.e., don’t smear the responses together.
- It is very helpful to show the RTARs or WSs to the Research Liaison before they are submitted to RAC,

*Status of ongoing projects*

- **1404-RP** (Robert Sonderegger) The PMS met during this meeting. Contractor is doing very good work, not the “same old, same old”. The work showed that if modeling and data are used in conjunction, one month is sufficient to obtain a good projection of annual energy use. Project should be done by now, All the work is there, but fair amount of clean-up needed.

MOTION: “Four-month No Cost Extension (NCX) to February 28 for RP-1404 , move by Macdonald and seconded by McDowell. Motion carries 9-0-1 CNV.

- **1416-RP** (Dan Fisher) – There is one remaining task to be done; the draft final report is due in a month. Request is for a NCX through February 28.

**Minutes of TC 4.7 Full meeting** (continued)

- **1413-RP** (co-sponsored with TC 4.2) – Steve Cornick, former Chair of lead TC 4.2, reported that TC 4.2 has recommended a bidder at this meeting.
- **1468-RP** Haberl called attention to this TC 1.5 project with which TC 4.7 is not involved, but whose contractor and PMS Chair are both present at this meeting.

Chip Barnaby, who's on the PMS, reported that 1468-RP ("Development of Reference Building Performance Model (BIM) for Thermal Model Compliance Testing") is about generating a thermal model from BIM

*Active RTARs and WSs*

- **1588-WS** (Huang). This WS was returned a second time from RAC with relatively minor comments and requests for clarification. The revised WS will need to be voted by the TC as well as for co-sponsorship by TC 4.5, first, so it need to be done by the end of July to make the next RAC meeting on August 15<sup>th</sup>.

ACTION ITEM: Huang to revise RP-1588 by end of July to respond to RAC comments and submit it for vote by TC 4.7 for approval and TC 4.5 for co-sponsorship.

- There are no other outstanding RTARs or WSs.

**Handbook** (Barnaby)

- The current Working Group consists of Barnaby, Kolderup, McDowell, Neymark, and Judkoff.
- TC 4.7 members should look over the chapter and give thoughtful comments back to the WG.
- The WG will send out a survey plus the Handbook chapter in MS-Word in the next couple of weeks.. These should be return in mid-August at the latest so that the responses can be collated.
- The aim is to have a draft ready for Chicago, and finished by June 2012.
- Reddy suggests that the chapter text mentions TC4.7-sponsored research

**Announcement by TC 4.0 Section Head** (Michael Bilderbeck)

- Opportunity for registration fees to go down, since ASHRAE has decided that more of the conference costs will be assumed by ASHRAE operating fees, rather than registration fees.
- The proposal that speakers pay 25% of registration fee might happen.
- CEC is interested in improving the program and looking at speaker ratings. CEC hopes that giving a notice to the TC of low speaker ratings would be sufficient, and that forcing speakers to go to training classes would not be necessary.
- Haberl expressed concern about non-TC people being able to propose program items, which might cut into the TCs' access to the program. Haberl was also concerned about making ASHRAE program welcoming to students.
- Craig Wray expressed concern that ASHRAE is a technical society, not Toastmaster, and that people should not be blacklisted for being bad speakers.

**Program** (Balback)

- There were four program items, all seminars, in Montreal (for details, see Appendix 5)
  - "Modeling Protocols for Building Energy Simulations for Code Compliance and Other Regulatory Programs"
  - "Building Simulation 103: Inverse Modeling Tools"
  - "Operation-oriented Flexible Building Systems Modeling"



**Minutes of TC 4.7 Full meeting** (continued)

- “Simulation Quality Assurance”
- For Chicago, there are five proposed seminars (*Chris – is this right, or is it just the first three ? YJH*)
  - “Integrated multi-domain simulations for innovative bldg design and operations” (SCM) looks good, has speakers and chair.
  - SCM – “reasons and causes for uncertainty in bldg energy simulation program” (SCM) has chair and three proposed speakers
  - “Building Simulation 104 Analysis of uncertainty” (DDM) has speakers but no chair
  - “STD 205 :Standard Representation of Performance data for HVAC”
  - “How to Assess the Performance of Sustainable Buildings”
- MOTION: “Approve Program Plan for Chicago proposed by Program Subcommittee Chair”, moved by Balbach, seconded by Neymark. Motion passes 9-0-1 CNV.

**Standards** (Neymark)

- *SSPC140 SMOT* (Judkoff)
  - 8<sup>th</sup> most requested document of ASHRAE standards.
  - Completed public review of new version, made many changes to tighten up
  - mandatory language to meet requests of International Code Council (ICC), will be included for 140-2011 (continuous maintenance revision)
  - 140-2011 will add three addenda to 140-2007: A – modeling reporting formats, B - HERS BESTEST, C - ICC language updates and errata, and other editorial revisions collected since 2007. To see which programs passed see [www.eere.gov/buildings/qualified\\_software](http://www.eere.gov/buildings/qualified_software).
  - Now working to include modeling tests for slab coupling, multi-zone issues (not incl. airflows), air-side mechanical equipment from 865 by Gren Yuill,
  - Trials sent out to SSPC 140 and IEA colleagues – 5 respondents. Names of programs are not given to encourage participation. Ron suggested a test of calibration methods. They’ve developed a method that will be talked about tomorrow.
- *SPC205* (Barnaby).
  - They’ve got unitary and chiller SC working diligently on **data formats for those formats**. Much of the discussion at this meeting focused at access to data, security, and IP being lost.
  - Set up SSC to work on that (usage and control of data).
- *SGPC 20* (Barnaby)
  - now in maintenance mode. Chip is former chair, current chair is Rob Hitchcock.
- *New proposed standard on simulation-aided design* (Jason Glazer)
  - Simulations are often not used in the design of a building. This standard will give minimum requirements on what should be done if simulations are used in building energy design.
  - McDowell thought this sounds more like a guideline.
  - Glazer felt a standard is more enforceable and could be adopted by USGBC, etc., to give credit.

MOTION: “Recommend that ASHRAE form a Standards Project Committee with the following title, “Energy Simulation Aided Design for High Performance Building”, moved by Barnaby, seconded by Crawley, Motion passes 6-3-1 CNV

**Minutes of TC 4.7 Full meeting (continued)**

MOTION: “Recommend Jason Glazer as chairman for the preceding proposed standards project committee” moved by Crawley, seconded by McDowell. Motion passes 10-0-0 CNV

- JHaberl described the New Water Standard 191, “Water
- Look at the session and DVD.

**Related Activities**

- TC 4.1 (Curt Peterson)
- TC 4.2 (Cornick)
  - 1477 RP (“Development of over 2,500 Typical Year Weather Files for International Locations”) will be coming out very soon.
  - Crawley mentioned that SP-169 will have three new climate zones (0 for very hot, ?, ?)
- TC 4.3 (Macdonald)
- TC 4.5 (Kamel Haddad)
  - There is a new project on the spectral quality of tubular skylights.
- TC.6.5 (also Haddad)
- TC 7.5 (Moncef Krarti)
  - Robert Sonderegger proposed an RTAR on smart meters; Wetter proposed a RTAR on a Modelica baseline for demand response.
- TC 7.6 (all)
  - name has been changed to Building Energy Performance.
- IBPSA (Wetter)
  - 10 scholarships being offered for students to go to the IBPSA conference in Australia, and for adding chapter in BEMBook
  - bldg energy modeling workshop being offered across the USA every 2 months (Kolderup is a speaker)
  - SimBuild12 will be held in Madison WA August 2012.
  - eSim will be held in Halifax May 2012; the call for abstracts to be coming out.
  - IBPSA World has the IBPSA conference in Sydney Nov. 2011, with over 400 papers..

**No old business**

**No new business**

**Attachments**

- A. Agenda
- B. Simulations and Component Models Subcommittee Agenda and Minutes
- C. Data-Driven Models Subcommittee Agenda and Minutes
- D. Applications Agenda and Minutes
- E. Handbook Subcommittee Minutes
- F. Program Plan
- G. SSPC 140 Agenda and Minutes

**Attachment A**  
**Agenda**  
**ASHRAE TC 4.7 Energy Calculations**  
TC 4.7 Energy Calculations (75) (screen)  
Tuesday 6:00-8:30p (H) Westmount (L)

- |   |                 |
|---|-----------------|
| 1. Roll call and introductions  | Huang           |
| 2. Accept agenda & approve minutes of Orlando meeting   | Haberl          |
| 3. Announcements/Liaisons   | Haberl          |
| 4. Membership   | Haberl          |
| 5. Subcommittee reports   |                 |
| 5.1 Applications  | Huang           |
| 5.2 Data-Driven Modeling  | Abushakra       |
| 5.3 Simulation and Component Models   | MacDonald       |
| 5.4 Research  | Abushakra       |
| <ul style="list-style-type: none"> <li>• <u>Status:</u> 1404-RP Modeling, analysis, and reporting protocols for predicting annual energy performance from short-term building energy monitoring (Milwaukee School of Engineering)</li> <li>• <u>Status:</u> 1416-RP Development of Internal Surface Convection Correlations for Energy and Load Calculations (TC 4.1/4.7 Univ. of Texas at Austin)</li> <li>• <u>Status:</u> 1588-WS Procedure to create hypothetical layer-by-layer fenestration descriptions when only the bulk properties such as U-Factor and SHGC have been defined</li> <li>• <u>Status:</u> 1413-RP Developing standard procedures for filling missing weather data (TC 4.2 lead)</li> <li>• RTARs and Work statements for consideration</li> <li>• Requests for co-sponsorship</li> </ul> |                 |
| 5.2 Handbook  | Barnaby         |
| 5.3 Program   | Balbach         |
| 5.4 Standards   | Neymark/Barnaby |
| <ul style="list-style-type: none"> <li>• SSPC 140 SMOT for Eval Bldg Energy Analysis Computer Programs</li> <li>• IEA Annex 34/43 Test and Validation of Bldg Energy Sim Tools</li> <li>• SPC 205 – Std. Repr. of Perf. Data for HVAC&amp;R Eq. &amp; Other Fac'I Eq.</li> <li>• SGPC 20 Documenting HVAC&amp;R Work Process and Data Exchange Requirements</li> </ul>  |                 |
| 5.5 Web Site  | Kinney          |
| 6. Related activities reports   |                 |
| TC 2.8 Building Environmental Impacts and Sustainability  |                 |
| TC 4.1 Load Calculation Data and Procedures   | Pedersen        |
| TC 4.2 Climate Information  | Degelman        |
| TC 4.3 Infiltration & Ventilation Requirements  | MacDonald       |
| TC 4.5 Fenestration   | Barnaby         |
| TC 6.5 Radiant Heating and Cooling  | Sommer          |
| TC 7.5 Smart Building Systems (now includes TC 7.4)   | Wetter          |
| TC 7.6 Systems Energy Utilization   | Abushakra       |
| BuildingSMART (formerly IAI International Alliance for Interoperability)  | Haves           |
| IBPSA: USA, SimBuild 2008; Canada, eSim 2006; IBPSA, BS 2009  | Wetter, Hensen  |
| 7. Old Business   | Haberl          |
| 9. New business   | Haberl          |
| 10. Adjourn   | Haberl          |

**Attachment B****TC 4.07 Simulation and Component Models Subcommittee  
Monday, 27 June, 2011  
Monday 6:00-7:30pm, Fairmont, Joliet (C)****Agenda**

- 1) Introductions and Agenda Review (5 minutes)
- 2) Program (20 minutes)
  1. 2011 Summer (Montreal)  
*Simulation Quality Assurance*, (Chair: Carol Gardiner), Wednesday, 11:00-12:30
  2. 2012 Winter (Chicago)  
*tbd*
  3. 2012 Summer (San Antonio)  
*tbd*
- 3) Research (60 minutes)
  1. Active Research (5 minutes)  
*1416-RP Development of Internal Surface Convection Correlations for Energy and Load Calculations* (Contractor: UTexas; PMS Chair: Fisher)
  2. Work Statements (20 minutes)  
*WSxxxx Develop comprehensive performance rating procedure for unitary equipment*  
(co-sponsor request from TC 8.1; Chip Barnaby)  
*WSxxxx Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations (Phase Two)* (Huang)
  3. RTARS (20 minutes)  
*RTAR 1629 Testing and Modeling Energy Performance of Active Chilled Beam Systems*  
(co-sponsor request from TC 5.3; Iain Macdonald)  
*RTARxxxx Modelica for simulation* (Wetter)
  4. Research Plan/New ideasm (15 minutes)  
Validation Issues (model algorithms)
- 4) AOCB (5 minutes)

**Minutes**

- 1) Introductions and Agenda Review
  1. 31 attendees
  2. Mike Sherber from TC 5.5 added air-air heat exchange to agenda
- 2) Program
  1. Chris Balbach informed participants about items from this meeting and generated ideas for 2012 winter meeting (Chicago):
    - i. Integrated multi-domain simulation – 5 speakers already identified
    - ii. Simulation of controls

**Attachment B (continued)**  
**(TC 4.07 Simulation and Component Models Subcommittee)**

**Minutes (continued)**

## 3) Research

<b>Topic</b>	<b>Champion(s)/Liaison(s)</b>	<b>Status</b>
<i>Active research</i>		
RP 1416 – Development of Internal Surface Convection Correlations for Energy and Load Calculations	PMS Chair: Dan Fisher	Work essentially complete. Looking for no cost extension until after Chicago meeting.
<i>Draft RTARs</i>		
Development of Modelica Models for the Evaluation of Supervisory Control Strategies in the ASHRAE Handbook	Lead author: Michael Wetter	Wetter distributed draft RTAR and discussed with cte. Feedback also from TC 1.4 and 7.5 (potential co-sponsors) ACTION Wetter to revise RTAR for possible TC vote and submission for August 15 <sup>th</sup> deadline.
<i>RTARs to be developed</i>		
Natural Ventilation (follow up to RP 1456)	Joe Huang, Malcolm Cook, Iain Macdonald	No progress on WS. RL suggested that we submit RTAR. ACTION Huang to draft RTAR for discussion at a forum at the IBPSA conference in Sydney.
Air to air heat exchange	Iain Macdonald, Dan Fisher, Phil Haves, Som Shrestha and Tim Mcdowell	Request from TC 5.5 for co-development of RTAR. ACTION MacDonald to contact Mike Sherber and coordinate 4.7 input.
<i>Co-sponsor requests</i>		
Develop comprehensive performance rating procedure for unitary equipment	Chip Barnaby	Request from TC 8.1 Not discussed as Barnaby not present.
1629 Testing and Modeling Energy Performance of Active Chilled Beam Systems	Iain Macdonald	Request from TC 5.3 No update.
<i>Ideas for development</i>		
Validation issues	Phil Haves and Iain Macdonald	Discussed availability of existing datasets. ACTION prepare list of issues for discussion at next meeting.
Uncertainty	Phil Haves and Iain Macdonald	Discussed sensitivity analysis of existing models. ACTION prepare discussion points for next meeting

## 4) AOCB

None.

**Attachment C**  
**TC4.7 Data-Driven Modeling Subcommittee**  
**June 27, 2011, Monday 7:30–9:00 PM**  
**Fairmont, Jolliet (C)**  
**Montreal, Canada**  
**Chair: Bass Abushakra**

**Agenda**

1. Introductions (5 minutes)
2. Approval of the minutes from the Las Vegas meeting, January 2011 ((5 minutes)
3. Discussion of Program (10 minutes)
  - a. Annual Conference 2011 (Montreal)
    - Seminar 49: *Building Simulation 103: Inverse Modeling Tools*, Wednesday, 8:00 AM – 9:30 AM
  - b. Winter Meeting 2012 (Chicago, Jan 21-25)
  - c. Annual Meeting 2012 (San Antonio)
  - d. Beyond.
4. Discussion of WS and RTAR's (50 minutes)
  - e. Existing WS and RTAR's
  - f. Ideas for new RTAR's

*RTAR's need to be aligned with the ASHRAE Research Strategic plan for 2010-2015 (attached, below).*

    - Ideas previously discussed:
      1. AI for data-driven modeling
      2. In-situ procedures for energy savings from renewable projects
      3. In-situ procedures for actual energy savings in LEED-Certified projects (**Draft RTAR**)
      4. Electricity demand savings
      5. Water use in a facility
      6. Smart-grid data in DDM (**Draft RTAR**)
      7. Standardized M&V for savings from operational changes
    - New ideas.
5. Current RP's (5 minutes)
  - RP-1404 "*Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance*": PMSC Meeting: Sunday, 11:00am -1:00 pm, Fairmont, Terrebonne (3<sup>rd</sup> floor)
6. Discussion on: (15)
  - Better ways to digest past research
  - Disseminate research results
  - Coordinate research and results with allied TC and SC
  - Participate in newly-formed "Multi-disciplinary Task Groups (MTG's)
  - Maintain expertise within SC even when membership changes.
7. Old Business
8. New Business
9. Adjourn

**Attachment C (continued)**  
**(TC4.7 Data-Driven Modeling Subcommittee)**

**DDM SC Agenda (continued)**

**Some Background Information:**

Review of ASHRAE Strategic Plan for Research:

- Research themes include:
  - 1) Energy and Resources,
  - 2) Indoor Air Quality,
  - 3) Tools and Applications, and
  - 4) Equipment, Components and Materials
- Weighted criteria:
  - 1) Supports strategic plan 45%,
  - 2) co-funding support 10%,
  - 3) anticipated application 10%,
  - 5) RAC vote 20%, and
  - 6) Tech Council Preview Feedback 5%
- RAC will review RTARs at all meetings: 3/yr –need 45 days advance – May 15, Aug 15, Dec 15
- Limited time for RTARs in Implementation Plan (4 meeting shelf life); intended to minimize delays in initiating research projects

**ASHRAE Research Strategic Plan – 2010-2015**

**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** To reduce significantly the energy consumption for 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 C (continued)**  
**(TC4.7 Data-Driven Modeling Subcommittee)**

**Minutes***Attendance*

<i>Name</i>	<i>Affiliation</i>
Bass Abushakra	MSOE
Joe Huang	WBT
Moncef Krarti	U Colorado Boulder
Kamel Haddad	NRCan
Bill Koran	QuEST
Dan Tuhus-Dubrow	Atelier Ten
Chris Balbach	Performance Systems Development
Mangesh Basarkar	LBNL
David Ellis	HDR
Lisa Ng	NIST
Eric Sturm	Trace
Mitch Paulus	MSOE
Heejin Cho	PNNL
Robert Sonderegger	ITRON
Nick Gayeski	KGS
Agami Reddy	ASU
Greg Pavlak	U Colorado Boulder
Peter Armstrong	MIT
Juan Carlos Baltazar	Texas A&M
Tim McDowell	TESS
Jeff Haberl	Texas A&M
Erik Kolderup	Kolderup Consulting

- Meeting started at 7:35.
- Introductions were made.
- Minutes from Las Vegas were passed around and the subcommittee reviewed what was discussed at Las Vegas.
- Minutes approved.

*Program*

- Seminar, Wed, 8:00 to 9:30, hope you can attend.
- CB: we have until August 12<sup>th</sup> to submit. Submissions are easy. Abstracts, 6 learning objectives,
- JH: Again, as discussed Standard 140 has a possible program for BESTEST EX.
- Questions were then discussed about that this is.
- New building institute is also doing work to determine how to automatically test parameters for residences, presented at ACEEE.
- BA: How about a follow-up for Wed's seminar, using the inverse modeling theme.
- JH: There was also a good seminar today by the Univ. of Dayton that could lead to more program about inverse modeling.
- How about follow-ups from the modeling summit that RMI put on, probably more appropriate for applications.
- DJ: What about the work that 1404 has been doing, taking a look at uncertainty and what to do with this.



**Attachment C (continued)**  
**(TC4.7 Data-Driven Modeling Subcommittee)**

**DDM SC Minutes (continued)**

**Research**

- Two documents were circulated for discussion: In-situ procedures for measuring the actual performance of LEED-certified buildings.
- I've asked the original author to send in what they had. I'm looking for someone to take this.
- AR: what do you do to see what's causing this? Try to explain as much as you can. What you can't explain then goes into the "unknown" group.
- BA: We do recognize that the problems do exist. We can turn this RTAR into a survey. See what % of the buildings are not performing. One could really dig into what caused the error.
- AR: I would also recommend a methodology to help reconcile.
- ?? You're never going to get at what is causing this.
- ?? LEED has a credit for calibrated models. So, there could be an effort to take these calibrated models and determine what went wrong.
- JH: has anyone contacted LEED for co-support? This might be a first step. These should all be 90.1 simulations. Yet, 90.1 has no idea about what gets build.
- DJ: What I'd like to see is to take a large number of buildings, create a large number of change point models and see what shows up. Then the next step is to drill down and see what's wrong.
- JH: The main problem that I see is someone has already plotted the "cloud", but nobody has gone in to see what caused the cloud. On average they don't have a problem.
- How are you going to get the inputs that went into the models, that's the issue.
- AR: I think the intent is not the do the change-point modeling, but to see if a standard method, or general pattern could be used by LEED to calibrate this.
- RS: the previous project took advantage for 1,000s of buildings in a logical way. It would be very valuable to characterize what's missing, 3, 4 or 5p models. This would be useful.
- Would it make any sense to get USGBC on board. It is in their interest to give them feed back on what's been found.
- BA: to really put this together there are 3 points that need addressing: why does it exist, what are the differences, how can we fix it in a standard way. This would be a good research project.
- The USGBC could provide the data, there could be a privacy issue. I heard they have a bank of data they are sitting on.
- For M&V credit you have to do a calibrated model. If USGBC could agree to let ASHRAE look at these data, convince them it would be helpful to investigate this.
- ACTION: BA: We need volunteers to take this further to develop version #2. David Jump, Joe Huang, and David Ellis will take this forward.
- BA: next RTAR is on smart grid.
- RS: This RTAR focuses on 2 needs by utility industry who have embraced smart meters. They measure, collect and store two orders of magnitude that are usually kept on commercial and industrial buildings. There are two things that happen. They enable buildings to enable demand response. They can give carrots for reducing electricity use at a particular time of day. However, you have to prove that energy has been saved. This is the same thing as having a baseline. However, this is not practical for millions of meters. Therefore, baselines tend to be rule driven. For example, one day is used for a baseline, then one looks for

**Attachment C (continued)**  
**(TC4.7 Data-Driven Modeling Subcommittee)**

**DDM SC Minutes (continued)**

baselines of the same day for the same temperature bins, etc. However, if one of these three days has bad data, then there are rules that require very specific days...rule based.

- The advantage is that if two persons use this they come up with the same answer, but it is often the wrong answer. Hence, the data-driven subcommittee could add some science to this to help make this work. Can the training be fast, repeatable, and accurate. Think millions of meters at one time.
- Applications two is for smart meters that have a fair amount of missing data. Typically what happens is that the software issues another request, then another...yielding 99% of the data. However, there is a big need for estimation. What is the most likely amount that a particular building should have used. Lots of rule base algorithms. A few have some weather related use, but very crude. From a modeling point of view the two cases need the same math. The utilities tend to stay away from it, but can't keep this up for long.
- A specific requirement is that the PMSC would facilitate making the data available for bidders to work on. This would move this forward.
- JH: This would need to be specifically spelled-out, and include requirements for the bidder to show they can handle this.
- What kind of data?
- RS: This is electrical data, use and PF.
- PNNL has a multi-building project to do a smart grid project to implement optimization solutions to have optimal conditions for grid to save money. This may also be useful for this.
- JH: Would the deliverable be a demonstration toolkit using publically available toolkits.
- RS: yes, that would be preferred. However, this would need to made useful for hourly data.
- BA: Who would be the user for this model?
- RS: Typically, utilities contract with companies to do this. It is an incredible amount of work to get the data for 10,000 buildings and yet do simple models. Yet, these efforts lack credibility. This would help make this more credible.
- RS: this is a hands-off approach. It has to be totally automated, reliable and use. Problem is for TC 4.7 is that you'll never know what building you're modeling.
- JH: One question is would automatically generate a baseline for each building?
- RS: yes, and the baselines might change daily for each building.
- JH: Interesting, I had a meeting with someone from Australia and they were getting interval data for 1,000s of customers and were building such models. Would this be similar.
- RS: yes, it would. They do seem to have a more enlightened attitude toward this.
- BA: What is your estimate on finishing this.
- RS: Not much. I spent some time going through the ASHRAE strategic plan and wrote something. However, this would deal with anonymous buildings. TC 7.5 – smart buildings, or TC 7.6 – building performance.
- BA: Volunteers? David Jump, Jeff Haberl.
- BA: Goal would be to have version 2 for discussion for Chicago.
- BA: Any new ideas?
- JH: What about prototypical buildings?

**Attachment C (continued)**  
**(TC4.7 Data-Driven Modeling Subcommittee)**

**DDM SC Minutes (continued)**

- BA: Recently the DOE want to stop maintaining the benchmark buildings. They want to stop development. Previously, they had been developed using EnergyPlus.
- JH: Isn't this Applications?
- BA: Yes, but we use this for generating synthetic data for inverse models.
- DE: There is also the potential loss of CBECS.
- PNNL has been maintaining the benchmark buildings for 90.1 support for 2007 and 2010 codes. Those models are available on DOE web site. PNNL will keep doing the work for 2013 for 90.1. I heard that there is an issue since the reference models are based on CBECS models.
- JH: One of the last things that I did at LBNL was to develop these models. DOE wanted LBNL to take these prototypes in DOE-2 and convert to EnergyPlus. This then migrated to NREL. However, one thing that I was not comfortable with was the description. But DOE insisted on publishing these in EnergyPlus. However, these were never back-calibrated against CBECS. So, it appears that these have data in lots of sources, but they need back calibration against something. This would be great for ASHRAE to take these and maintain them.
- JH: The work that needs to be done is specific: update HVAC models, back-calibrate the models, then republish them. This is something that can be done in a research project.
- DE: I thought that there was an open meeting that tried to address this problem. Does anyone know what happened to this?
- JH: The back calibration needs to include building description and usage. Look at CBECS and say what is the system type. What's being done is not calibrated against utility bills.
- PNNL: The EUI #s were vetted with 90.1 members and they felt these were appropriate.
- BA: Can you envision how this can be an RTAR and then some sort of continuous maintenance. Maybe every three years.
- JH: Ideally, this would be building description spreadsheet, all the building inputs, EnergyPlus and DOE-2 inputs, TRNSYS.
- PNNL: One of the issues is that the models must change as EnergyPlus changes.
- JH: That's a problem for EP and not for other models.
- ACTION: BA: I'd like to ask that Huang and PNNL, can you work together to get an RTAR developed.
- AR: RAC is quite fussy about RTARs that don't have a research focus. You'll need to make this specific about it linkage to 90.1.
- AR: We need to wrap this up...
- Old business? New Business?
- Adjourned.

**Attachment D**  
**TC 4.7 Applications Subcommittee**  
**Tuesday, June 28, 2011**  
**3:30-5:00pm (H) Westmount (L)**

**Agenda**

- 1) Introductions and Agenda Review (5 minutes)
- 2) Program (15 minutes)
  - a. 2011 Summer (Montreal)  
**Seminar:** *Modeling Protocols for Building Energy Simulations for Code Compliance and Other Regulatory Programs* (chair Joe Huang) , presenters: Charles Eley, Jason Glazer, Aleka Pappas (Monday 6/27 8:00-10:00)
  - b. 2012 Winter (Chicago)
  - c. 2012 Summer (San Antonio)
  - d. Beyond
- 3) Research (65 minutes)
  - a. Existing Work Statements (5 minutes)
    - 1588-WS Representative Layer-by-Layer Descriptions for Fenestration Systems with Specified Bulk Properties such as U-Factor and SHGC (co-sponsored by TC 4.5) (Joe Huang)
  - b. Ideas for new RTARS or other research activities (15 minutes each)
    - What should TC 4.7 do in support or collaboration on modeling protocols for regulatory programs, e.g., COMNET, LEED ratings, and ASHRAE-90.1? (Joel Neymark, Sue Reilley, others)
    - Rocky Mountain Institute has recently put together a white paper on "Methods and Procedures" as an outgrowth of the Building Energy Modeling Summit in Boulder in March (Roger Hedrick)
    - Proposed standard on " Energy Simulation Aided Design for High Performance Buildings" (Jason Glazer)
    - Should TC 4.7 maintain a set of prototypical building models and input files, possibly building on DOE's "Reference Building Models" (Bass Abushakra, Joe Huang)
- 4) Any other ideas and burning issues (time permitting) (5 minutes)

**Attachment D (continued)**  
**(TC 4.7 Applications Subcommittee)**

**Minutes**

*Attendance List*

<b>Name</b>	<b>Affiliation</b>
Bass Abushakra	Milwaukee School of Eng.
Bernt Askildsen	Lloyds Systems
Chris Balbach	Performance Systems Development
Juan-Carlos Baltazar	TAMU
Mangesh Basarkar	LBNL
Larry Degelman	TAMU
Charles Eley	A/E
Keith Emerson	Tri-State GT
Jason Glazer	GARD Analytics
Jeff Haberl	TAMU
Roger Hedrick	AEC
Joe Huang	White Box Technologies
Erik Kolderup	Kolderup Consulting
Bill Koran	Quest
Amanda Lowenberger	ACEEE
Tim McDowell	TESS
Joel Neymark	J. Neymark & Assoc
Lisa Ng	NIST
Aleka Pappas	Group 14 Eng.
Mitch Paulus	Milwaukee School of Eng.

- Joe Huang (JH) started the meeting at 3:32 PM.
- Introductions were made.
- JH then asked the subcommittee to review the agenda and asked for any new agenda items.
- JH instructed the subcommittee that Charles Eley (CE) needed to leave soon, so he wanted to jump ahead to the discussion of COMNet to accommodate Charles.
- JH informed the subcommittee that there had been many previous discussions on codes and regulations, including a seminar yesterday. JH then yield the floor to CE.
- CE said that he was double-booked with 189 so he had to leave early. He mentioned the meeting that RMI had arranged. He said that there was a camtasia file that could be viewed on the comnet.org site regarding the RMI meeting to discuss COMNet.
- CE said COMNet was looking to organize itself with other NGOs to help promote how to define a baseline building for specific purposes, such as LEED, etc.
- CE mentioned that 90.1, ECB defines the baseline building that COMNet uses.
- CE also mentioned that Std 140 also has overlap with what COMNet is trying to do.
- CE would like COMNet to become 140's document and Std 140 is tied to TC 4.7. He therefore seeks the input from the experts on TC 4.7.
- CE said the minutes of the past TC 4.7 meetings showed that there had been a request to review COMNet. CE said that there would be a series of conf calls in the coming weeks to review COMNet. So he felt the vetting effort was underway.

**Attachment D (continued)**  
**(TC 4.7 Applications Subcommittee)**

**Minutes (continued)**

- JH mentioned that the working group that had been proposed by TC 4.7 had actually not done much. In fact, the review meeting was actually carried by IBPSA USA.
- Chip Barnaby (CB) suggested that TC 4.7 just needs to make sure they have person(s) on the conf calls to keep the committee informed.
- CB said that folks just need to email Ellen Franconi to get added to the conf call.
- CB asked where's this going to land in terms of long term affiliation.
- CE said that this may be like RESNet but not exactly the same, since this involves more ASHRAE members.
- CE said that BECAP was one example of a partnership that COMNet seeks to be like. Another is for COMNet to file and become a 501c.
- CE said that another challenge that COMnet has is to develop its own revenue sources to stand on its own feet. So, COMNet is looking for membership categories to help accomplish this.
- CE said that COMNet needs a home for the future.
- JH asked CE what he wanted from TC 4.7.
- CE asked that TC 4.7 join the vetting process.
- Ron Judkoff (RJ) asked CE what he envisioned COMNet becoming.
- CE said he would like USGBC and ICC to reference COMNet. IECC can only reference ANSI standards. What COMNet is a reference standard. It seeks to test if a software can automatically generate schedules, etc. Part of COMNet is like the User's manual for 90.1. There are a few things that go beyond what the ratings are looking for. Fan Curves, defaults, techniques for generating plug loads, etc. One of the ideas is to pull those things out and make them an ASHRAE standard. We've talked to Jason and asked if the Appx G and COMNet were consistent.
- CE felt COMNet goes into areas that Apx G does not.
- JH expressed concerns about the curves and defaults in COMNet. He was wondering where these had come from.
- CE said these were only defaults and did not have to be used.
- JH said that unfortunately, they do get used for testing purposes and in some cases get burned into code.
- RJ expressed concern that COMNet is not following the same rigor as ANSI standards.
- Are there research items that ASHRAE could to do help explain some of these differences?
- Jason Glazer (JG) said that it would be valuable to get these things identified.
- Tim McDowell (TM) said that this might not get RAC's attention because it might not be viewed as research.
- JH said that he was concerned that it might take 1 or 2 person years to test COMNet.
- CB said that we have a plan (i.e., the conf.calls), we need to proceed with that, and then decide where to go.
- Discussion then moved to the next item on the agenda.

**Program**

- JH said there was very good attendance at the session. Especially when there was one particular question raised. Other than that the room was very full.
- JH turned the program discussion over to Chris Balbach (CBa).

**Attachment D (continued)**  
**(TC 4.7 Applications Subcommittee)**

**Minutes (continued)**

- CBa said that Chicago had a specific track on modeling, systems buildings and communities and read to the subcommittee that the track pretty well hit TC 4.7 Applications.
- TM explained his idea to have program to address the uncertainties in simulation, including calibration, aimed at informing membership about simulation and uncertainty.
- JH asked if this needed to DDM or Applications.
- CBa said this was previously discussed at DDM and had speakers.
- TM said he would chair if nobody else wanted to.
- CBa said the second idea that came up was Standard 205.
- Chip Barnaby (CB) said that they hope would be to have a standard using chiller representation and perhaps unitary representation. The program would then be a PR event for the standard, and this was the cognizant TC. Basically data formatting for simulation. Mark Hydeman volunteered to be chair, or speak.
- RJ expressed concern that uncertainty was not well understood by average ASHRAE engineers and that this might be an issue. For example, how to use Monte Carlo method.
- CBa asked for others ideas. One was to get ahold of Ellen at RMI to get a program item as a follow-up to the RMI Modeling Summit.
- CBa reminded the committee that Seminar and Forum abstracts needed to be submitted by August 12<sup>th</sup>.
- CBa reminded the subcommittee that ASHRAE is looking for paper reviewers.

**Research**

- JH then moved to Research. He showed ASHRAE spreadsheet concerning research.
- He said that he had one WS (1588-WS, “Representative layer-by-layer window models”) that was submitted and returned. He edited the WS and resubmitted, and it came back with more comments.
- The WS needed work regarding the references, which can be addressed. The next comment was not as easy to address regarding the value to ASHRAE. Another one mentioned that TC 4.5 was not in the loop. JH said this was not true but needed addressing.
- JH explained the WS, saying that the purpose was to create a Window 5 file without manufacturer’s data.
- He expected that he could address the comments, after discussing with Agami (who is on RAC). He thought this could be done by August, for 4.7 and 4.5.
- CB heard a story that he knew of one that he heard of a response where the “letter” got separated from the rewritten WS, and was rejected by RAC because they had been separated. Therefore, he suggested wrapping both into on PDF.
- Discussion then moved to the new proposed standard by Jason Glazier (JG)
- JG said that one of the issues is that in LEED a model gets developed but often does not get used later in the design standard. Therefore, there is a need to have a standard to address this issue.
- JG said that title, purpose and scope was variable, it had already changed and would probably change again. He felt this would allow for a requirement for organizations to use to assure that simulation gets used all the way through the design process.
- JG then projected the title, purpose and scope “Energy simulation aided design for high performance buildings” The purpose was to establish a criteria for determining the appropriate types and quantity of energy conservation measures to be simulated during each stage of the design process. The scope applies to new buildings or major renovations of buildings utilizing energy simulation during the design process. This

**Attachment D (continued)**  
**(TC 4.7 Applications Subcommittee)**

**Minutes (continued)**

standard does not apply to single family houses, multi-family structures of three structures or less above grade, manufactured houses (mobile homes) and manufactured houses (modular).

- CB mentioned that he was not 100% sure that it needed a vote from TC 4.7.
- JG said that he was told that standard proposals with TC backing tend to move ahead further.
- CB said to get full committee vote there needed to be 2 motions: one to approve and one to recommend a chair.
- JG said that proposed standards tend to change between when it is proposed and when it finally gets to be a standard.
- JH asked the subcommittee if there was any discussion.
- Bass Abushakra (BA) said he had indigestion about using energy conservation vs using energy efficiency.
- Joel Neymark (JN) asked about baselining.
- JG said that it had previously been broad, then was narrowed to its current version.
- JG said this was not intended to replace Appendix G.
- JG said this was meant to be for designing. It would cover massing, orientation, etc.
- JH expressed concerned that he purpose and title did not exactly agree.
- Aleka Pappas (AP) agreed with JN that this needed to be more vague. Don't describe the criteria up front.
- JH then asked for a straw poll supporting the measure. Straw poll showed limited support.
- JH then moved the discussion to RMI building energy modeling summit.
- Since Ellen Franconi could not be here Roger Hedrick (RH) at AEC agreed to give the presentation.
- RH showed the slides from the RMI Summit. He then focused on the methods and processes group. What's wrong with the industry, what's right? What do we need to do to make it better.
- RH said that a subject that kept coming up was the breakdown in simulation and followup.
- Clients understand purpose of modeling, modeling guidelines exist, and efforts exist to define building energy modeling procedures.
- The methods and processes work plan was suggested and shown to the TC.
- Example of customer brochure:
  - Compare different ECRMs.
  - Code Compliance
  - Determine whole-building energy use for operating the building
- RH then showed a brochure that the Governor's Energy Office in Colorado had developed, included intro, overview, best uses, etc.
- RH then showed how different tasks mapped to the three tasks (above)
- RH then showed how things would be judgment based, standardized, or in the future automated.
- RH said that Ellen was developing this framework, she had funding to proceed, she would be developing flowcharting to better explain the tasks, identifying key modeling processes, branches and exceptions, visual representations, specs for method components, eventually developing a white paper, etc.
- RH then showed a slide that had showed how this would fit into the design, construction and operation phase.
- RH mentioned that the method would recommend standard outputs, etc.
- RH said that RMI was hoping that TC 4.7 was being consulted to review the work and provide input.
-



**Attachment D (continued)**  
**(TC 4.7 Applications Subcommittee)**

**Minutes (continued)**

- JH expressed concern that standardization might be a two edged sword. Although, standardization might not be the most accurate way to do things.
- Jeff Haberl (JH2) suggested that COMNet, RMI and Jason's work needed to communicate and merge into one effort.
- JH said that due to the limits of time he would need to skip over the discussion of the prototypical buildings that began in DDM.
- Meeting adjourned.

**Attachment E**  
**ASHRAE TC 4.7 Energy Calculations**  
**Handbook Subcommittee**  
**Tuesday, June 28, 2011, 5 – 6 PM**  
**Hilton Westmount, Montreal, PQ**

**Minutes***Attendance*

Who	Affiliation
Ron Judkoff	NREL
Tim McDowell	TESS
Jeff Haberl	TAMU
Joel Neymark	JNA
Larry Degelman	TAMU
Erik Kolderup	Kolderup Consulting
Chip Barnaby	Wrightsoft
Bernt Askildsen	Lloyd's Systems
Mitchell Paulus	MSOE

The approved, revised chapter manuscript must be delivered to ASHRAE by June 16, 2012 – this is before the SA meeting. This will require a draft at Chicago and e-mail final ballot.

General schedule –

- Identify specific changes, assign revision authors, June – September, 2011
- Section writing / intermediate deadlines as needed: September, 2011 – January, 2012
- Draft chapter: January, 2012 (Chicago)
- Revisions January – May, 2012
- TC approval (e-mail ballot) – approx June 1, 2012
- Submission to Handbook and ASHRAE – before June 16, 2012.

Review and discussion on Erik Kolderup draft description of the audience of the chapter. Based on his thoughts and also College of Fellows review, there probably should be more information regarding application of energy calculation techniques.

The group concentrated on brainstorming on how to organize the revision process. After various ideas were considered, Haberl suggested we send a section-by-section survey questioning the TC about quality and revision needs. Kolderup and Barnaby agreed to assemble and send the survey. Survey will list all existing sections plus a list of possible additional topics.

Results of the survey will be collated by late August. A working group of Barnaby, Kolderup, Neymark, and McDowell will hold a conference call in mid-September to plan revision work in order to produce a revised chapter by Chicago.

Anyone wanting a copy of the current chapter in Word format should contact Barnaby.

**Attachment E (continued)**  
**(Handbook Subcommittee)**

**Handbook Minutes** (continued)

*Action Items*

Who	What	When
Erik Kolderup, Chip Barnaby	Assemble and circulate section survey to full TC	July 15, 2011
Erik Kolderup, Chip Barnaby	Receive and summarize survey	August 15, 2011
Chip Barnaby	Doodle poll / organize working group conference call to plan revision work	Sept. 15, 2011
<i>Working group -- Chip Barnaby, Erik Kolderup, Joel Neymark, Tim McDowell, Nathan Kegel, Bernt Askildsen, others to be coerced later</i>	Perform revisions	Oct. 2011 – Jan. 2012

**Attachment F  
TC 4.7 Program Plan  
ASHRAE Meeting  
6/28/11**

**June 25 -29,2011, Montreal, Canada****Theme: Sustainability Knows No Borders!**

RECAP – Las Vegas – With respect to attendance, TC 4.7 sponsored 2 of 7 highest attended seminars.

Program: 07							Attendance: 255
Building Energy Simulation 102							
Speaker 1:	3%	3%	17%	49%	28%	220	3.96
Speaker 2:	-%	1%	9%	45%	45%	220	4.31
Speaker 3:	2%	8%	33%	42%	15%	181	3.59
Speaker 4:	-	7%	30%	25%	39%	57	3.95
Speaker 5:	-	-	17%	67%	17%	6	4.00

Program: 14							Attendance: 311
Energy Modeling of Existing Buildings							
Speaker 1:	1%	13%	36%	35%	15%	156	3.51
Speaker 2:	-	10%	33%	38%	19%	168	3.66
Speaker 3:	-	4%	15%	49%	32%	120	4.08
Speaker 4:	-	-	67%	33%	-	6	3.33
Speaker 5:	-	-	-	-	-	-	-

**TC 4.7 SPONSORED PROGRAMS PRESENTED AT FOR MONTREAL:**

SEMINAR #20 – (Sunday) “Operation Oriented Flexible Building Systems Modeling”

Chair: Wangda Zuo (Jim Braun); Speakers: Michael Wetter, Zheng ONiel, Wangda Zuo

SEMINAR #24 – (Monday) – “Modeling Protocols for Building Energy Simulations for Code Compliance and Other Regulatory Programs”

Chair – Joe Huang; Speakers: Charles Ely, Jason Glazer, Aleka Pappas

SEMINAR #49 – (Wednesday) “Building Simulation 103: Inverse Modeling Techniques”

Chair : Chris Balbach; Speakers: Bill Koran, Bass Abushakra, John Shonder

SEMINAR #62 – (Wednesday) “Simulation Quality Assurance”

Chair : Carol Gardner (Ron Judkoff); Speakers: Joel Neymark, Maria Karpman, Nick Long

**Next ASHRAE Meeting: January 21 - 25, 2012 / Chicago, IL****Theme: “High Performance Buildings, Integrated Design, Energy Modeling and Specialized Applications”****CHICAGO SUBMISSION WEBSITE ([www.ashrae.org/chicago](http://www.ashrae.org/chicago)) OPEN FOR SUBMISSION OF SEMINAR AND FORUM PROPOSALS**

- 1) Energy Efficiency – New Technologies and Applications
- 2) ***Energy Modeling Applications*** – TRACK CHAIR – Bill Dean  
“Building Developers and Urban Planners are using Energy Modeling and Building Information Modeling programs to make decisions about our future communities. This track seeks papers and programs that address the range of different modeling tools available, their use and specific applications including systems, buildings and communities. Sessions that address an integrated approach from modeling through the end designs including planners, owners, architects, engineers and operations personnel are encouraged.”
- 3) High Performance Buildings

**Attachment F (continued)**  
**(TC 4.7 Program Plan)**

- 4) HVAC&R Fundamentals and Applications
- 5) HVAC&R Systems and Equipment
- 6) Installation, Operation & Maintenance of HVAC Systems
- 7) Integrated Design
- 8) Professional Skills
- 9) Refrigeration
- 10) Specialized Applications – Healthcare, Laboratories, and Data Centers

08/12/2011: SEMINAR AND FORUM PROPOSALS DUE  
 09/02/2011: CONFERENCE PAPER ACCEPT / REJECT NOTIFICATIONS  
 09/07/2011: FINAL TECHNICAL PAPERS AND CONFERENCE PAPERS DUE  
 09/16/2011: NOTIFICATION OF SEMINAR / FORUM / TPS / CPS PAPER ACCEPT/REJECT DISTRIBUTED  
 12/09/2011: UPLOAD OF SEMINAR AND CONFERENCE PAPER TPS BEGINS  
 01/06/2012: ALL SEMINAR AND CONFERENCE PAPER .PPT UPLOADS COMPLETE

? VOLUNTEERS TO TECHNICAL PAPER REVIEWS?

**POTENTIAL SEMINAR SUBMISSIONS FOR CHICAGO**

1) TC4.7 Simulation and Component Models Seminar(s) : “Integrated Multi-domain Simulations for Innovative Building Design and Operation”

Chair: Wangda Zuo:

Jan Hensen: “Why and when we need integrated simulations for buildings?”

Michael Wetter: “Integrated multi-domain simulation of building systems with Modelica, the Building Controls Virtual Test Bed and the Functional Mockup Unit Standard”

Yao-Jung Wen (Philips): “Study of lighting and daylighting control with their impact on building energy performance”

John Zhai: “Integrated energy simulation with multi-zone airflow modeling for building natural ventilation”

Christoph Van Treeck: “Coupling heterogeneous computational codes in a distributed simulation environment featuring human-centered indoor thermal and air quality performance prediction”

2) TC4.7 (Simulation and Component Models) Seminar Chair: Joe Huang:

Topic Reasons or Causes for Uncertainty in Building Energy Simulation

Speakers: Ian, NREL, Jan Hansen

3) TC4.7 (Applications) Seminar Chair: **Chair Needed** (Tim McDowell)

Topic Building Simulation 104 Analysis of uncertainty....Uncertainty validation and calibration input uncertainty, output uncertainty of the result...

Speakers Phil Haves, Nick Long, Ron Judkoff

4) TC4.7 (Applications) Seminar on SPC 205, TC 4.7 STD 205 :Standard Representation of Performance data for HVAC” to coincide w/ release **Chair Needed** ....3 sections .. general structure, water cooled chiller data representation, single speed package units unitary equipment data representation. Mike Brandamuel, Chip Barnaby, Mark Hydemann,

5) Eric suggested contacting Ellen Franconi for specific ideas – RMI Modeling Summit (Modeling Processes, quality assurance)

**Attachment F (continued)**  
**(TC 4.7 Program Plan)**

6) TC4.7 (Simulation and Component Models) Seminar Chair: Phil Haves  
Topic: Representations of Control Strategies in Energy Simulation Programs  
Speakers TBD

7) TC4.7 (Data Driven Models) Seminar Chair: Bill Koran  
Topic UNCERTAINTY Technical  
Speakers TBD

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Code-Compliance Organized by: TC 4.7 (Applications) Chair: Larry Degelmann Status: Moved from Dallas. (Jeff Haberl, Eric Richmond, Paul Mathew).	Scheduled
Seminar “How to Assess the Performance of Sustainable Buildings” Organized by: TC 4.7 (Data Driven Models) Chair: Moncef Krarti Status: 4 speakers (B. Koran, Bass Abushakra, David Claridge)	Scheduled
Seminar “Computer Simulation of Supermarkets” Organized by: TC 10.7 (co-sponsored by 4.7) Chair: Van D. Baxter, ORNL Status: Since 7/09. Has 4 speakers	Not scheduled
Transaction “Use of ‘equation solvers’ for Simulation” Organized by: TC 4.7 (Data Driven Models) Co-Chair: Jean Lebrun/Michael Wetter Status: Have 1 paper (Lebrun), need one more paper.	
Forum “Should ASHRAE Develop a Standard for Simulation Aided Design of High Performance Buildings” Track: Sustainability/LEED Organized by: TC 4.7 (Applications) Chair: Jason Glazer Status: Since 6/08	
Conference Paper “Use of Building Energy Simulation in Energy Code and Policy Analysis” Organized by: TC 4.7 Chair: Russ Taylor Status: Since 1/09. 3 speakers (R. Taylor, R. Brahme, K. Otto)	
Seminar “Simulation Support for the Solar Decathlon” Track: Applications Organized by: TC 4.7 (Applications) Chair: Kamel Haddad Status: Since 6/07. Has speakers.	
Seminar “Shoot-out of Code Compliance Simulation for Residential Buildings” Organized by TC 4.7 (Applications) Chair: Jeff Haberl	

**Attachment F (continued)**  
**(TC 4.7 Program Plan)**

Seminar “Simulation of HVAC/R equipment and systems using the limited data published by manufacturer”

Track: Systems and Equipment

Organized by: TC 4.7 (Simulation and Component Models)

Chair: Michael Wetter

Status: Since 6/08. Joel Neymark, Vincent Lemort, Stephane Bertagnolio & Jean Lebrun, Craig Wray.

Seminar “You don't know what you've got 'till it's checked! The importance of QA in benchmarking energy analysis results”

Organized by: TC 4.7 (Simulation and Component Models)

Chair: Russ Taylor

Status: Since 1/08. Had two speakers (summer 09).

**June 2012 – San Antonio (Conference Themes go away) Theme: The Impact of HVAC&R on our Daily Lives**

NOTES:

9/12/2011 Deadline for uploading “conference and technical paper” abstracts.

Technical Paper – Academia / Published in Transactions, sold in bookstore, double blind review. 30 page limit.  
(Poster Session)

Conference Papers. 8 page limit. Single blind review. Reviewer knows who the author is...

Volunteers for Reviewers?

Submission for PDH

Seminar Track Chairs + CEC members

Quality of the Abstract

Whether it is a hot topic or not.

If person scores 3.5 or lower for 3 times – speaker would need to take training provided by ASHRAE before speaking

Chicago Papers - 160 submitted, 135 approved, dropout to 120.

~ 30% dropout rate for programs....

High Performance Buildings Conference - San Diego

**Attachment G**  
**SSPC 140**  
**(Standard MOT for the Evaluation of Building Energy Analysis Computer Programs)**  
**Monday, June 27, 2011**

**Montreal, Canada**

1. Introductions

2. Chair Announcements/Communications since last meeting [*Judkoff, 10 min.*]

- **ANSI/ASHRAE Standard 140-2007 listed with ASHRAE's 10 Most Popular Standards and Guidelines.** It is 8<sup>th</sup> on the list of 111 Standards and 18 Guidelines. See [http://www.techstreet.com/lists/ashrae\\_standards.tmpl](http://www.techstreet.com/lists/ashrae_standards.tmpl)
- **Standard 140-2007 Addendum C** incorporates *ICC Mandatory Language revision and other user and PC requested improvements and clarifications*. The changes are intended to be editorial (non-substantive), but the nature of the changes requires public review. Publication/Public Review completed May 2, 2011 with no comments.
- **Standard 140-2011** (to be published Aug/Sep) adds the following to current Std 140-2007:
  - 140-2007 Addendum A (updated modeler reports to match content and format of those used for posting Standard 140 results on the DOE Tools Directory web site)
  - 140-2007 Addendum B (HERS BESTEST)
  - 140-2007 Addendum C (ICC language changes)
  - Errata (from Dec 2008) related to Section 5.4 (Furnace tests), including update to informative DOE-2 input files, and editorial revisions to relevant normative and informative sections
  - 2<sup>nd</sup> errata to Section 5.4 (as discussed by SSPC 140 in Las Vegas).
- **Current IRS rules** (IRS notice 2008-40, published Apr 2008) relating to the deduction for energy efficient commercial buildings require software used for assessing tax credits be tested to Standard 140-2007. Currently **10** programs have satisfied the new requirements; since Jan 2011, one of those programs satisfied the requirements for updated versions. **Direct new submittals to [brent.griffith@nrel.gov](mailto:brent.griffith@nrel.gov)**

3. Membership [*Judkoff, 2 min.*]

- Fairey re-upped for 4-year term through June 2015.

4. Acceptance of Previous Minutes [*Judkoff, 5 min.*]

5. Adjustments to Agenda [*Judkoff, 5 min.*]

6. 140-2011 Continuous Maintenance Revision [*Neymark, 10 minutes*]

- 140-2007-C completed public review May 2 with no comments
- Details of changes in Jan 2011 meeting handout
- SSPC 140 officers will work with ASHRAE Staff on final publication (Jul-Sep 2011)
- ICC wording of their Std 140 referencing

7. 140-2011-A: Adaptation of NREL/IEA-34/43 Ground Coupling Tests [*Neymark, 2 minutes*]

- PC approved for Public Review April 2010; Public Review with no comments Fall 2010.
- Public reviewed version did not have ICC language improvements.
- SSPC 140 voted to hold publication in January, pending compliance with ICC language requirements
- See meeting handout for example proposed changes
- Work on updated addendum will proceed after publication of 140-2011.

8. 140-2011-B: Adaptation of NREL/IEA 34/43 Multi-Zone Tests [*Neymark, 2 min.*]

- Initially distributed to SSPC 140 during Feb 2010



**Attachment G (continued)**  
**(SSPC 140)**

(continued)

- Requires ICC language edits before re-distribution to PC for initial comments.
9. 140-2011-C: Adaptation of ASHRAE/RP-865 (air-side mechanical equipment): Modifications and Simulation Trials [*Neymark/Kennedy 30 min*]
10. Comments by P. Sahlin on Case CE410 (Economizer with non-integrated compressor – i.e., economizer only operates when it can satisfy the entire cooling load by itself). [*Neymark/Kennedy 15 min*]
11. Adaptation of BESTEST-EX residential physics test cases and calibrated energy savings test cases [*Judkoff/Neymark, 60 min*].
12. References to Standard 140 in Standard 90.1 [*Pegues, 10 min – hold until 4:15P for JP*]
- After publication of 140-2011, recommend to SSPC 90.1 to specifically cite the Class I test procedures (Section 5 of Std 140) for 90.1-2013. *Publication of 140-2011 expected Aug/Sep 2011, keep on agenda as continuing reminder.*
  - If GC and MZ addenda (coming after 140-2011 CM) are part of 5.2 (as 5.2.4 and 5.2.5), is that ok for future (2016?) referencing by 90.1 and others?
13. COMNET and ASHRAE Building Energy Quotient (EQ) Referencing of Standard 140 [*Haberl/Fairey 10 min*]
14. Ad-Hoc Data Format Subcommittee Report [*Pegues/Witte, 15 min.*]
- Data Format SubC did not meet in Montreal
  - Consider renaming subcommittee as “Results Maintenance SubC” with the following topics to address: how to update example results, development of example pass/fail criteria for test suites that do not have them, other.
15. Residential Incentives Programs [*Fairey 10 min.*]
- RESNET, Tax Credits/Supplemental Cases, IECC Section 404, Homestar Gold
16. Adaptation of RESNET test cases [*Judkoff/Neymark, 15 min*]
17. Additional Future Test Suites that could be adopted [*Judkoff, 5 min.*]
- Other IEA-34/43: Shading/Daylighting/Load Interaction by Switz. (empirical), Hydronic Equipment by Germany, Airflow by Japan (final report still in progress), Double-Skin Façade empirical by Denmark.
  - IEA ECBCS Annex 42: Comparative Testing and Empirical Validation of Annex 42 Models for Residential Cogeneration Devices
  - Other Existing Test Suites
  - New Research
18. Investigate possibility of ASHRAE funding research projects for Std 140 [*McDowell, 5min.*].
- Has anyone written RTARs?
19. New business
20. Adjourn

**Attachment G (continued)**  
**(SSPC 140)**

**SSPC 140 Meeting Summary –1/31/11 (submitted 2/1/11)**

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

**ANSI/ASHRAE Standard 140-2007 listed with ASHRAE's 10 Most Popular Standards and Guidelines.** It is 8<sup>th</sup> on the list of 111 Standards and 18 Guidelines. See [http://www.techstreet.com/lists/ashrae\\_standards.tmpl](http://www.techstreet.com/lists/ashrae_standards.tmpl)

- **Standard 140-2007 Addendum C** incorporates *ICC Mandatory Language revision and other user and PC requested improvements and clarifications*. The changes are intended to be editorial (non-substantive), but the nature of the changes requires public review. Publication/Public Review completed May 2, 2011 with no comments.
  - IgCC may drop the section referring to standard 140. ICC change is not final yet. Completing the mandatory language revisions allows them to bring back referencing of 140 if they choose to, and is generally important for future referencing elsewhere.
- **Standard 140-2011** (to be published Aug/Sep) adds the following to current Std 140-2007:
  - 140-2007 Addendum A (updated modeler reports to match content and format of those used for posting Standard 140 results on the DOE Tools Directory web site)
  - 140-2007 Addendum B (HERS BESTEST)
  - 140-2007 Addendum C (ICC language changes)
  - Errata (from Dec 2008) related to Section 5.4 (Furnace tests), including update to informative DOE-2 input files, and editorial revisions to relevant normative and informative sections
  - 2<sup>nd</sup> errata to Section 5.4 (as discussed by SSPC 140 in Las Vegas).
- **Current IRS rules** (IRS notice 2008-40, published Apr 2008) relating to the deduction for energy efficient commercial buildings require software used for assessing tax credits be tested to Standard 140-2007. Currently **10** programs have satisfied the new requirements; since Jan 2011, one of those programs satisfied the requirements for updated versions. **Direct new submittals to [brent.griffith@nrel.gov](mailto:brent.griffith@nrel.gov). List of programs available at [www1.eere.energy.gov/buildings/qualified\\_software.html](http://www1.eere.energy.gov/buildings/qualified_software.html)**

**Standard 140-2011, Proposed Addendum A** (BESTEST In-Depth Slab-On-Grade Ground-Coupling adaptation by NREL/JNA) was approved by SSPC 140 for publication/public review via letter ballot closed Apr 22, 2010, and completed Public Review with no comments during Fall 2010. Publication is on hold pending revisions to comply with ICC language requirements; those revisions will have to be public reviewed (as we did for 140-2007-C).

**Standard 140-2011, Proposed Addendum B** (BESTEST Multi-Zone Non-Airflow adaptation by NREL/JNA) initial draft was submitted to SSPC 140 for initial review Feb 27, 2010. It will be redistributed to the PC after revisions to comply with ICC language requirements. Content includes:

- Analytical verification conduction test
- Comparative tests of
  - The effect of shading on a window, where a shading device is affixed to the window of a neighboring zone
  - The effect of shading on a window by a neighboring zone of the building
  - Internal windows

**Standard 140-2011, Proposed Addendum C (ASHRAE RP-865 Airside-Mechanical Equipment tests adaptation):** NREL is proceeding with adaptation for Standard 140 of ASHRAE RP 865 (by Yuill and Haberl) – air-side mechanical equipment analytical verification test cases. RP 865 includes 78 test cases over 7 air-distribution systems with similarly varied loads, set points and economizer controls. The tested systems are: four pipe fan coil (FC), single-zone air conditioner (SZ), constant volume terminal reheat, VAV, single fan constant volume dual duct,

**Attachment G (continued)**  
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dual fan VAV dual duct, four pipe induction. The initial draft spec, distributed Mar 2011, includes a subset of 10 total test cases for FC and SZ systems. 5 sets of simulation results were received in May/June; results and next steps were discussed with the participants in Montreal. The spec will be revised, and additional cases considered as indicated by the discussions. Several rounds of simulation trials are expected, with incremental expansion of the test specification. Completion of the work is planned for 2013. After that the test suite will be submitted to SSPC 140 for publication/public review recommendation.

**SSPC 140 is developing a new erratum for the Furnace cases developed by NRCan.** This is to correct a minor discrepancy with developing equivalent base case furnace loads for programs that cannot directly input specified surface coefficients. The erratum is expected to be integrated with the 140-2011 continuous maintenance revision.

**References to Standard 140 in Standard 90.1.** Jim Pegues is working with Jason Glazer (90.1 ecb sub chair) to indicate that with respect to 140-2011 (forthcoming cm revision), future references by 90.1 must be specific to Section 5 (Class I) test procedures, which are more appropriate for testing detailed models used with 90.1 modeling. The newly added Section 7 (Class II) test procedures are more appropriate for testing simplified models commonly used for low-rise residential modeling. Standard 90.1 will not be able to reference 140-2011 until after 140-2011 is published. 90.1's referencing of 140-2011 can be via an addendum to 90.1-2010. The next CM revision of 90.1 that can reference 140-2011 is 90.1-2013.

**References to Standard 140.** Standard 140 is referenced by:

- Listed above: IRS, Standard 90.1
- Standard 189 (High Performance Green Building Design) Appendix D
- IECC
- The newly developing COMNet (BPI, Energy Foundation et al) User's Manual.
- Implicitly referenced for ASHRAE Building Energy Quotient IF that is based on the COMNet User's Manual;
- RESNET plans to reference Section 7 tests after they are published (in 140-2011).

**BESTEST-EX UPDATE**

This is a **new comparative test suite (published Aug 2010) for testing the ability of software used for modeling residential retrofits to predict energy savings.** Part of the test process also tests the ability to initially calibrate the model of the existing building (pre-retrofit). The **Phase-1 Test Procedure** includes a set of **building physics tests with calibrated energy savings test versions of the physics tests. The test spec and physics tests results are available; calibration test results will be published in 2011.** The test cases are **based on HERS BESTEST, but with improvements** including to equivalent constant surface coefficients (lower values based on recent advancements in the modeling state of the art) and Sherman-Grimsrud infiltration modeling. Test case **parametric variations** include the following retrofits: **air sealing, attic insulation (blown cellulose), wall insulation (blown cellulose), thermostat setback, low-e windows, exterior shading, cool roof, and all retrofits combined.** There are also a number of **targeted calibration scenarios** including targeted high and low space heating energy consumption base case scenarios, and fully random selection base case scenarios. Future test cases would be developed for BESTEST-EX to address furnace and space cooling system retrofits, duct leakage, and domestic hot water modeling. Additionally, other building physics test cases for BESTEST-EX could be cross-referenced from HERS BESTEST. **SSPC 140 does not seem interested in addressing calibration tests (outside current scope of 140). Incorporation of the B-EX physics test cases and reference results could still be considered.**

**Listing of test suites either included in Std 140 or listed in Annex B18 (of Std 140)** is included below. (Included per Jan 2010 request by TC 4.7 Chair; a more comprehensive listing requires a literature survey.)

**Attachment G (continued)**  
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*Analytical Verification Tests and Comparative Tests already in Standard 140 (or with addenda in progress)*

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

*Other Analytical Verification and Comparative Tests*

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

**Empirical Validation Tests**

- IEA-34/43: “Empirical Validations of Shading/Daylighting/Load Interactions in Building Energy Simulation Tools (EMPA, Switzerland)
- IEA-34/43 “Chilled Water and Hot Water Mechanical Equipment and Control Comparative and Empirical Validation Tests (empirical and comparative, TUD, Germany)
- IEA-34/43 “Double-Skin Façade Empirical Validation Tests” (Aalborg U., Denmark).
- IEA 22 “Daylighting/HVAC Interaction Tests for the Empirical Validation of Building Energy Analysis Tools (Iowa ERS, US)
- IEA 22 Economizer Control Tests for the Empirical Validation of Building Energy Analysis Tools (Iowa ERS, US and Spain)
- “ETNA BESTEST Empirical Validation Test Specification (NREL and Electricite de France)
- IEA ECBCS Annex 42: Comparative Testing and Empirical Validation of Annex 42 Models for Residential Cogeneration Devices (NRCan)
  - [http://cogen-sim.net/index.php?pg=&download=Annex\\_42\\_ST\\_B\\_Final\\_report\\_on\\_comparative\\_testing\\_and\\_empirical\\_validation.pdf](http://cogen-sim.net/index.php?pg=&download=Annex_42_ST_B_Final_report_on_comparative_testing_and_empirical_validation.pdf)
- New Research: There is a possibility of developing a test facility for empirical validation of software used to model retrofits of existing building (i.e., software that is currently the subject of the BESTEST-EX test suite). Such a test facility would be expensive relative to developing comparative and analytical verification tests, but such expense would be well justified if U.S. energy policy moves towards supporting energy efficiency retrofits of energy-inefficient houses that comprise a large portion of the current U.S. housing stock.

Full SSPC 140 meeting notes are available from the Chair on request.