

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 person listed below within 60 days following the meeting.)

TC/TG/TRG No. TC 4.7 DATE: August 29, 2005

TC/TG/TRG TITLE: Energy Calculations

DATE OF MEETING: June 28, 2005 LOCATION: Denver

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS & ADDIT'L ATTENDANCE
I. es Norford (CHM)	2004			
Dan Fisher (VC)	2004			
Jeff Haberl (PROG)	2002			
Agami Reddy (DD)	2004			
Bill Bahnfleth	2003			
	2004	Brent Griffith		
Patrick Carpenter	2003			
Joe Huang (RES)	2004			
Michael Brandemuehl	2003			
Tim McDowell	2002			
	2001	Rick Strand		
Robert Sonderegger	2002			
George Walton	2003			
	2004	Simon Rees (INTL)		
	2003	John Wright (INTL)		
	2004	Mingsheng Liu		

DISTRIBUTION

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

TAC CHAIR	William P. Bahnfleth
TAC SECTION HEAD	Craig C. Wray
SPECIAL PUBLICATIONS LIAISON	Kimball E. Ferguson
STANDARDS LIAISON	George Reeves
HANDBOOK LIAISON	William S. Fleming
PROGRAM LIAISON	Mohammad H. Hosni
RAC RESEARCH LIAISON	Michael J. Brandemuehl
PROF DEV COMM LIAISON	Mark M. Hydeman
TECH TRANSFER LIAISON	Charles E. Gullledge III
STAFF LIAISON (RESEARCH)	Michael R. Vaughn
STAFF LIAISON (TECH SERVICES)	Michael R. Vaughn
STAFF LIAISON (STANDARDS)	Claire Ramspeck

## ASHRAE TC 4.7 Energy Calculations

## DENVER MEETING

## ACTION ITEMS

1. **MOTION**—That RTAR on "Improved Modelling of Internal Surface Convection for Energy and Load Calculation Methods" be accepted (Fisher/Walton). Wray proposed title change to "Developing internal surface convection correlations for energy and load calculations". Agreed. **Motion carried 8 / 0 / 0 CNV.**
2. **MOTION**—That RTAR on "Development of Analysis and Monitoring Protocols for Accurate Prediction of Building Annual Energy Use Based on Minimum Short-Term Data Monitoring Periods" be accepted (Fisher/Sonderegger). USGBC has approached ASHRAE for help on measuring performance of buildings. **Motion carried 9 / 0 / 0 CNV.**
3. **MOTION**—That RTAR on "New Method of On-Demand Delivery of Simulation Results to Building Owners" be accepted (Reddy/Fisher). Reddy: is budget sufficient? Sonderegger: yes. Haves: why refer to "Office" suite of software and "Google"? Revise to make look less commercial. Brandemuehl: include key references and cite examples of datamarts. Brandemuehl: should this be moved to the "high-risk, innovative, and emerging technologies" category? Yes. **Motion carried 9 / 0 / 0 CNV.**
4. **MOTION**—That TC 4.7 accept to co-sponsor RTAR on "Developing Standard Procedures for Filling Weather Data Gaps During Analysis of Measured Building Energy Use" under TC 4.2's lead (Huang/Fisher). Bahnfleth: does TC 4.7 need to co-sponsor or should TC 4.7 endorse? Abushakra: should scope be limited to filling gaps in weather data? What about filling gaps in measured energy usage? Barnaby: this would be too broad. RTAR requires references and editorial changes. **Motion carried 9 / 0 / 0 CNV.**
5. **MOTION**—That TC 4.7 co-sponsor RTAR (TC 5.3 is lead) on "Effects of Turbulent Air Jet Introduction into Stratified Room Air Systems" (Fisher/Reddy). Reddy: needs some formatting and editorial changes. **Motion carried 10 / 0 / 0 CNV.**
6. **MOTION**—That above RTAR's be prioritized as follows: 1) internal surface convection, 2) short-term monitoring, 3) on-demand delivery. (Huang/McDowell). **Motion carried 10 / 0 / 0 CNV.**
7. **MOTION**—To accept the program prioritization for Chicago as listed below. (Walton/Brandemuehl). **Motion carried 10-0-0 CNV.**
  - a. 1) Seminar "How and why to calibrate a simulation to measured data" (Sonderegger).
  - b. 2) Seminar "Application and experiences with the new simulation software" (Fisher).
  - c. 3) Forum "What controls capabilities are needed for energy simulation" (Haves).
8. **MOTION**—That TC 4.7 express concern about compression of program sessions. (Sonderegger/Haberl). **Motion carried 9 / 0 / 1 CNV.**

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<b>TC/TG/TRG MEETING SCHEDULE</b>				
<b>LOCATION – past 12 months</b>		<b>DATE</b>	<b>LOCATION - planned next 12 months</b>	
Orlando		February 8, 2005	Chicago	
Denver		June 28, 2005	Québec City	
January 24, 2006				
June 27, 2006				
<b>TC/TG/TRG SUBCOMMITTEES</b>				
<b>Function</b>			<b>Chair</b>	
Simulation and Component Models			Phil Haves	
Applications			Chip Barnaby	
Data-Driven Modeling			Agami Reddy	
<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>
2005 Fundamentals	Energy Estimating Methods	31		Strand/Fleming
<b>STANDARDS ACTIVITIES - List and Describe Subjects</b>				
SPC 140 Standard Method of Test for Building Energy Software – Joel Neymark				
<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

This 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. Email addresses are listed for those who have explicitly authorized their inclusion in the minutes, which are posted on the TC's web site.

Present at TC 4.7 meeting?					Last name	First name	E-mail
Add to email list	Denver June 2005	Orlando Feb. 2005	Nashville June 2004	Anaheim January 2004			
	X	X		X	Abushakra	Bass	abushakr@msoe.edu
	X	X	X	X	Anderson	J.R.	<a href="mailto:jrhazel@bellsouth.net">jrhazel@bellsouth.net</a>
		X			Ahmad	Mushtaq	<a href="mailto:mushtaq@esl.tamu.edu">mushtaq@esl.tamu.edu</a>
			X		Armour	Steve	sbarmour@southernco.com
		X			Armstrong	Peter	<a href="mailto:Peter.armstrong@pnl.gov">Peter.armstrong@pnl.gov</a>
	X		X	X	Bahnfleth	Bill	wbahnfleth@psu.edu
	X	X	X	X	Barnaby	Chip	<a href="mailto:CBarnaby@wrightsoft.com">CBarnaby@wrightsoft.com</a>
	X		X	X	Beausoleil-Morrison	Ian	<a href="mailto:IBeausol@nrcan.gc.ca">IBeausol@nrcan.gc.ca</a>
	X	X			Bernier	Michel	michel.bernier@polymtl.ca
	X				Black	Al	ablack@mclureeng.com
		X			Bojic	Milorad	<a href="mailto:bojic@nq.ac.yu">bojic@nq.ac.yu</a>
	X				Bourassa	Norman	njbouras@energy.state.ca.us
					Bradley	Brian	bbradley@nrcan.gc.ca
	X	X	X	X	Brandemuehl	Mike	michael.brandemuehl@colorado.edu
	X	X			Carpenter	J Patrick	FACPERFENGINEER@aol.com
	X				Chantrasrisalai	Chanvit	<a href="mailto:chanvit@okstate.edu">chanvit@okstate.edu</a>
	X		X	X	Claridge	David	<a href="mailto:Claridge@esl.tamu.edu">Claridge@esl.tamu.edu</a>
	X	X	X	X	Crawley	Dru	<a href="mailto:Drury.Crawley@ee.doe.gov">Drury.Crawley@ee.doe.gov</a>
	X	X	X	X	Degelman	Larry	<a href="mailto:larry@taz.tamu.edu">larry@taz.tamu.edu</a>
					Deng	Zheng	<a href="mailto:zhengd@okstate.edu">zhengd@okstate.edu</a>
					Eldridge	David	dancingdavid@hotmail.com
	X			X	Ellis	Peter	peter_ellis@nrel.gov
X	X				Filler	Mike	mike.filler@york.com
	X	X	X	X	Fisher	Dan	<a href="mailto:DFisher@okstate.edu">DFisher@okstate.edu</a>
	X				Firrantello	Joseph	jxf282@psu.edu
			X		Gawin	Dariuh	gawindar@p.lodz.pl
				X	Gardner	Carol	gems@teleport.com
				X	Gehlin	Sigge	gehlin@siki.se
	X				Goldman	Milton	greenbuilding@???
			X		Gorwick	Susie	susan.gorwick@honeywell.com
				X	Gowri	Krishna	<a href="mailto:k_gowri@pnl.gov">k_gowri@pnl.gov</a>

Present at TC 4.7 meeting?					Last name	First name	E-mail
Add to email list	Denver June 2005	Orlando Feb. 2005	Nashville June 2004	Anaheim January 2004			
X	X				Gueymard	Chris	chris@solarconsultingservice.com
	X	X	X	X	Haberl	Jeff	<a href="mailto:JHaberl@esl.tamu.edu">JHaberl@esl.tamu.edu</a>
X	X				Haddad	Kamel	khaddad@nrcan.gc.ca
					Haiad	Carlos	Carlos.haiad.sce.com
	X	X	X	X	Haves	Philip	<a href="mailto:PHaves@lbl.gov">PHaves@lbl.gov</a>
		X			Hensen	Jan	<a href="mailto:j.hensen@tue.nl">j.hensen@tue.nl</a>
	X	X		X	Huang	Joe	<a href="mailto:YJHuang@lbl.gov">YJHuang@lbl.gov</a>
		X			Judkoff	Ron	ron_judkoff@nrel.gov
					Klaassen	Curtis	curtk@energy.iastate.edu
					Kong	Weixiu	weixiu@okstate.edu
	X	X			Kootin-Sanwu	Victor	victor.kootin-sanwu@uc.edu
			X		Koran	Bill	William.koran@honeywell.com
	X	X	X		Kosny	Jan	kyo@ornl.gov
	X	X			Krarti	Moncef	krarti@colorado.edu
				X	Lebrun	Jean	J.lebrun@ulg.ac.be
	X				Lemort	Vincent	vincent.lemort@ulg.ac.be
		X		X	Levermore	Geoff	geoff.levermore@umist.ac.uk
	X		X	X	Liesen	Richard	rliesen@uiuc.edu
	X	X	X	X	Lisenbee	Larry	<a href="mailto:lrlisenb@southern.com">lrlisenb@southern.com</a>
					Liu	Xiaobin	<a href="mailto:Xiaobin@okstate.edu">Xiaobin@okstate.edu</a>
				X	Long	Nicholas	<a href="mailto:Nicholas_long@nrel.gov">Nicholas_long@nrel.gov</a>
			X		Luo	Dong	luod@utrc.utc.com
					MacCracken	Mark	<a href="mailto:mmaccracken@calmac.com">mmaccracken@calmac.com</a>
	X				malone	brian	bmalon1@uic.edu
	X	X	X	X	McDowell	Tim	<a href="mailto:Mcdowell@tess-inc.com">Mcdowell@tess-inc.com</a>
	X	X	X	X	Neymark	Joel	neymarkj@msn.com
	X		X		Norford	Les	<a href="mailto:lnorford@mit.edu">lnorford@mit.edu</a>
				X	Pegues	Jim	james.f.pegues@carrier.utccom
		X			Pinel	Patrice	ppinel@nrcan.gc.ca
	X	X	X	X	Pedersen	Curt	cpederse@uiuc.edu
			X		Radosevic	Marija	m.radosevic@bwk.tve.nl
				X	Ramirez	Bob	Bob.Ramirez@itron.com
	X	X	X	X	Reddy	T. Agami	reddyta@drexel.edu
					Sahlin	Per	per.sahlin@equa.se
				X	Selkowitz	Steve	seselkowitz@lbl.gov
		X	X	X	Shirey	Don	shirey@fsec.ucf.edu
					Silvetti	Brian	bslivetti@calmac.com

Present at TC 4.7 meeting?					Last name	First name	E-mail
Add to email list	Denver June 2005	Orlando Feb. 2005	Nashville June 2004	Anaheim January 2004			
		X		X	Smith	Vernon	<a href="mailto:VSmith@archenergy.com">VSmith@archenergy.com</a>
	X	X	X	X	Sonderegger	Robert	Robert.sonderegger@itron.com
		X	X	X	Spitler	Jeffrey	<a href="mailto:Spitler@okstate.edu">Spitler@okstate.edu</a>
		X	X	X	Strand	Rick	<a href="mailto:rkstrand@uiuc.edu">rkstrand@uiuc.edu</a>
	X				Subbarao	Kris	ksubbarao@comcast.net
	X				Theios	Jason	jtheios@guardian.com
	X				Thomaston	Bill	bhomast@energen.com
	X	X		X	Walton	George	<a href="mailto:GWalton@nist.gov">GWalton@nist.gov</a>
		X			Weaver	Kevin	<a href="mailto:KWeaver@tamu.edu">KWeaver@tamu.edu</a>
			X		Wen	Jin	jinwen@drexel.edu
				X	Willson	Jim	<a href="mailto:jimwill@indy.net">jimwill@indy.net</a>
		X	X	X	Wray	Craig	<a href="mailto:CPWray@lbl.gov">CPWray@lbl.gov</a>
			X	X	Wright	Jonathan	<a href="mailto:J.A.Wright@lboro.ac.uk">J.A.Wright@lboro.ac.uk</a>
					Xiao	Dongyi	xdongyi@okstate.edu
			X	X	Xu	Peng	pxu@lbl.gov
				X	Yuill	Gren	yuill@unomaha.edu

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

<b>#</b>	<b>Title</b>	<b>Joint TC</b>	<b>Cog SC/ Contractor</b>	<b>PMSC</b>	<b>Dates / status</b>
1051-RP	Procedures for Reconciling Computer-calculated Results with Measured Energy Data		Data Driven Models Drexel Univ., Agami Reddy	Robert Sonderegger (chair)	WS approved June 2003 Start: 12-03 NCE: 02-28-06 (02-08-05)
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 6-04 Start: 02-05



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

**ASHRAE**  
**Technical Committee 4.7 Energy Calculations**  
**2005-2006 Research Plan**  
**24 August 2005**

TC 4.7 approved three new RTARs for consideration on the 2005-2006 Research Plan. In addition, there are three existing Work Statements under development

<b>Title</b>	<b>TC Priority 2005-2006</b>	<b>Prior TC priority</b>	<b>Society status</b>	<b>TC Status</b>	<b>Authors</b>	<b>Subcom</b>
Technical and Usability Enhancements to the Energy Calculation Toolkits	0	3 (2003-2004)	RTAR 2004 accepted	WS under development	Dan Fisher	SCM
Development of a Procedure for Base-lining Energy Use at Large Central Plants	0	2 (2003-2004)	RTAR approved and prioritized by RAC	WS under development	Moncef Krarti, Agami Reddy	DDM
Procedures and Data for High-Performance Residential Design	0	1 (2003-2004)	RTAR accepted	WS under development	Joe Huang, Danny Parker, Tim McDowell	A
Developing internal surface convection correlations for energy and load calculations	1	0 (2004-2005)	Under review	RTAR approved and forwarded to RAC	Dan Fisher, Ian Beausoleil-Morrison	SCM
Development of protocol for accurate prediction of building annual energy use based on minimum short-term monitoring	2	0 (2004-2005)	Under review	RTAR approved and forwarded to RAC	Bass Abushakra	DDM
Datamarts of on-demand delivery of simulation results to building owners	3	0 (2004-2005)	Under review	RTAR approved and forwarded to RAC	Robert Sonderegger	DDM

SCM = Simulations and Component Models

DDM = Data Driven Modeling (formerly Inverse Methods)

A = Applications

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

<b>RP</b>	<b>Title</b>	<b>Contractor</b>	<b>Approved</b>	<b>Paper</b>
865	Accuracy Tests	UNO, TAMU	Honolulu, June 2002	G.K. Yuill, PhD, PEng; J.S. Haberl, PhD, PE; J.S. Caldwell, 2005, " Accuracy Tests for Simulations of Constant Volume, Dual Duct, and Variable Volume Air-Handling Systems", ASHRAE Trans., vol. 111, pt. 2, paper no. 4796, p. 137-153.
1222	Nodal Models	MIT, Chen	Honolulu, June 2002	Griffith, B. and Chen, Q. 2004. "Framework for coupling room air models to heat balance model load and energy calculations," International Journal of HVAC&R Research, 10(2), 91-111.
1222	Nodal Models	MIT, Chen	Honolulu, June 2002	Griffith, B. and Chen, Q. 2003. "A momentum-zonal model for predicting zone airflow and temperature distributions to enhance building load and energy simulations", International Journal of HVAC&R Research, 9(3), 309-325.
1050	Inverse Modeling TK	U Dayton, TAMU	Kansas City June 2003	<i>Kissock, J.K., J.S. Haberl D. E. Claridge,</i> 2003, "Inverse Modeling Toolkit - Numerical Algorithms", ASHRAE Transactions, 425-434.
1050	Inverse Modeling TK	U Dayton, TAMU	Kansas City June 2003	<i>Haberl, J.S., A. Sreshthaputra, D. E. Claridge, J.K. Kissock,</i> 2003, " Inverse Modeling Toolkit - Application and Testing", ASHRAE Transactions 435-448.

**Appendix 4**  
**TC/TG/TRG SPONSORED SYMPOSIA**

**Current as of June 2005**

***PRESENT:***

Denver/June 2005

*None.*

***PLANNED:***

Chicago/January 2006

*What to do when Data Misbehave (Chair: Agami Reddy)*

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

*Recent Advances in Energy Simulation (Chair: Dan Fisher)*

*Validation of building simulation programs through ASHRAE Standard 140 (Chair: Chip Barnaby)*

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

*Application of Inverse Models (Chair: Jeff Haberl)*

Québec City/June 2006

*Survival of the Least Square Fittest: Genetic Algorithms for Buildings (Chair: Les Norford)*

*Modelling of Residential Cogeneration Systems: IEA/ECBS Annex 42 (Chair: Ian Beausoleil-Morrison)*

***PAST:***

Orlando/February 2005

*None.*

Nashville/June 2004

*Modeling Moisture Sorption/Desorption by Building Materials (Chair Jan Kosny)*

Anaheim/January 2004

*Applications and Knowledge-based Tools for Enhanced Building Energy Simulation (Chair, Vern Smith)*

Kansas City/June-July 2003

*Inverse Methods for Calculating Energy Savings from Energy Conservation Retrofits (Chair: Jan F. Kreider)*

*Coupling of Building Airflow and Energy Modeling Programs (Co-sponsored with TC4.10 Chair: Jelena Srebric)*

Chicago/January 2003

*Recent Advances in Energy Simulation: Building Loads (Co-sponsored with TC4.1/Chair: Jan Hensen)*

Honolulu/June 2002

*Recent Advances in the Thermal Simulation of HVAC Equipment* (Co-sponsored by TC4.1/Chair: Ian Beausoleil-Morrison)

*Atlantic City/January 2002*

*Tools and Techniques for Calibration of Component Models* (TC1.5 sponsor; TC4.7 co-sponsor/Chair: Agami Reddy)

**Appendix 5**  
**TC/TG/TRG SPONSORED SEMINARS**

**Current as of June 2005**

***PRESENT:***

Denver/June 2005

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

***PLANNED:***

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)*

***PAST:***

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)*

Kansas City, June-July 2003

*Successful Applications of Energy Simulation in Building Design (Chair: Vernon A. Smith)*

Chicago, January 2003

*Getting started in Building Simulation (Chair: Chip Barnaby)*

*Using Monitored Data for Solving Engineering Problems (Chair: Agami Reddy)*

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

**Current as of June 2005**

***PRESENT:***

Denver/June 2005

*None.*

***PLANNED:***

Chicago/January 2006

*What Controls Modelling Capabilities are Needed for Energy Simulations (Chair: Phil Haves)*

*Application and Experiences with the New Simulation Software (Chair: Dan Fisher)*

***PAST:***

*None.*

**ASHRAE TC 4.7 Energy Calculations**  
**Tuesday, June 28, 2005, 18h00 to 20h30**  
**Plaza Ballroom ABC, Adam's Mark Hotel**  
**Denver, Colorado**

**1. Roll call and introductions (Beausoleil-Morrison)**

- The meeting convened at 18h02.
- Norford chair, Beausoleil-Morrison secretary.

**2. Accept agenda & approve minutes of Orlando meeting Norford (Attachment A)**

- Agenda accepted (Sonderegger/McDowell **8-0-0 CNV**).
- Minutes accepted without changes (Haberl/Reddy **8-0-0 CNV**).

**3. Announcements/Liaisons (Norford)**

- Scope of TC 4.7: TC 4.7 is concerned with identifying, evaluating, developing, and recommending procedures for calculating energy performance of buildings.
- No restriction on when or how many RTARs can be submitted. RAC will now pay more attention to "roll-off": WS should be written within two years of RTAR acceptance.
- TC chairs and vice-chairs will be discouraged, but permitted, to bid on contracts.
- Symposia chairs to appoint two reviewers in future and ASHRAE will appoint the third reviewer.
- Program committee considering either extending or eliminating Wednesday program.
- ASHRAE has e-mail alias list that will be circulated.
- ASHRAE has document on Homeland Security. Chair can provide copy to those interested.
- Nominations being sought for the George B. Hightower Technical Achievement Award for technical leadership and technical contribution during the preceding Society year. Submit to TAC by September 30.
- ASHRAE FAQs on weather data and selection of energy simulation tools. These are in pretty good shape. Crawley and Norford to make some minor revisions.
- Plans underway to establish a 4.0 web site.
- TC 4.7 SCM wish list has been shared with other section 4 TCs.
- Fundamentals 2005 has nice example of loads calculations using ASHRAE headquarters building.
- Wray reported on Section 4. USGBC has taken lead on "sustainability". Onus on ASHRAE to produce materials quickly to meet needs, e.g. LEED.

**4. Membership (Norford)**

- Strand rolling off. Chair thanked him for a nice job on Handbook.
- Abushakra, Barnaby, Liesen rolling on.
- Management changes: Crawley to chair Handbook. Liesen to be webmaster.

**5. Subcommittee reports**

**5.1 Applications:** Chip Barnaby (chair): **(Attachment B)**

- Symposium on validation using Standard 140 on plan: 3 papers in hand, 1 more expected. Likely won't make Chicago. Need reviewers.
- Most of meeting spent discussing RTARs/wish list. Most items on back burner since in many cases other groups are doing similar projects, or there is no champion.
- Some brainstorming done at meeting, will be continued by e-mail over coming months.
- Two WS from TC 9.6 on health care facilities discussed (1342 and 1343). Goal is to characterize energy consumption by space. We would like refinement of 1342. Does this fit within scope of TC 4.7? TC 4.7 to develop a note of concern regarding two WS from SC to RAC.

**5.2 Data-Driven Modeling** Agami Reddy (chair) reporting: **(Attachment C)**

- Long meeting, moderate attendance.
- 3 RTARs and 1 WS discussed.

- Scope of SC discussed. Concern that TC 4.7 SC's becoming too compartmentalized. DDM should be involved (in some capacity) whenever measured data are used, e.g. experimental design techniques. Should DDM have a role in 140? Calibration of simulation models presumes fault-free operation: should TC 4.7 be involved in this area, e.g. development of models that simulate faults? Scope of SC is to enhance the operation of existing buildings and systems using monitored performance data anchored in simulation programs and models. This includes the use of calibrating detailed and lumped simulation programs, grey-box and black-box inverse models, statistical analysis methods, monitoring strategies and methodologies for predicting energy use of secondary and primary equipment, systems and whole building energy use.
- 1051-RP (Sonderegger): Drexel University is contractor. Contract well underway, in finishing phase. Draft final report due soon. TC 4.7 should have a final report to vote upon for Chicago.

### 5.3 Simulation & Component Models Phil Haves (chair) reporting: **(Attachment D)**

- Research topic prioritization conducted via e-mail. Only 7 responses, but some new volunteers identified to develop RTAR's and WS's. Process to be streamlined but will retain weighting approach.
- Number of RTAR's discussed. SC recommending internal convection RTAR to full committee. Wray suggests that TC 4.10 be consulted. Moisture RTAR getting close. Natural ventilation RTAR has been on highest priority list for a long time and is now heading in an appropriate direction. Wray suggests that TC 5.12 be consulted.
- Toolkit enhancement WS to be dropped and work will commence on an alternate approach.
- SCM has a 1.5 hour time slot, but this does not seem sufficient. Can SCM start its meeting half hour earlier? This would overlap with Handbook and perhaps other TC meetings. Norford and Haves to discuss time slot.

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

- Four RTAR's recommended by SC's for consideration by full committee.
- Internal surface convection RTAR. Fisher and Beausoleil-Morrison reporting. Experimentally determine convection coefficients and correlations for various convection regimes. TC 4.1 very interested since incorrect convection coefficients can lead to large errors in cooling loads. They did not vote on it because of lack of quorum but will have mail ballot. TC 5.3 has approved co-sponsorship and has nominated 3 people to work on WS. **MOTION**—That RTAR on "Improved Modelling of Internal Surface Convection for Energy and Load Calculation Methods" be accepted (Fisher/Walton). Wray proposed title change to "Developing internal surface convection correlations for energy and load calculations". Agreed. **Motion carried 8 / 0 / 0 CNV.**
- Analysis and monitoring protocols RTAR. Abashkara and Reddy reporting. Previously returned by RAC mainly because there were many previous studies on short-term monitoring and the results have been mixed. RTAR has been modified to address this concern. TC 7.6 voted to endorse RTAR. What is optimal season to monitor and how short a period is sufficient to predict energy performance for full year? ESCO's would be main beneficiary but others would benefit as well. Might result in new method for Guideline 14 and expand its use. **MOTION**—That RTAR on "Development of Analysis and Monitoring Protocols for Accurate Prediction of Building Annual Energy Use Based on Minimum Short-Term Data Monitoring Periods" be accepted (Fisher/Sonderegger). USGBC has approached ASHRAE for help on measuring performance of buildings. **Motion carried 9 / 0 / 0 CNV.** Cover letter should be written to accompany RTAR to explain to RAC why it is being resubmitted.
- On-demand RTAR. Sonderegger reporting. Goal is to deliver simulation results to building owners/managers--expand the market for simulation. These people rarely have time to run simulations or analyze results in detail. Datamarts to be used to store calibrated simulation results on a building and parameterized variants. Query system would extract these data to respond to questions that could be posed by building owner/manager. TC 7.4 has approved to co-sponsor. Project would develop datamarts on a few buildings to demonstrate. **MOTION**—That RTAR on "New method of On-Demand Delivery of Simulation Results to Building Owners" be accepted (Reddy/Fisher). Reddy: is budget sufficient? Sonderegger: yes. Haves: why refer to "Office" suite of software and "Google"? Revise to make look less commercial. Brandemeuhl: include key references and cite examples of datamarts. Brandemeuhl: should this be moved to the "high-risk, innovative, and emerging technologies" category? Yes. **Motion carried 9 / 0 / 0 CNV.**
- Filling weather data RTAR. Huang reporting. TC 4.2 voted to accept and would like to be cognizant committee with TC 4.7 co-sponsorship. Frequently missing data fields in weather files. Usually data is thrown away when there are periods of missing data. Are there clever ways to fill in these missing



data? Barnaby: why not drop "during analysis of measured building energy use" from title?

**MOTION**—That TC 4.7 accept to co-sponsor RTAR on "Developing Standard Procedures for Filling Weather Data Gaps During Analysis of Measured Building Energy Use" under TC 4.2's lead (Huang/Fisher). Bahnfleth: does TC 4.7 need to co-sponsor or should TC 4.7 endorse? Abashkara: should scope be limited to filling gaps in weather data? What about filling gaps in measured energy usage? Barnaby: this would be too broad. RTAR requires references and editorial changes. **Motion carried 9 / 0 / 0 CNV.**

- Turbulent jet RTAR from TC 5.3. TC 5.3 is seeking TC 4.7's co-sponsorship. **MOTION**—That TC 4.7 co-sponsor RTAR on "Effects of Turbulent Air Jet Introduction into Stratified Room Air Systems" (Fisher/Reddy). Reddy: needs some formatting and editorial changes. **Motion carried 10 / 0 / 0 CNV.**
- 3 accepted RTAR's from TC 4.7 about to fall off plan due to inactivity. Draft WS required for "Baselining cooling plants" by October or it will be dropped. Reddy: a WS is under development and TC 4.7 will consider it in Chicago. "Toolkit enhancements" and "Procedures and data for high-performance residential design" will be dropped if no WS received by October.
- **MOTION**—That above RTAR's be prioritized as follows: 1) internal surface convection, 2) short-term monitoring, 3) on-demand delivery. (Huang/McDowell). **Motion carried 10 / 0 / 0 CNV.**
- 1311-RP (Crawley). PMS met Sunday. U Waterloo is contractor. Improve load calculations of fenestration with shading devices. Experimental and modelling work. Contract signed in January. Project on schedule.

#### 5.5 Handbook, Crawley (chair) reporting (no attachment)

- 2005 Fundamentals has been sent to all members.
- Crawley has conflict with Handbook meeting time slot.
- Norford to work on schedule with SC chairs.

#### 5.6 Program, Haberl (chair) reporting (Attachment G)

- **MOTION**—To accept the program prioritization for Chicago as listed below. (Walton/Brandemeuhl). **Motion carried 10-0-0 CNV.**
  - 1) Seminar "How and why to calibrate a simulation to measured data" (Sonderegger).
  - 2) Seminar "Application and experiences with the new simulation software" (Fisher).
  - 3) Forum "What controls capabilities are needed for energy simulation" (Haves).
- The following symposia were not ranked. They will go ahead if they are available:
  - "Thermal modelling of phase change materials in building envelopes" (Kosny).
  - "Recent advances in simulation" (Fisher).
  - "Validation of building simulation with 140" (Barnaby).
  - "How low can you go" (Crawley).
  - "Applications of inverse models" (Haberl).
- **MOTION**—That TC 4.7 express concern about compression of program sessions. (Sonderegger/Haberl). **Motion carried 9 / 0 / 1 CNV.**
- ASHRAE Transactions are not referenced in "Science Citations Index". No time to discuss today. Can be raised in Chicago.

#### 5.7 Standards, Neymark (chair) reporting (Attachment H)

- Furnace test cases addendum from NRCAN to 140. Minor editorial changes required then will be voted for public review.
- SC working on establishing facility to post results on web for software tested to 140.
- FSEC working on adapting HERS BESTEST to 140.
- Unitary cooling adaptation by NREL/Neymark to 140.
- 155 copies of 140 have been sold.
- IEA Task 34/43: comparative tests on ground heat transfer, multi-zone, air flow, daylighting and shading, double facades, mechanical equipment. Schedule to complete by end of 2007.

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

- TC web sites being moved to ASHRAE's central server.
- New TC 4.7 site went live today.
- Web site is now <http://tc47.ashraetcs.org>.

- 30 MByte quota so old items will be archived rather than left on site. Items should be archived forever.
- TC requests that more space be made available.
- Seminar presentations can be posted in PDF format and without audio with approval of author, session chair, and program chair.

#### **6. TC 4.7 support of ASHRAE Standard 90's ECB method, Bahnfleth reporting (no attachment)**

- 90.1 ECB (chapter 11) requires simulation to demonstrate compliance. ECB SC has posed many questions that could be researched.
- What are minimum requirements for simulation tool? Are ECB compliant buildings really equivalent in energy performance to a building compliant with the prescriptive path.
- Are compliance "shells" available?
- Appendix G. LEED requires that ECB be used.
- Should there be a joint meeting between ECB and TC 4.7 to stimulate ideas and collaboration?
- 90.1 does not develop RTAR's and WS's.
- Should there be a SC of TC 4.7 to liaise and work with 90.1 ECB. Norford to consider in scheduling.

#### **7. Reports on related activities**

##### **7.1 GPC 20 XML Definitions for HVAC&R**

- Barnaby reporting.
- Not much progress in past year. Chair has resigned. Barnaby now acting chair.

##### **7.2 TC 2.8 Sustainability**

- Crawley.
- LEED has been a focus.

##### **7.3 TC 4.1 Load Calculations**

- Barnaby reporting.
- ASHRAE and ACCA have agreed to work jointly on standard for load calculations for non-residential buildings.
- Two RP of interest to TC 4.7.

##### **7.4 TC 4.2 Climatic Information**

- Huang reporting.
- Weather data now only on CD with 2005 Fundamentals. TC soliciting feedback on this.
- New WS on creating the design day.
- New RTAR on climate change effects.

##### **7.5 TC 4.5 Fenestration**

- Kootin-Sanwu reporting.
- Supporting TC 4.7 internal convection RTAR. Considering another RTAR on convection.

##### **7.6 TC 6.5 Radiant Heating and Cooling**

No report.

##### **7.7 TC 7.4 Building Operation Dynamics**

- Brandemeuhl reporting.
- RP on dynamic cooling coil model in progress.
- RP on thermal energy storage.
- RTAR on control of distributed generation.

##### **7.8 TC 7.5 Smart Building Systems**

- Reddy reporting.
- FDD of chillers, AHU, whole buildings.

##### **7.9 TC 7.6(9.6)Systems Energy Utilization**

- Haberl reporting.
- No report.

**7.10 IAI International Alliance for Interoperability**

- Three main CAD vendors implementing IFC data model for geometry.

**7.10 IBPSA (USA, Canada, World, BS 2005)**

- Haves: IBPSA-USA will hold SimBuild 2006 end of July/beginning of August. Joint meeting held in Denver with USGBC. To talk with EPA about simulation.
- Beausoleil-Morrison: IBPSA-Canada has applied to incorporate. eSim 2006 to be held in Toronto in May.
- Building Simulation 2005: all papers have been reviewed, proceedings under production, over 150 registrations to date, program to be released in coming days.
- Spittler: BS 2007 to be held in Beijing in September.

**8. Old Business**

- No old business

**9. New business**

- None.

**10. Executive Session**

- None required at this meeting

**11. Adjourn**

- Meeting adjourned at 20h48.

**Attachments**

- A. Agenda
- B. Applications Subcommittee Minutes
- C. Inverse Methods Subcommittee Minutes
- D. Simulation and Component Models Subcommittee Minutes
- E. Research Subcommittee Minutes
- F. Handbook Subcommittee Minutes (not included—no meeting held in Orlando)
- G. Program
- H. SSPC 140 Minutes

**ASHRAE TC 4.7 Energy Calculations**

Tuesday, June 28, 2005, 6:00-8:30 p.m.

Plaza Ballroom ABC (Concourse Level)

Adam's Mark Hotel

Denver, Colorado

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1. Roll call and introductions	Beausoleil-Morrison
2. Accept agenda & approve minutes of Anaheim meeting	Norford
3. Announcements/Liaisons	Norford
4. Membership	Norford
5. Subcommittee reports	
5.1 Applications	Barnaby
Applications Research Wish List Update	Barnaby
5.2 Data-Driven Modeling	Reddy
Data-Driven Modeling Research Wish List Update	Reddy
1051-RP Procedures for Reconciling Computer-Calculated Results with Measured Energy Data (Drexel Univ)	Sonderegger
5.3 Simulation & Component Models	Haves
Simulation & Component Models Research Wish List Update	Haves
5.4 Research	Huang
TC 4.7/ASHRAE Research Plan	Huang
1311-RP Improving Load Calculations for Fenestration with Shading Devices (TC 4.1/4.5/4.7)	Crawley
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. TC 4.7 support of ASHRAE Standard 90's ECB method	Bahnfleth
7. Related activities reports	
GPC 20 XML Definitions for HVAC&R	Haves/Barnaby
TC 2.8 Building Environmental Impacts and Sustainability	Crawley
TC 4.1 Load Calculation Data and Procedures	Barnaby
TC 4.2 Climatic Information	Huang
TC 4.5 Fenestration	Pedersen
TC 6.5 Radiant Heating and Cooling	--
TC 7.4 (4.6) Building Operation Dynamics	Brandemuehl
TC 7.5 (4.11) Smart Building Systems	Reddy
TC 7.6 (9.6) Systems Energy Utilization	--
IAI International Alliance for Interoperability	Haves
IBPSA: USA, Canada, IBPSA, BS 2005	Haves, Beausoleil-Morrison, Spittler, Bernier
8. Old Business	
9. New business	
10. Executive Session	
11. Adjourn	

NEXT MEETING: Tuesday, January 24, 2006, CHICAGO

ASHRAE TC 4.7 Energy Calculations  
**Applications Subcommittee**  
 Tuesday, June 28, 2005, 3:30 – 5 PM  
 Plaza Ballroom ABC, Adam’s Mark, Denver, CO

**Minutes**

Present: Abushakra, Armstrong, Barnaby, Beausoleil-Morrison, Degelman, Doebber, Haberl, Huang, Kootin-Sanwu, Kosny, McDowell, Neymark, Norford, Sonderegger, Walton.

Meeting began at 3:35 p.m. The agenda was circulated and introductions were made. Subcommittee minutes from Orlando will be subject to an approval vote by the full TC, as part of the complete minutes package.

***Status of Orlando (Jan. 2005) Action Items***

<b>Who</b>	<b>When</b>	<b>What</b>	<b>Action</b>
Barnaby	Prior to Denver	Circulate subcommittee goal statement	No action
Barnaby	Program deadlines for Chicago presentation	Chair Std 140 Symposium	In progress
Huang	Prior to Denver	Corral Danny Parker, review Building America, revise RTAR #2 (“Representative Data for Residential Energy and Load Calculations”)	?
Judkoff / Huang	Prior to Denver	Expand “Prototypical Utility Rates” RTAR	?
Barnaby / Hensen	March 15	Demo Toolkit RTAR draft	?
Barnaby	Immediate	Contact Les Norford re better liaison with Standard 90 applications. Plan Denver activities as appropriate	Agenda for main TC meeting will include Std 90 ECB discussion.
Sonderegger	Prior to Denver	Investigate Wikis and what they might do for us. Verbal report, perhaps propose an experiment if a suitable host site can be set up.	No action
Haberl	Prior to Denver	Investigate network / web meeting aids (working toward a paperless meeting)	No action

***Program***

Seminar – Chicago

“Application and Experiences with the New Simulation Software”, Dan Fisher, chair. Proposed speakers: Yuill, Haves, Pedersen, Crawley. Status: did not make Denver program. Check with Fisher about trying again for Chicago.

Symposium – Chicago

“Validation of building simulation programs through ASHRAE Standard 140”, Chip Barnaby, chair. Status: 3 papers in hand, 1 promised. Reviews getting started. Neymark to help. Not likely to make August 5 deadline for Chicago.

### ***Research***

Copies of 1342-WS, Energy Consumption of Health Care Spaces by Function, and 1343-WS, Method of Testing and Data Collection for Energy Characteristics of Health Care Equipment, were circulated and discussed. TC 9.6, Health Care Facilities, is the cognizant TC; TC 4.7 is being asked to endorse.

The concept of the second work statement was supported by the subcommittee. Walton suggested focusing on health-care equipment, particularly convection-radiation splits, and de-emphasizing cooling equipment dedicated to the health-care equipment. Haberl suggested adding power-quality measurements.

Data from the first project were considered to be specific to a given space and of limited generalizability. A better approach would be to use an inventory of equipment and utilization patterns as inputs to simulation. Further, it is not feasible to measure heating and cooling loads and associated fuel usage at the space level. Haberl noted that data associated with heating and cooling loads would at best describe existing practice, without consideration of reduced energy usage associated with improved operation.

Barnaby appointed Haberl, Walton and Sonderegger to assist him in preparing comments. Guidance will be sought from RAC members at the full TC 4.7 meeting.

### **RTARs / Work Statements / Wish List**

1. Development of Enhanced Window Simulation Capability for Standard 90.1 Prescriptive Simulation (Jeff Haberl/Joe Derringer). There is increasing interest / awareness of data mismatch between standard window ratings (U-factor and SHGC) and input typically required by simulation applications. Huang is working on this for California applications and it is being discussed in 1311-RP. General issue: U and SHGC are not enough. Need NFRC involvement. Let it stew for six months. Joe Huang’s work, outside ASHRAE, may lead to a paragraph in the handbook.
2. Representative Data for Residential Energy and Load Calculations (Joe Huang / Danny Parker). Coordination with Building America. Tim McDowell is starting work with Building America data, he will in a few months be in a position to advise on whether Building America sufficiently addresses the same need as this project. Consensus: stew for six months. The previously-approved RTAR is at risk of being dropped due to RAC time limits. If that happens, start again if needed, with input from McDowell.
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? We expect to gain perspective from ECB discussion at main TC 4.7 meeting. Reassess in Chicago.
4. Prototypical Utility Rates (Ron Judkoff / Joe Huang). This would provide a consensus operating cost basis for broad-based studies. Sonderegger notes that an RP underway has done part of the proposed work by generating a simple rate tool. Huang noted that simulation programs can model rates but users have difficulties with the inputs. Consensus: back-burner project.

5. Demonstration Toolkit on Building Energy Simulation use in Building Design for Training and ASHRAE Handbook CD+ Use. (Chip Barnaby / Jan Hensen). No progress.
6. Algorithms for mapping manufacturers' data to simulation inputs. Draft by Bojic circulated. Brandemuehl to work on it.

Wish-list brainstorm:

Haberl noted holes in 90.1 for natural ventilation, under consideration by SCM for incorporation into energy simulations, and thermal comfort.

Barnaby will issue reminder to think about the subcommittee's mandate and ideas for the research wish-list.

The meeting adjourned at 5:04 p.m.

***Summary of action items***

<b><i>Who</i></b>	<b><i>When</i></b>	<b><i>What</i></b>
Barnaby	Meet program deadlines for Quebec	Std 140 Symposium
Barnaby, Haberl, Sonderegger, Walton	July?	Comments on 1342-WS and 1343-WS
Barnaby	September	Circulate ideas re SC goals / mandate / research wish list
McDowell	Chicago	Assess Building America re overlap with Representative Data project

**TC 4.7: Data Driven Sub-Committee**  
**June 27, 2005**  
**MINUTES**

- 1) Agami Reddy (AR) started the meeting at 7:40 p.m. Introductions were then made.
- 2) The Agenda discussed. Copies of the minutes were passed around and discussed. The minutes were approved by voice vote.
- 3) Discussion then moved on to Program. Jeff Haberl (JSH) gave a report on the program for Data Driven for the future models.
- 4) AR then opened the discussion to a review of the scope and name of the sub-committee. The following reflect the new and old scopes of the SC.

New scope (6/2005)

Scope of the SC is to enhance the operation of existing buildings and systems using monitored performance data anchored in simulation programs and models. This includes the use of calibrating detailed and lumped simulation programs, grey-box and black-box inverse models, statistical analysis methods, monitoring strategies and methodologies for predicting energy use of secondary and primary equipment, systems and whole building energy use.

Old scope (2003)

Scope of the SC: *To develop physically plausible modeling methodologies and models using monitored data. These models should be applicable to base-casting energy use, secondary and primary equipment, systems and whole building energy use, and should be easy to use and suitable for automation.*

- 5) Discussion then moved on to the RTARs and WS that had been developed by various individuals.

(a) Moncef Krarti (MK) presented his WS on “Development of a Procedure for Baseline Energy Use for Large Central Plants”. There were some questions about whether or not this WS had been assigned a number from Mike Vaughn. MK was unable to get the RAC’s comments on the earlier version of this WS. After reading this WS, it was deemed that some more specifics need to be provided (for example, what do we mean by baselining?, does this require intrusive monitoring?...).The WS was deemed not yet ready for discussion at the main TC.

**ACTION 1:** AR agreed to help MK revise the WS so that it could be finalized during the Chicago meeting.

**ACTION 2:** Joe Huang (JH) agreed to check with Mike Vaughn to see if there is a number assigned to this WS.

(b) Discussion then moved on to the RTAR #1404 from Bass Abushakra (BA): “Development of Analysis and Monitoring Protocols for Accurate Prediction of Building Annual Energy use Based on Minimum Short-term Data Monitoring Periods”.

BA passed out copies of the RTAR which were worked upon by AR and Vern Smith (VS) and addressed the comments he received from the RAC via Mike Vaughn.

**ACTION 3:** BA to seek endorsement from TC7.6 with whom he had already been in touch.

**ACTION 4:** BA agreed to clean-up references, edit the RTAR, and have another version for the full TC to vote upon the next day. Robert Sonderegger (RS) agreed to help BA with the \$ number in relation to the ESCO industry which would benefit from this research.

(c) Discussion then moved to RS’s RTAR “Methodology to Develop DataMarts Capable of Providing Quick Answers to Numerous Alternative Building Operation and Control Scenarios”. Active discussion followed. It was deemed that this research should focus on the framework development issue and not on the subsequent business plan on how to commercialize it. Also, RS reported that TC 7.4 had discussed this RTAR and agreed to endorse it.



**ACTION 5:** Robert agreed to revise the RTAR based on the discussions at the meeting and bring the revised RTAR to the full TC meeting.

(d) Discussion then moved to JH's RTAR "Developing Standard Procedures for Filling Data Gaps During Analysis of Measured Building Energy Use".

The subcommittee agreed that this was a good RTAR that needed minor revisions.

**ACTION 6:** JH agreed to make the revisions and bring it back to the main committee.

Meeting adjourned at 9:30 pm.

## TC 4.7 SUBCOMMITTEE: DATA-DRIVEN MODELING

Monday, June 27, 2005

7:30 to 9:00 p.m.

Plaza Directors Row F (S)

Adams Mark Hotel, Denver, CO

Chair: Agami Reddy (AR)

### AGENDA

1. Introductions

2. Approval of the minutes from the Orlando, FL meeting, February 7, 2004

1. Program (Haberl)

2. Discussion on scope of TC and prioritizing "Research Wish List"- Long Range Research Plan

5. Discussion of WS and RTARs

- WS- Development of a procedure for baselining energy use at large central plants - Krarti

- RTAR- Development of analysis and monitoring protocols..short-term monitoring...- Abushakara

- RTAR- Methodology to develop datamarts.....- Sonderegger

- RTAR- Determining Standard (Robust) Procedures for Filling Data Gaps Important for Energy Analysis - Huang

6. Discussion (if time permitting):

- 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

7. Old Business

8. New Business

9. Adjourn

## **TC4.7 Simulation and Component Models Subcommittee**

### **Meeting Minutes: Monday, June 27, 2005**

The meeting was called to order at ~6:07. The meeting was well attended (25) but the time allocated (90 minutes) proved insufficient. An extension of 30 minutes is requested for future meetings.

#### **Program**

The seminar on *Neglected Topics in Building Simulation* was reported to be well attended and well received.

Programs for Chicago and Quebec City were discussed. See Program Subcommittee report for the current status of all program items.

#### **CHICAGO (JANUARY 2006)**

- **Symposium** on *Recent Advances in Energy Simulation* (Chair: Dan Fisher) – ready to go
- **Symposium** on *Thermal Modeling of Phase Change Materials in Building Envelopes: Old Problem, New Developments* (Chair: Jan Kosny) – almost ready to go
- **Symposium** on *How Low Can You Go? Low-energy Buildings Through Integrated Design* (Chair: Dru Crawley).- double session
- **Forum** on *What Controls Modeling Capabilities are Needed for Energy Simulation* (Moderator: Philip Haves) – co-sponsorship will be sought from TC1.4

#### Quebec City (June 2006)

- **Symposium** on *How Low Can You Go? Low-energy Buildings Through Integrated Design* (Chaired by Dru Crawley) – potential third session
- **Symposium** on *Modeling of Residential Cogeneration Systems: IEA/ECBS Annex 42* (Chaired by Tim McDowell)

*Modeling the Performance of Double Envelop Facades* was suggested as a topic for a future symposium or seminar, with TC4.4 as a potential co-sponsor.

#### **Results of Research Topic Prioritization**

A reprioritization of the Subcommittee's research topics was carried out by email using a procedure in which votes were weighted by the self-professed willingness of the responder to work on the RTAR and Work Statement. Only seven people responded but most volunteered to work on the topics for which they voted. The top five topics were:

1. Models for natural and hybrid ventilation (McDowell, Norford, Rees)
2. More detailed modeling of internal surface convection and stratification within rooms (Beausoleil-Morrison, Norford, Rees)
3. Duct models to consider air leakage and thermal losses. (Haberl, Lebrun)

4. Moisture absorption/desorption (Norford, Rees)
5. Update toolkits (Lebrun)

The exercise will be repeated, using a simpler procedure, before the Chicago meeting, and annually thereafter.

### **RTARS Potentially Approvable and Prioritizable**

Three RTARS were discussed:

- *Internal Surface Convection Modelling* (Dan Fisher, Ian Beausoleil-Morrison). Discussion focused on the range of systems to be studied, existing experimental facilities and how the work might be phased. Jan Kosny stated that Oak Ridge National Laboratory has a suitable test facility that could be made available at modest cost. This would make it easier for different organizations to bid different phases successfully. The Subcommittee recommends that this RTAR be prioritized in the Committee's research plan
- *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). Points raised in discussion included the need to consider computational efficiency when evaluating models and the need to assess moisture absorption in different situations, e.g. in HVAC load shifting (beneficial) and in natural ventilation (potentially harmful).
- *Models for Natural and Hybrid Ventilation* (Joe Huang). The scope has been narrowed to assessment of existing models for wind-driven cross ventilation, including prediction of flow rates through openings and prediction of the thermal consequences of non-uniform flow fields inside the building.

### **Other RTARS**

- *Technical and Usability Enhancements to the Energy Calculation Toolkits* RTAR 2004-19 (Dan Fisher, Jean Lebrun). Doubt was expressed about the potential enthusiasm of Special Publications for an updated combined version of the existing toolkits. Jean Lebrun has proposed significant extensions, including parameter estimation methods to facilitate the use of the models with manufacturers' data and with field measurements.
- *Create algorithms to allow mapping of manufacturer's or available data to simulation inputs* (Milorad Bojic, Bruce Billedeaux?, Mike Brandemuehl). A revised version, prepared by Milorad Bojic, was distributed but there was no time for discussion. Chip Barnaby opined that the topic is complementary to, rather than overlapping with, the work of GPC-20 (XML Definitions for HVAC). The topic may be considered by the Applications Subcommittee.

A request has been received from TC5.3 for co-sponsorship of an RTAR entitled *The Effects of Turbulent Air Introduction into Stratified Room Air Systems*. Copies were distributed but there was no time for discussion.

The meeting was adjourned at 7:36.

Submitted by Philip Haves

**ASHRAE**  
**Research Committee 4.7 Energy Calculations**  
**2005-2006 Research Plan**  
**24 August 2005**

TC 4.7 approved three new RTARs for consideration on the 2005-2006 Research Plan. In addition, there are three existing Work Statements under development.

<b>Title</b>	<b>TC Priority 2003-2004</b>	<b>Prior TC priority</b>	<b>Society status</b>	<b>TC Status</b>	<b>Authors</b>	<b>Subcom</b>
Technical and Usability Enhancements to the Energy Calculation Toolkits	0	3 (2003-2004)	RTAR 2004 accepted	WS under development	Dan Fisher	SCM
Development of a Procedure for Base-lining Energy Use at Large Central Plants	0	2 (2003-2004)	RTAR approved and prioritized by RAC	WS under development	Moncef Krarti, Agami Reddy	DDM
Procedures and Data for High-Performance Residential Design	0	1 (2003-2004)	RTAR accepted	WS under development	Joe Huang, Danny Parker, Tim McDowell	A
Developing internal surface convection correlations for energy and load calculations	1	0 (2004-2005)	Under review	RTAR approved and forwarded to RAC	Dan Fisher, Ian Beausoleil-Morrison	SCM
Development of protocol for accurate prediction of building annual energy use based on minimum short-term monitoring	2	0 (2004-2005)	Under review	RTAR approved and forwarded to RAC	Bass Abushakra	DDM
Datamarts of on-demand delivery of simulation results to building owners	3	0 (2004-2005)	Under review	RTAR approved and forwarded to RAC	Robert Sonderegger	DDM

SCM = Simulations and Component Models

DDM = Data Driven Modeling (formerly Inverse Methods)

A = Applications

**Additional TC 4.7 RTARs and WSs in Process – status as of 24 August 2005**

<b>Title</b>	<b>TC Priority 2004-2005</b>	<b>Prior TC priority</b>	<b>Society status</b>	<b>TC STATUS</b>	<b>Lead/ Comments</b>	<b>Subcom &amp; Priority</b>
Models for Natural and Hybrid Ventilation	HIGHEST	HIGHEST		RTAR under development	Paul Linden, Joe Huang, Phil Haves, George Walton, Les Norford, Tim McDowell	SCM
Assessment of moisture absorption/desorption models in whole building energy simulations	HIGH	HIGHEST		RTAR under development	Rich Liesen, Jan Kosny, Mike Brandemuehl	SCM
Algorithms for Mapping Manufacturer's or Available Data to Simulation Inputs	HIGH	HIGHEST		no progress	Milorad, Bruce Billedeaux, Mike Brandemuehl	A
Explicit Modeling Strategies for Radiant Heating and Cooling		HIGHEST		No progress since Jan 03 draft RTAR	Rick Strand, Jan Kosny	SCM
Procedures for adjusting baseline model for M&V projects due to creep and other causes.				No progress since concept proposed Jun 03	Dave Claridge	DDM

SCM = Simulations and Component Models

DDM = Data Driven Modeling (formerly Inverse Methods)

A = Applications

**ASHRAE TC4.7 HANDBOOK SUBCOMMITTEE NOTES**

The handbook chapter for the 2005 Fundamentals Handbook has been completed. The subcommittee did not meet.

**TC 4.7 program plan  
June 28<sup>th</sup>, 2005**

**Scheduled for Denver/June 25-29<sup>th</sup>, 2005**

Seminar

“Neglected Topics in Building Simulation”

Organized by: TC 4.7 (Simulation and Component Models)

Chaired by: Ian Beausoleil-Morrison

Status: Moved from Orlando

Contributions: (Spitler, McDowell, Huang, Brandemeuhl, Pedersen)

**Scheduled for Chicago/January 27-31<sup>st</sup>, 2006 \*\*\*Package Due 8/5/2005 \*\*\***

Seminar (Priority #1, Left-over from Denver)

“How and Why to Calibrate a Simulation to Measured Data”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Robert Sonderegger

Status: New (contributions by: Claridge, Reddy, Smith, Abushakra)

Seminar (Priority #2, Left-over from Denver)

“Application and Experiences With the New Simulation Software”

Organized by: TC 4.7 (Applications)

Chaired by: Dan Fisher

Status: Moved from Orlando

Contributions by: (Yuill, Haves, Pedersen, Crawley)

Forum (Priority #3)

“What Controls Modeling Capabilities are Needed for Energy Simulations”

Organized by: TC 4.7 (Sim. and Component Models)

Moderated by: Phil Haves

Status: New

Symposium

“Thermal Modeling of Phase Change Materials in Building Envelopes: Old Problem, New Developments”

Organized by: TC 4.7 (Sim. and Com. Models)

Chaired by: Jan Kosny

Status: 4 papers finished, 1 paper in progress.

Symposium

“Recent Advances in Simulation”

Organized by: TC 4.7 (Sim and Comp Models)

Chaired by: Dan Fisher



Status: 2 papers in hand, 1 technical paper from Brandemuehl - 1197

Symposium

“Validation of Building Simulation Programs Through ASHRAE Standard 140”

Organized by: TC 4.7 (Applications)

Chaired by: Chip Barnaby

Status: 4 papers being considered (contributions by: Yuill & Haberl, Judkoff & Neymark, Maxwell, Loutzenhiser).

Symposium

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

Organized by: TC 4.7 (Sim. and Com. Models)

Co-sponsored by: TC 2.8 & 7.1

Chaired by: Dru Crawley

Status: 8 papers submitted, 2 reviewed (possibly 2 symposiums)

Symposium

New Title “Application of Inverse Models”

Old Title “Inverse Models for Optimal Control”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Jeff Haberl

Status: (contributions by: Sonderegger, Norford x 2, Krarti)

**Quebec City/June 24-28<sup>th</sup>, 2006 \*\*\* Package Due 2/10/2006 \*\*\***

Symposium

“Survival of the Least Square Fittest: Genetic Algorithms for Buildings”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Les Norford

Status: New, 1 or 2 papers possible from Jonathan Wright

Symposium

“Modelling of Residential Cogeneration Systems: IEA/ECBS Annex 42”

Organized by: TC 4.7 (Sim. And Component Models)

Co-Sponsored by: TC 1.10

Chaired by: Tim McDowell

Status: 6 papers promised

**Dallas/January 27-31<sup>st</sup>, 2007**

Seminar

“Modeling of Double Envelope Facades and Active Windows”

Organized by: TC 4.7 (Simulation and Component Models)

Chaired by: Mike Brandemuehl

Status: New

Seminar

“Genetic Algorithm Shootout”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Bass Abushakra

Status: New

Symposium

“How and Why to Calibrate a Simulation to Measured Data”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Robert Sonderegger

Status: New (contributions by: Claridge/Liu, Reddy, Smith, Abushakra)

**Long Beach/June 23-27<sup>th</sup>, 2007**

## SSPC 140 Denver Meeting Summary – 6/27/05 (submitted 6/28/05)

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

#### SALES OF STANDARD 140

- 140-2001: 118 units sold (\$7712)
- 140-2004: 37 units sold (\$2581)

#### **Addition of new test procedures (as addenda):**

##### *Furnace BESTEST (proposed Addendum a to 140-2004):*

Substantial progress has been made. Furnace BESTEST was originally developed by NRCAN (Beausoleil-Morrison and Purdy) and field tested during IEA SHC Task 22. During the winter NRCAN (Patrice Pinel) distributed a draft addendum incorporating prior comments of Neymark. That draft was reviewed by the full PC with several pages of comments submitted in late April by Crawley, McDowell, Neymark and Pegues. Those comments were addressed with a new draft submitted by NRCAN on June 10, 2005. At the Denver SSPC 140 meeting further comments were submitted by Neymark, Pegues and Witte (about 1 page total of comments). NRCAN will address this latest round of revisions prior to addressing publication/public review approval (under new ASHRAE Standards approval procedures).

Development of a format for 140 results data to be posted on the DOE Tools web site. In Orlando an ad-hoc Data Format Subcommittee was formed to develop a format for 140 results data to be posted on the DOE Tools web site. The subcommittee has just begun work on this; specific key tasks have been assigned to various subcommittee members to formulate the format.

#### **Addition of other new test procedures (as addenda):**

##### *HERS BESTEST:*

HERS BESTEST was originally developed by NREL (Judkoff and Neymark) in conjunction with the HERS (Home Energy Rating Systems) Council. HERS BESTEST is similar to IEA BESTEST, but is meant for software that produce seasonal outputs rather than hourly outputs (hourly outputs are required by IEA BESTEST). Florida Solar Energy Center (Fairey) is championing adaptation of HERS BESTEST for Std 140, and reports to be roughly 50% complete with adaptation of the test suite.

##### *HVAC BESTEST VOLUME 2:*

NREL will put together a draft for adaptation of HVAC-BESTEST Volume II to Standard 140 by Sept 2005. Volume II is similar to Volume I except that dynamic cases

that cannot be solved analytically are treated.

### **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 and basements. This includes analytical verification tests (NREL, US)
  - 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)
  - Double-façade building – Aalborg U. (Denmark)
  - Mechanical equipment test cases - Dresden University of Technology (Germany):
    - Focusing on water-side components/systems: chillers, boilers, pumps, piping, valves, etc