

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: June 26, 2007

TC/TG/TRG TITLE: Energy Calculations

DATE OF MEETING: June 26, 2007 LOCATION: Long Beach

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS & ADDIT'L ATTENDANCE
Dan Fisher (CHM)	2006	Ian Beausoleil-Morrison	2006	Suzanne LeViseur (TAC)
Joe Huang (RES)	2004	Chip Barnaby (APP)	2005	Hugh Henderson (RAC)
Richard Liesen (WEB)	2005	Simon Rees (INTL)	2005	Craig Wray (TAC)
Patrick Carpenter	2003	Jonathan Wright (INTL)	2003	Doug Hittle (Handbook)
Larry Degelman	2006	Bill Bahnfleth	2003	
Peter Ellis	2006	Mingsheng Liu	2004	(see below for additional attendees)
Jan Kosny	2006	George Walton	2003	
Agami Reddy	2006			

DISTRIBUTION

ALL MEMBERS OF THE TC/TG/TRG

TAC CHAIR	Craig Wray
TAC SECTION HEAD	Suzanne LeViseur
SPECIAL PUBLICATIONS LIAISON	Mark Fly
STANDARDS LIAISON	Jerry White
HANDBOOK LIAISON	Douglas C Hittle
PROGRAM LIAISON	Carol Lomonaco
RAC RESEARCH LIAISON	Hakim Elmahdy
PROF DEV COMM LIAISON	Kenneth Fulk
TECH TRANSFER LIAISON	Stephen V Abernathy
STAFF LIAISON (RESEARCH)	Michael R Vaughn
STAFF LIAISON (TECH SERVICES)	Michael R Vaughn
STAFF LIAISON (STANDARDS)	Claire Ramspeck

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

LONG BEACH MEETING

ACTION ITEMS

(none)

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DATE OF MEETING: June 26, 2007 LOCATION: Long Beach

TC/TG/TRG MEETING SCHEDULE				
LOCATION – past 12 months		DATE	LOCATION - planned next 12 months	
Québec City		June 27, 2006	New York City	
Dallas		January 30, 2007	Salt Lake City	
TC/TG/TRG SUBCOMMITTEES				
Function			Chair	
Simulation and Component Models Applications Data-Driven Modeling			Tim McDowell Chip Barnaby Kris Subbarao	
RESEARCH PROJECTS – Current			Monitoring	Report Mode
Project Title	Contractor		Comm.Chm.	At Meeting
Appendix 1				
LONG RANGE RESEARCH PLAN				
Rank	Title	W/S Written	Approved	To R & T
	Appendix 2			
HANDBOOK RESPONSIBILITIES				
Year & Volume	Chapter Title	No.	Deadline	Handbook Subcom. Chair/Liaison
2005 Fundamentals	Energy Estimating Methods	31	June 2008	Crawley/Hittle
STANDARDS ACTIVITIES - List and Describe Subjects				
SPC 140 Standard Method of Test for Building Energy Software – Joel Neymark				
TECHNICAL PAPERS from Sponsored Research - Title, when presented (past 3 yrs. present & planned)				

Appendix 3
TC/TC/TRG Sponsored Symposia - Title, when presented (past 3 yrs. present & planned)
Appendix 4
TC/TG/TRG Sponsored Seminars - Title, when presented (past 3 yrs. present & planned)
Appendix 5
TC/TG/TRG Sponsored Forums - Title, when presented (past 3 yrs. present & planned)
Appendix 6
JOURNAL PUBLICATIONS - Title, when published (past 3 yrs. present & planned)
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
Long Beach June 2007	Dallas Jan 2007	Québec City June 2006	Chicago Jan 2006		
	X	X	X	Abushakra	Bass
X	X	X		Anderson	J.R.
				Armstrong	Peter
				Bahnfleth	Bill
			X	Balaras	Costas
	X	X	X	Barnaby	Chip
	X	X	X	Beausoleil- Morrison	Ian
	X	X		Bernier	Michel
				Black	Al
				Bojic	Milorad
				Bourassa	Norman
	X	X		Bou-Saada	Tarek.
	X	X	X	Brandemuehl	Mike
				Brown	Rob
X	X	X	X	Carpenter	J Patrick
				Chantrasrisalai	Chanvit
X			X	Claridge	David
X	X	X	X	Cornick	Steve
X	X	X	X	Crawley	Dru
X				Culp	Charles
X	X	X	X	Degelman	Larry
X	X	X		Ellis	Peter
X	X	X		Fisher	Dan
				Firrantello	Joseph
X	X	X		Gardner	Carol
				Gowri	Krishnan
X	X	X	X	Haberl	Jeff
				Haddad	Kamel
X	X	X		Haves	Philip
	X	X		Henderson	Hugh
				Hensen	Jan
X	X	X	X	Huang	Joe
	X	X	X	Judkoff	Ron
				Kootin-Sanwu	Victor
X	X	X	X	Kosny	Jan
X	X	X		Krarti	Moncef
			X	Kummert	Michaël

Present at Meeting				Last name	First name
Long Beach June 2007	Dallas Jan 2007	Québec City June 2006	Chicago Jan 2006		
			X	Laouadi	Aziz
	X	X		Lebrun	Jean
			X	Lemort	Vincent
				Levermore	Geoff
			X	Leviseur	Suzanne
X	X	X	X	Liesen	Richard
X	X	X		Lisenbee	Larry
			X	Ljungquist	Damian
X	X	X		MacDonald	Ian
X	X	X	X	McDowell	Tim
X	X	X	X	Neymark	Joel
				Nigusse	Bereket
X	X	X	X	Norford	Les
	X	X		O'NEILL	Zheng
				Pinel	Patrice
X	X	X	X	Pedersen	Curt
				Radosevic	Marija
X	X	X	X	Reddy	T. Agami
	X	X	X	Rees	Simon
			X	Roth	Stephen
				Shirey	Don
				Smith	Vernon
				Sonderegger	Robert
X	X	X	X	Spitler	Jeffrey
			X	Strachan	Paul
				Strand	Rick
X	X	X	X	Subbarao	Kris
				Walton	George
				Weaver	Kevin
X	X	X	X	Wetter	Michael
X	X	X	X	Wray	Craig
	X	X		Wright	Jonathan
	X	X		XIAO	Dongyi
X	X	X	X	Xiaobing	Liu
X				Taylor	Russell
X				Parekh	Anil
X				Mukhopadhyay	Jaya
X				Graves	
X				Gray	
X				Douglas	Jim
X				Hittle	Doug

Appendix 1**RESEARCH PROJECTS****TC 4.7 RESEARCH PROJECTS STATUS****Active projects**

#	Title	Joint TC	Cog SC/ Contractor	PMSC	Dates / status
1311-TRP	Improving Load Calculations for Fenestration with Shading Devices	4.1 (cognizant TC), 4.5	Sim/Comp, University of Waterloo	Robert Hopper (chair/4.1); Ross McCluney (4.1); Chris Wilkins (4.1); Dru Crawley (4.7)	Contractor selected 6-2004 Start: 02-2005

Appendix 2**RESEARCH PLAN**

**ASHRAE
Technical Committee 4.7 Energy Calculations
2006-2007 Research Plan
(June 30, 2007)**

Title	Society status	TC 4.7 Status	Authors or TC 4.7 Prime Contact	Sub committee*
Approved WS				
TRP-1456 Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations	Ready to Bid	PES formed	PES J Huang (chair), P Haves, J Hensen, R Banks, N Bourassa, S Szymurski	SCM
TRP-1416 Development of Internal Surface Convection Correlations for Energy and Load Calculations	Ready to Bid	PES formed	PES: I Beausoleil-Morrison (chair), S Bruning, J Kosny	SCM
Approved RTARs				
RTAR-1468 Development of reference Building Information Model (BIM) for thermal model compliance testing	TC 1.5 lead, RTAR approved Jun 07	RTAR to be circulated within SC for comments	C Barnaby	A
RTARs under development (Prioritized)				
1. Modeling, analysis, and reporting protocols for predicting annual energy performance from short-term building energy monitoring	None (previously approved RTAR expired)	1404-RTAR expired Aug 07. New RTAR under development	A Reddy, L Norford, and V Smith	DDM
2. Assessment of the potential for application of moisture absorption/desorption models in whole building energy simulations to evaluate possible energy savings caused by moisture buffering effects in building enclosure and furnishings	None	Highest priority in SC; draft RTAR under revision in SC, no progress since Quebec (June 06)	J Kosny	SCM
3. Development of Enhanced Window Simulation Capability for Standard 90.1 Prescriptive Simulation	None	RTAR under development, topic under discussion since Jan 07	JHaberl, JDeringer,	A
4. Performance metrics for HVAC secondary systems	None	RTAR under development	J Wright, J Haberl, and C Barnaby	SCM

* SCM = Simulations and Component Models
DDM = Data Driven Modeling (formerly Inverse Methods)
A = Applications

ASHRAE
Technical Committee 4.7 Energy Calculations
2006-2007 Research Plan (continued)
(June 30, 2007)

Title	Society status	TC 4.7 Status	Authors or TC 4.7 Prime Contact	Sub-committee*.
Research topics under discussion (unprioritized)				
Develop a radiant system module for the simulation and analysis of spaces and systems	None	Proposed by TC 6.5; under discussion in SC	?	SCM
Moisture storage in typical office buildings	None	Proposed by TC 5.5 ; under discussion in SC	?	SCM
Use of evolutionary computation for inverse problems	None	Under discussion in SC	R Nelson	DDM
Development of a procedure for baselining energy use at large central plants	None	Under discussion in SC	A Reddy	DDM
Toolkit of Energy Conservation Measures for ASHRAE Standard 90.1 Energy Cost Budget Method / Prototypical Buildings for use in ASHRAE Standard 90.1 Energy Cost Budget Method / Sensitivity Analysis of 90.1 ECMs	None	Under discussion in SC	J Glazer, L Norford	A
Development of integrated models for liquid desiccant dehumidification driven by heat recovery or renewable energy	None	Under discussion in SC	J Haberl	SCM
Thermal mass toolkit: optimization of the calculation of the thermal mass energy benefits for residential and commercial buildings	None	Under discussion in SC	J Kosny	SCM
Development of humidistat-driven air-conditioner model for residential applications	None	Under discussion in SC	J Haberl	SCM
Modeling of the ground heat exchanger in foundation systems	None	Under discussion in SC	J Kosny	SCM

* SCM = Simulations and Component Models
DDM = Data Driven Modeling (formerly Inverse Methods)
A = Applications

Appendix 3
TECHNICAL PAPERS FROM SPONSORED RESEARCH

RP	Title	Contractor	Approved	Paper
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	<i>Reddy, T.A., 2006. "Literature Review on Calibration of Building Energy Simulation Programs: Uses, Problems, Procedures, Uncertainty and Tools", ASHRAE Transactions, vol 112(1).</i>
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	<i>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.</i>
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	<i>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.</i>
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	<i>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.</i>

Appendix 4
TC/TG/TRG SPONSORED TRANSACTIONS SESSIONS

Current as of July 2007

PRESENT:

Long Beach/June 2007

How Low Can You Go? Low-Energy Buildings Through Integrated Design (Co-sponsored by TC 4.7)
(Chair: Dru Crawley)

PLANNED:

New York City/January 2008

How Low Can You Go? Low-Energy Buildings Through Integrated Design (Co-sponsored by TC 4.7)
(Chair: Dru Crawley)

How and Why to Calibrate a Simulation to Measured Data (Chair: Robert Sonderegger)

PAST:

Dallas/January 2007

How Low Can You Go? Low-Energy Buildings Through Integrated Design (Co-sponsored by TC 4.7)
(Chair: Dru Crawley)

Québec City/June 2006

Validation of Building Simulation Programs Through ASHRAE Standard 140 (Chair: Chip Barnaby)

How Low Can You Go? Low-Energy Buildings Through Integrated Design (Co-sponsored by TC 4.7)
(Chair: Dru Crawley)

Chicago/January 2006

Thermal Modeling of Phase Change Materials in Building Envelopes: Old Problem, New Developments
(Chair: Jan Kosny)

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)

Denver/June 2005

None.

Orlando/February 2005

None.

Appendix 5
TC/TG/TRG SPONSORED SEMINARS

Current as of July 2007

PRESENT:

Long Beach/June 2007

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

PLANNED:

New York City/January 2008

How to model nothing – Energy Modeling for ZNEB (Chair: Jan Kosny)

Simulation of HVAC/R Components based on published Manufacturer Data (Chair: Michael Wetter)

PAST:

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)

Nashville/June 2004

Co-sponsored with TC 7.5. Models for Automated Building/HVAC Fault Detection and Diagnostics (Chair: Michael Brandemuehl)

Anaheim / January 2004

Energy Use Calculations and Evaluations for Laboratories (co-sponsored with TC. 9.10, Chair Patrick Carpenter)

Appendix 6
TC/TG/TRG SPONSORED FORUMS

Current as of July 2007

PRESENT:

None.

PLANNED:

None.

PAST:

Chicago/January 2006

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

ASHRAE TC 4.7 Energy Calculations
Tuesday, June 26, 2007, 18h00 to 20h30
R/R Ballroom V
Long Beach, California

1. Roll call and introductions (Haves)

- The meeting convened at 18h05, with Fisher as chair and Haves as secretary.
- 8 voting members were present, including the Chair, out of 15 non-international members, constituting a quorum.
- Those present introduced themselves.

2. Accept agenda & approve minutes of Chicago meeting (Fisher) (Agenda: Attachment A)

- Motion to accept the minutes of the Dallas meeting (Degelman / Huang) **Approved by voice vote.**

3. Announcements/Liaisons (Fisher)

- Susan LeVisieur (TAC) announced new rules for uploading program presentations. Most need to be uploaded 10 days before the start of the meeting. Those preselected for New York State PDH continuing education credit are needed 1 month ahead.
- ASHRAE's Advanced Energy Design Guide (AEDG) for K-12 schools is nearly ready for publication.
- Other AEDG drafts are on the ASHRAE website for review.

4. Membership (Fisher)

- Bill Bahnfleth, Michael Brandemuehl, Patrick Carpenter, George Walton and Jonathon Wright will roll off after the Long Beach meeting and Moncef Krarti, Joe Neymark, Klaus Sommer and Michael Wetter will roll on.

5. Subcommittee reports

5.1 Applications: Tim McDowell reporting for Chip Barnaby (chair): **(Attachment B)**

- *ASHRAE Special Project: Carbon Emissions Calculation Tool* authored was discussed
- A proposal from Jason Glazer for a new Standard on *Simulation-Aided Design for Efficient Buildings* was discussed
- IBPSA-Germany is developing a wiki for building simulation
- Comments will be provided to TC1.5 on their approved RTAR *Development of Reference Building Information Model (BIM) for Thermal Model Compliance Testing.*

5.2 Data-Driven Modeling Kris Subbarao (chair) reporting: **(Attachment C)**

- *Work Statement Modeling, Analysis, and Reporting Protocols for Predicting Annual Energy Performance from Short-term Building Energy Monitoring* was discussed; specific use cases will be added
- RTAR *Automated Calibration of Detailed Building Energy Simulation Programs* was discussed, as were several prospective RTAR's on baselining.

5.3 Simulation & Component Models Tim McDowell (chair) reporting: **(Attachment D)**

- Work Statements on radiant systems from TC6.5 - support for idea, not for WS
- RTAR from TC5.5 on moisture storage in the building fabric – request for cosponsorship. More information requested, primarily on scope
- The TC7.7 RTAR on the assessment of moisture absorption/desorption models was put on hold pending completion of relevant IEA work.
- SCM will include brainstorming on modeling for ZEB on agenda for New York City meeting

5.4 Research, Joe Huang (chair) reporting **(Attachment E)**

- RAC has conducted a survey on why the number of Work Statements submitted is down. Reasons cited by respondents include conflict of interest rules, funding unpredictability, work required of authors. Ways to reduce barriers to bidding by WS authors will be considered by RAC.
- The Research Advisory Panel (RAP) has been reconstituted.
- ASHRAE research is being cosponsored by other organizations, e.g. ARTI, California Energy Commission, CIBSE

- Priority will be given to research that is aligned with ASHRAE's strategic plan
- RTAR's and Work Statements to be reviewed by RAC 3 times a year
- Work Statements can be conditionally approved by RAC if only minor changes are required
- Projects <\$100k can be approved by RAC alone, >\$100k projects also need the approval of Technology Council and projects >\$200 need approval by both Technology Council and the Board of Directors
- RTAR from TC5.5 on moisture storage in the building fabric – request for cosponsorship, assigned to SCM for review. Tim McDowell summarized the concerns identified in the SCM discussion – uncertainty re objectives, modeling vs simulation
MOTION: That TC4.7 reject the request for co-sponsorship from TC5.5 (Kosny/Liesen) **Motion failed due to lack of a quorum 5-0-2 CV.** Tim McDowell and Dan Fisher to draft a letter to TC 5.5 describing the concerns raised in the SCM discussion.
- Research plan: 1416-TRP and 1456-TRP will go out to bid, RTAR 1404 is still under development
- Project Evaluation Subcommittee for 1416-TRP: Kosny, Beausoleil-Morrison (chair), Bruning (TC4.1)

5.5 Handbook – no report

5.6 Program, Michael Wetter (chair) reporting (**Attachment G**)

- The Low-Energy Buildings Transactions session was attended by ~40 people and the Solar Decathlon Seminar by 20-30
- New York: two Transactions sessions are planned: "How Low Can You Go? Low-Energy Buildings Through Integrated Design," chaired by Dru Crawley, and "How and Why to Calibrate a Simulation to Measured Data," chaired by Robert Sonderegger. Three seminars are also planned.
- **MOTION:** That TC 4.7 accept the program plan for NYC (Degelman/Liesen). **Motion carried on a voice vote.**

5.7 Standards, Joel Neymark (chair) reporting (**Attachment H**)

- SPC 140 (Neymark reporting).
 - Furnace tests and dynamic unitary cooling tests have been added as Addenda to Standard 140 and publication is expected shortly.
 - Galleys have been produced for the 2007 continuous maintenance edition of Standard 140; publication is expected by November.
 - A new standard format for simulation results has been developed and will be posted on the DOE tools website. The new format will be proposed as an addendum to the Standard
 - The HERS BESTEST will be adapted for Standard 140 – ASHRAE has granted an IP-only exception
 - IEA Task 34 / Annex 43 is in its last year and the final report is due soon – topics to be addressed include ground heat flow and multizone envelope simulation.

5.8 Web Site, Liesen (chair) reporting (**no attachment**)

- The web site has been updated

6. Reports on related activities

6.1 GPC 20 XML Definitions for HVAC&R (No report)

6.2 TC 2.8 Sustainability (Crawley)

- TC2.8 is sponsoring Standard 189 (Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings), which is out for public review. The Standard will be used by USGBC's LEED rating system.
- TC2.8 is sponsoring Standard 191, which deals with water conservation. The work, which is just starting, is being performed in conjunction with APPA (formerly the Association of Physical Plant Administrators).

6.3 TC 4.1 Load Calculations (Spitler)

- TC 4.1 has a Work Statement on office equipment
- TC4.1 has RTAR's on UFAD and double facades.

6.4 TC 4.2 Climatic Information (Barnaby)

- TC4.2 received URP 1477 and has made a recommendation to RAC
- The climate change session at the Long Beach meeting was well attended.

6.5 TC 4.5 Fenestration ()

- TC4.5 is working on U values for doors
- An RTAR to update handbook tables U-values is being developed
- There is increasing collaboration between TC4.1 and TC4.5
- The need to develop a MOT for in-situ glazing comps has been identified.

6.6 TC 6.5 Radiant Heating and Cooling (no report)

6.7 TC 7.4 Building Operation Dynamics (Norford)

- 1313-RP *Evaluation of Building Thermal Mass Savings* is essentially finished. The next step is to reduce the results to guidelines
- An RTAR on modeling the effects of furnishings on building dynamics is under development

6.8 TC 7.5 Smart Building Systems ()

- TC7.5 is developing an RTAR to produce guidance on interfaces for building operators. A key objective is to have energy information on the main screen.

6.9 TC 7.6 Systems Energy Utilization (no report)

6.10 IAI International Alliance for Interoperability (no report)

6.11 Standard 90.1 (Liesen)

- There is pressure to produce the Advanced Energy Design Guides (30% savings). These guides can recommend measures that can't be required in 90.1.

6.12 IBPSA (USA, Canada, World, BS 2007)

- IBPSA-USA (Brandemuehl):
 - 50 people attended the Long Beach meeting.
 - Interaction with US GBC on training for simulation
 - Wiki-like database for simulation topics.
 - SimBuild 2008 will be held in Berkeley July 29 – August 1
- IBPSA-Canada (no report)
- IBPSA-World (Spitler):
 - Building Simulation 2009 will be held in Glasgow, Scotland

7. Old Business

- none.

8. New business

- The possibility of making TC4.7 meetings paperless was discussed

9. Adjourn

- Meeting adjourned at 19h40.

Attachments

- A. Agenda
- B. Applications Subcommittee Minutes
- C. Data Driven Modelling Subcommittee Minutes
- D. Simulation and Component Models Subcommittee Minutes
- E. Research Subcommittee Minutes
- F. Handbook Subcommittee Minutes
- G. Program
- H. SSPC 140 Minutes

Attachment A**Agenda****ASHRAE TC 4.7 Energy Calculations**

Tuesday, June 26, 2006, 6:00-8:30 p.m.

R/R Ballroom V

Long Beach, California

1. Roll call and introductions	Haves
2. Accept agenda & approve minutes of Dallas meeting	Fisher
3. Announcements/Liaisons	Fisher
4. Membership	Fisher
5. Subcommittee reports	
5.1 Applications	Barnaby
5.2 Data-Driven Modeling	Subbarao
5.3 Simulation & Component Models	McDowell
5.4 Research	Huang
1311-RP Improving Load Calculations for Fenestration with Shading Devices (TC 4.1/4.5/4.7; Univ. of Waterloo)	Crawley
RTARs and Work statements for consideration	Huang
5.5 Handbook	Crawley
5.6 Program	Haberl
5.7 Standards	Neymark
SSPC 140 SMOT for Eval Building Energy Analysis Computer Programs	Judkoff
IEA Annex 34/43 Test and Validation of Building Energy Simulation Tools	Judkoff
5.8 Web Site	Liesen
6. Related activities reports	
GPC 20 XML Definitions for HVAC&R	Barnaby
TC 2.8 Building Environmental Impacts and Sustainability	Crawley
TC 4.1 Load Calculation Data and Procedures	Fisher
TC 4.2 Climate Information	Barnaby
TC 4.5 Fenestration	---
TC 6.5 Radiant Heating and Cooling	Strand
TC 7.4 Building Operation Dynamics	Brandemuehl
TC 7.5 Smart Building Systems	Reddy
TC 7.6 Systems Energy Utilization	Abushakra
IAI International Alliance for Interoperability	---
IBPSA: USA, SimBuild 2006; Canada, eSim 2006; IBPSA, BS 2007	Brandemuehl, Beausoleil- Morrison, Hensen
7. Old Business	
8. New business	
9. Executive Session	
10. Adjourn	

Attachment B

ASHRAE TC 4.7 Energy Calculations

Applications Subcommittee

Tuesday, June 26, 3:30 – 5 PM

Long Beach, CA

Minutes

Present: Chip Barnaby, Michael Wetter, Joel Neymark, Tim McDowell, Kamel Haddad, Larry Degelman, Larry Lisenbee, Bill Koran, Jaya Mukhopadhyay, Klaus Sommer, Les Norford, Joe Huang, Dan Fisher

Meeting called to order at 3:40 PM. Introductions. Agenda approved.

Program

Simulation Support for the 2007 Solar Decathlon (chair: Kamel Haddad). Presented at this meeting; well received.

Ideas for New York or future meetings. New York submissions due Aug. 3.

- *Fenestration Data Needs for Energy and Loads Calculations* (with TC 4.1). Session not accepted for Long Beach. Believe TC 4.1 is still pursuing, but no additional action taken by TC 4.7
- *Web-Based Programs for Calculating Code Compliance*. Larry Degelman has 3 speakers in mind. Possible Salt Lake seminar.
- *Appliance Performance Compliance Tools to Mitigate Climate Change*. Carol Gardner knows of potential speakers. No known progress
- Kamel Haddad suggested session on comparison of empirical vs. component-base equipment models. Michael Wetter notes similar session proposed by SCM. Could merge. Mike Brandemuehl 1197-RP work is on topic, Kamel will talk to Mike.

Carbon Accounting Initiative. Barnaby introduced report *ASHRAE Special Project: Carbon Emissions Calculation Tool* authored by Hal Levin et al. Joe Huang and Dan Fisher have reviewed the report. Discussion re how TC 4.7 might contribute to this initiative. General consensus: “We are not the experts re carbon emission modeling.” Les Norford and Klaus Sommer agreed to review the report more thoroughly and provide an update in New York.

Standards idea: Simulation-Aided Design for Efficient Buildings. Jason Glazer transmitted a draft standards proposal to TC 4.7. Joel Neymark has talked to Jason about the proposal and provided additional info. General discussion. Why not a Guideline? Should be stated as a minimum list of measures. How does this compare to Design Guides? Les Norford and Joel Neymark will explore further with Jason and report at New York if we are interested in pursuing this standard.

Standard 90.1 ECB coordination. Std. 90 has independently developed a related RTAR. RTAR has been approved. Les Norford to follow up with Jason Glazer to determine status and possible TC 4.7 involvement

IBPSA Simupedia status. Michael Wetter reported on IBPSA-Germany effort. See <http://129.187.44.165/index.php/Simupedia/en>

Research. RTARs / Work Statements / Wish List

1. RTAR from TC 1.5: Development of Reference Building Information Model (BIM) for Thermal Model Compliance Testing. RTAR has been approved. Chip Barnaby to get RTAR from John Kennedy and transmit to Joel Neymark, Michael Wetter, Joe Huang, and Ian Beausoleil-Morrison. They will review and return comments to TC 1.5 for possible inclusion in the work statement.
2. Development of Enhanced Window Simulation Capability for Standard 90.1 Prescriptive Simulation (Jeff Haberl/Joe Derringer). No progress.
3. Toolkit of Energy Conservation Measures for ASHRAE Standard 90.1 Energy Cost Budget Method / Prototypical Buildings for use in ASHRAE Standard 90.1 Energy Cost Budget Method / Sensitivity Analysis of 90.1 ECMs. Boil down to single project to develop supporting methods for Std 90 ECB? No progress.
4. Algorithms for mapping manufacturers' data to simulation inputs. No progress.

Meeting adjourned, 5:05 PM.

Long Beach Action Items

Who	When	What
Degelman	New York	Line up speakers for possible Salt Lake City seminar <i>Web- Based Programs for Calculating Code Compliance</i>
Norford, Sommer	New York	Review Carbon Accounting report, recommend TC 4.7 action if any
Norford, Neymark	New York	Discuss with Jason Glazer proposed standard <i>Simulation-Aided Design for Efficient Buildings</i>; recommend TC 4.7 action.
Norford	New York	Coordinate with Jason Glazer re possible cooperation on Std. 90.1 ECB methods.
Barnaby	ASAP	Get TC 1.5 BIM RTAR, distribute to Joel Neymark, Michael Wetter, Joe Huang, and Ian Beausoleil-Morrison.
Neymark, Wetter, Huang, Beausoleil-Morrison	Aug? As needed for work statement development	Review BIM RTAR, send comments to TC 1.5.

Attachment C

TC4.7 Data-Driven Modeling Subcommittee

Monday, June 25, 2007

6:00 to 7:30 p.m.

Long Beach, TX

Chair: Kris Subbarao

Minutes

Meeting started at 6:00 pm. Chair called session to order followed by introductions and approval of Dallas meeting minutes. Attendance sheet was circulated.

Program:

New York City:

Transaction: "Use of Equation Solver for Building Simulation", Chair: Mike Wetter

Transaction: "How and Why to Calibrate a Simulation", Chair: Sonderegger; Subbarao to contact Sonderegger; 2 papers by Claridge and Liu from RP-1092; coordinate with TC9.6 which sponsored RP-1092

Salt Lake City:

Seminar: "Methods of Certification of Savings from Energy Efficiency Measures: White Tags for Carbon Credits", Chair: Kris Subbarao

Beyond:

"Enhanced Value of Calibrated Simulations in Energy Policy Making"

Drop previous suggestions:

"Whatever Happened to AI"

"Survival of the Least Square Fittest: Genetic algorithms"

Work Statement:

"Modeling, Analysis, and Reporting Protocols for Predicting Annual Energy Performance from Short-term Building Energy Monitoring" Vern Smith, Agami Reddy and Les Norford. A revised work statement generated a great deal of interest and discussion. Philip Haves suggested that some use cases be included in the work statement. Jeff Haberl suggested that perhaps the focus should be certification of built buildings for code compliance. These discussions helped clarify the scope of the work statement. The authors will revise the work statement for discussion and possibly vote by TC 4.7 in New York (Jan 2008)

RTARS:

"Automated Calibration of Detailed Building Energy Simulation Programs" Reddy to work with Sonderegger for a follow up to RP-1051

Several RTARS below have a common thread: baselining. Philip Haves suggested combining them suitably

Procedures for adjusting baseline models for M&V projects due to creep and other causes

Development of procedures for baselining electricity demand savings

Development of in-situ procedures for baselining energy savings from renewable projects

Standardized M&V for savings from operational changes:

SAT reset, static pressure reset, ..."

Kris Subbarao to prepare a draft RTAR for New York.

Drop previous suggestions:

"Use of Evolutionary Computation for Inverse Problems"

“Development of a procedure for baselining energy use at large central plants”

Ideas mentioned not discussed:

- Standardization (ActiveX DLL, ...) of software component of deliverables of ASHRAE projects sponsored by the subcommittee, so that users can imbed them directly in their software.
- better ways to digest past research
- how best to disseminate research results
- how best to coordinate research and results with allied TC and SC
- maintain expertise within SC even when membership changes

The meeting was adjourned at 7:30 pm.

Attachment D

TC4.7 Simulation and Component Models Subcommittee
Minutes: Monday, June 25, 2007, 7:30-9:00pm
R/R.Ballroom III (2nd Level)

Called to Order: 7:35 pm

Attendance:

Tim McDowell	TESS
Joel Neymark	J. Neymark & Assoc
Vern Smith	AEC
Joe Huang	White Box Technologies
Larry Degelman	TAMU
Les Norford	MIT
Philip Haves	LBNL
Richard Leisen	Owens Corning S&T
Russell Taylor	UTRC
Kamel Haddad	CETC
Moncef Krarti	University of Colorado
Iain MacDonald	NRC
Dan Fisher	Oklahoma State
Xiaubing Liu	Climatemaster
Bob Ramirez	Itron
Jan Kosny	ORNL
Michael Wetter	LBNL
Jeff Haberl	TAMU
Ron Judkoff	NREL
Carol Gardner	BSC Inc
Klaus Sommer	Cologne Univ of Applied Sciences

Program

New York (January 2008)

- **Seminar** on *Modeling of Double Envelope Facades and Active Windows* (Chaired by Mike Brandemuehl)
- **Seminar** *How to Model Nothing – Energy Modeling of ZNE Buildings* (Chaired by Han Kosny) Speakers (McDowell, Haves, Ellis or other NREL, MacCrachen, Huang)

Salt Lake City (June 2008)

- **Transactions** on *Evolution Design of HVAC Systems* for RP 1049 (Chaired by Les Norford)
- **Transactions** on *Modeling and Experimental Validation of Active Building Components* (Chaired by: Jan Kosny)
- **Seminar** on *Simulation of HVAC/R Components based on published Manufacturer Data* (Chaired by Mike Wetter)

WORK STATEMENTS

- *Develop a Radiant System Module for the Simulation and Analysis of Spaces and System* (TC 6.5 – request for co-sponsorship). The draft workstatement has not dealt with the previous comments. The background section is not up to date with current simulation programs. While the work needs to be done we cannot support the workstatement, however we are willing to work with TC 6.5 to develop a new RTAR.

RTARS

- *Moisture Storage in Typical Office Buildings* (TC 5.5 – request for co-sponsorship). Questions about whether the project is practical. Unclear on exactly what the scope of the project is. What is the end product of the project? The objective is simply not clear enough for us to act at this time. Will report to full TC on subcommittee recommendation.
- *Modeling of Radiant System Components* (Kosny, Haves)
- *Assessment of the Potential for Application of Moisture Absorption/Desorption Models in Whole Building Energy Simulations to Evaluate Possible Energy Savings Caused by Moisture Buffering Effects in Building Enclosures and Furnishing* (Jan Kosny, Andre Desjarlais, Rich Leisen).
- *Performance Metrics for HVAC Secondary Systems* (Jonathon Wright) A new idea for a RTAR for a metric of evaluating HVAC secondary systems. Jeff Haberl and Chip Barnaby raised concerns and will work with Jon on this RTAR.
- *Development of Integrated Models for Liquid Dessicant Dehumidification Driven by Heat Recovery or Renewable Energy* (Jeff Haberl).
- *Thermal Mass Toolkit: Optimization of the Calculation of the Thermal Mass Energy Benefits for Residential and Commercial Buildings* (Jan Kosny).
- *Modeling of Humidity Controlled Equipment* (Jeff Haberl).
- *Modeling of the ground heat exchanger in foundation systems* (Jan Kosny)
- *Combined Modeling of Daylighting and Energy Calculations* (Jeff Haberl)
- *Energy Calculations and Water Usage* (Jeff Haberl)
- *Natural Ventilation Controls* (Jeff Haberl)
- *Infiltration of Crawlspace and Attics* (Jeff Haberl)
- *Modeling of Multi-Split Variable Refrigerant Volume Systems* (Carol Gardner, Russ Taylor)
- *Variable R-value Insulation* (Jeff Haberl)

At the next meeting, brainstorm research topics that specifically address the problems that arise in modeling ZNE and carbon assessments.

Adjourned at 9:35 pm

Attachment E

ASHRAE
Technical Committee 4.7 Energy Calculations
2006-2007 Research Plan
(January 29, 2007)

Title	TC Priority 2005- 2006	Prior TC priority	Society status	TC Status	Authors or Prime Contact	Sub com.
Prioritized						
1416-RTAR Developing internal surface convection correlations for energy and load calculations	1	1 (2005-2006)	RTAR accepted 05, WS due before Aug 07	WS approved by subcommittee, and referred to full committee	D Fisher, I Beausoleil-Morrison	SCM
1404-RTAR Development of protocol for accurate prediction of building annual energy use based on minimum short-term monitoring	2	2 (2005-2006)	RTAR accepted 05, WS due before Aug 07	WS draft developed, modifications needed, will be represented at Long Beach	A Reddy, Y J Huang	DDM
1456-RTAR Models for Natural and Hybrid Ventilation	3	0 (2005-2006)	RTAR accepted Jun 06, WS due before Jun 08	WS draft reviewed in subcommittee, modifications needed, may be referred to full committee for letter ballot	Y J Huang, S Rees, G Walton	SCM
Unprioritized						
Assessment of the potential for application of moisture absorption/desorption models in whole building energy simulations to evaluate possible energy savings caused by moisture buffering effects in building enclosure and furnishings				RTAR draft under revision, no progress since Quebec City, awaiting completion of related IEA work	J Kosny	SCM
Development of reference Building Information Model (BIM) for thermal model compliance testing				Expression of interest to work with TC 1.5	L Norford	A

SCM = Simulations and Component Models

DDM = Data Driven Modeling (formerly Inverse Methods)

A = Applications

Attachment G

TC 4.7 Program Plan
Long Beach ASHRAE Meeting
June 2007

Long Beach June 23-27th, 2007

Transaction “How Low Can You Go? Low-Energy Buildings Through Integrated Design”
Organized by: TC 2.8 (Co-sponsor)
Chaired by: Dru Crawley

Seminar “Simulation Support for the 2007 Solar Decathlon”
Organized by: TC 4.7 (Applications)
Chaired by: Kamel Haddad

New York, January 19-23, 2008 * Deadlines: Manuscripts 4/6/07; Package 8/3/07**

Transaction “How Low Can You Go? Low-Energy Buildings Through Integrated Design”
Organized by: TC 2.8 (Co-sponsor)
Chaired by: Dru Crawley
Status: 5 papers in review, 4th transaction session

Transaction “How and Why to Calibrate a Simulation to Measured Data”
Organized by: TC 4.7 (Data Driven Models)
Chaired by: Robert Sonderegger
Status: Moved from Dallas (Claridge and Liu from 1092-RP, Reddy from 1051-RP)

1) Seminar “How to model nothing – Energy Modeling for ZNEB”
Organized by TC 4.7 (Simulation and Component Models)
Chaired by: Jan Kosny
Status: New (1 NREL (-> Ron Judkoff), Tim McDowell, Phil Haves, Thierry Carriere(?))

2) Seminar “Simulation of HVAC/R Components based on published Manufacturer Data”
Organized by: TC 4.7 (Simulation and Component Models)
Chaired by: Michael Wetter
Status: Presenter: Joel Neymark, Vincent Lemort, Kamel Haddad(?), Russ Taylor(?),
Tim McDowell(?)

3) Seminar “Simulation Support for the 2007 Solar Decathlon”
Organized by: TC 4.7 (Applications)
Chaired by: Kamel Haddad
Status: Continuing series from Long Beach. Confident he can find speakers.

4) Seminar “Use of ‘equation solvers’ for Simulation”
Organized by: TC 4.7 (Data Driven Models)
Chaired by: Michael Wetter
Status: Changed from Symposium to Seminar, 4 presenters identified

5) Seminar “Applying Performance Assessment Tools to mitigate Climate Change”

Organized by TC 4.7 (Applications)
Chaired by: Carol Gardner
Status: New. 4 speakers

? Seminar “Modeling of Double Envelope Facades and Active Windows”

Organized by: TC 4.7 (Simulation and Component Models)
Chaired by: Mike Brandemuehl
Status: Moved from Dallas

? Seminar “Fenestration Data Needs for Energy and Loads Calculations”

Organized by: TC 4.1 Loads
Co-Sponsored by TC 4.7 (Applications)
Chaired by Glen Friedman
Status: Moved from Dallas

Salt Lake City June 12-25, 2008 ***** Deadlines: Manuscripts 9/28/07; Package 2/8/08. Theme: Benchmarking: The Current Standard of Care**

Transaction “How Low Can You Go? Low-Energy Buildings Through Integrated Design”

Organized by: TC 2.8 (Co-sponsor)
Chaired by: Dru Crawley
Status: 5 papers in review, 4th transaction session

Transaction “Use of ‘equation solvers’ for Simulation”

Organized by: TC 4.7 (Data Driven Models)
Co-chaired by: Jean LeBrun/Michael Wetter
Status: New, would be based on 4 abstracts from Dallas

Transaction “Synthesis of Optimum HVAC System Configurations”

Organized by: TC 4.7 (Simulation and Component Models)
Chaired by: Les Norford
Status: Jon Wright has 2 to 3 papers. Depending on publication date, may move to Salt Lake City

Seminar “Web-based Programs for Calculating Code-Compliance”

Organized by: TC 4.7 (Applications)
Chaired by: Larry Degelmann/Norm Bourassa
Status: Moved from Dallas, Larry has three speakers in mind

Seminar “Modeling and Experimental Validation of Active/Phase Change Building Envelope Components”

Organized by: TC 4.7 (Simulation and Component Models)
Chaired by: Jan Kosny
Status: Moved from Long Beach, 4 presenters

Seminar “Experience with Simulation of Standard 90.1 Code-compliant Buildings”

Organized by TC 4.7 (Applications)
Chaired by: Carol Gardiner
Status: Moved from Dallas

Seminar (new) “Methods of certification of savings from energy efficiency measures; white tags for carbon credits”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Kris Subbarao

Status: New

Chicago, January 24-28, 2009

Theme: Sustainable Urban Design

-

Retracted

Seminar “What Ever Happened to AI for Simulation”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Agami Reddy

Status: Moved from Dallas, 3 abstracts received (Cal Poly; PNNL, ISU)

Seminar “Genetic Algorithms for Energy Calculations”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Bass Abushakra

Status: Moved from Dallas (Replaced by Jon Wright's Symposium)

SSPC 140 Long Beach Meeting Summary June 25, 2007

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

Chair Announcements

Chair Announcements/Communications since last meeting [*Judkoff*]

- Galley reviews of Addendum *a* (furnace test cases) and Addendum *b* (HVAC BESTEST Volume 2, unitary cooling equipment dynamic comparative test cases) were completed in February. Per ASHRAE Staff, publication/posting of both addenda is imminent; this was delayed because of staff changes at ASHRAE.
- In February, the Chair submitted to SPLS a formal IP-units-only exception request for NREL's HERS BESTEST; this is a pre-requisite for initiating adaptation of HERS BESTEST for Std 140. SPLS/StdC approved this request in Long Beach
- Galley reviews of 140-2007 (incorporating 140-2004 Addenda *a* and *b*) are in progress by ASHRAE Staff. Chair will also review galleys. Publication is expected later this year.
- An IEA ministerial level publication highlights promulgation of ASHRAE Standard 140, which was underpinned by many collective years of work developing BESTEST in conjunction with IEA. This publication will be distributed at high-level IEA events around the world as well as a serving as the calling card for the IEA G8 outreach programme.

The *Ad-hoc SSPC 140 Data Format Subcommittee*, chaired by Neymark, met Sunday (1/28) evening. *Meeting objective*: Continue with developing a format for Std-140-2004 results data to be posted on the DOE Tools web site. The Subcommittee is developing data format, submittal, and posting recommendations; much of this can also be applied for tax-deductions related software approvals. Progress:

- Jim Pegues has completed the initial design work to develop Web Cover Page content and layout, and rules for submitting results, including how submitted material will be posted or otherwise be available from vendors.
 - This work involves improvements to the standard output reports of Std 140.
- Mike Witte is working on improving two results spreadsheets currently in 140-2004 for automating inclusion of new results into formatted charts and tables, for comparing submitted results with the current Std-140 example results set.
 - The spreadsheet and xls-to-pdf conversion process is complete for the HVAC spreadsheet (Sec 5.3 results)
 - Work is in progress for the Envelope spreadsheet (Sec 5.2 results)
- DOE is requesting that we have a format available for their use in the next couple of months.

Proposed Addendum A to 140-2007 to include updates to modeling notes and related examples for: alternative modeling methods, anomalous results, and software/platform requirements

Pegues developed an addendum that revises the modeler report templates and modeler report examples in forthcoming 140-2007 to be consistent with those developed for the

DOE Tools site. The addendum is complete except for a few minor editorial changes; a publication/public review letter ballot is planned for July/August.

Adaptation of HERS BESTEST for Std 140

SPLS/StdC approved an I-P units exception request, only for new sections to Std 140 that would include HERS BESTEST. This allows adaptation of HERS BESTEST to Std 140 to move forward. Fairey (of FSEC) indicated that the DOE Builder Challenge Program desires that software certifications they use (e.g., HERS BESTEST) be under the umbrella of Std 140. This raises the prioritization for 140-adaptation of HERS BESTEST. FSEC will continue work on the adaptation; Neymark will provide reviews.

Investigate Possibility of ASHRAE Funding Research Projects for Standard 140

There are 2 areas where SSPC 140 could use help from ASHRAE research:

- Field testing (with simulation programs) existing test suites being considered for adaptation into Std 140, and modifying the test suites such that a greater variety of simulation programs can apply them
- Developing new test cases for Std 140

Members of SSPC 140 will look into developing 1 or 2 RTARS related to this.

Update for IEA Task/Annex 34/43

This new IEA research effort focuses on validation and testing of building simulation tools. The work is making progress, and is due for completion in late 2007. Some of this work could be included with Standard 140 in the future. The following projects are included:

- Comparative Tests (Software-to-software comparisons)
 - Ground coupled heat transfer related to floor slabs (NREL, US)
 - This includes analytical verification tests, and the methodological advancement of developing a mathematical truth standard using numerical-method results for other test cases included within the test suite.
 - Multi-zone envelope test cases (NREL, US) including:
 - Analytical verification conduction test
 - 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.
 - Airflow test cases including single- and multi-zone (INCT, Japan)
- Empirical Validation Tests (Compare software to empirical data)
 - Daylighting/shading/load interaction – EMPA (Switz.); ERS (Iowa)
 - Final report is in the final stage of the approval process; publication/posting expected July/August.
 - Double-Skin Façade (DSF) building – Lund U. (Sweden); Aalborg U. (Denmark)
 - DSF literature review by Lund U. is published/posted on the Task web site
 - Aalborg U. work includes empirical validation and comparative test cases
 - Mechanical equipment test cases - Dresden University of Technology (Germany):
 - Focusing on water-side components/systems: chillers, boilers, pumps, piping, valves, etc
 - Includes empirical validation and comparative test cases.