

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: April 27, 2006

TC/TG/TRG TITLE: Energy Calculations

DATE OF MEETING: January 24, 2006 LOCATION: Chicago

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS & ADDIT'L ATTENDANCE
Les Norford (CHM)	2004			
Dan Fisher (VC)	2004			
Jeff Haberl (PROG)	2002			
Agami Reddy (DD)	2004			
	2003	Bill Bahnfleth		
	2004	Brent Griffith		
Patrick Carpenter	2003			
Joe Huang (RES)	2004			
Chip Barnaby (APP)	2005			
	2005	Richard Liesen (WEB)		
Michael Brandemuehl	2003			
Tim McDowell	2002			
Robert Sonderegger	2002			
George Walton	2003			
Bass Abushakra	2005			
	2004	Simon Rees (INTL)		
Jonathan Wright (INTL)	2003			
	2004	Mingsheng Liu		

DISTRIBUTION

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

TAC CHAIR	Eckhard Groll
TAC SECTION HEAD	Craig C. Wray
SPECIAL PUBLICATIONS LIAISON	Kimball E. Ferguson
STANDARDS LIAISON	George Reeves
HANDBOOK LIAISON	Douglas C Hittle
PROGRAM LIAISON	Joseph S Ferdelman
RAC RESEARCH LIAISON	Michael J. Brandemuehl
PROF DEV COMM LIAISON	Julian R. De Bullet
TECH TRANSFER LIAISON	Stephen V Abernathy
STAFF LIAISON (RESEARCH)	Michael R. Vaughn
STAFF LIAISON (TECH SERVICES)	Michael R. Vaughn
STAFF LIAISON (STANDARDS)	Claire Ramspeck

## ASHRAE TC 4.7 Energy Calculations

## CHICAGO MEETING

## ACTION ITEMS

1. **MOTION**—That TC 4.7 confirm the revisions to the three FAQ's on weather data made by Norford and approved by Applications SC (Barnaby/Fisher). **Motion carried 10-0-1 CNV.**
2. **MOTION**—That TC 4.7 recommends that the final report for 1051-RP be accepted subject to incorporation of editorial changes recommended by PMS by end of February (Sonderegger/Haberl). **Motion carried 11-0-2 CNV and Reddy (PI) abstaining.**
3. **MOTION**—To accept the program prioritization for Québec City as listed below (Haberl/Huang). **Motion carried 12-0-1 CNV.**
  - a. Symposium on "Validation of Building Simulation Programs Through ASHRAE Standard 140"  
(Chair: Chip Barnaby)

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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>	
Denver		June 28, 2005	Québec City	
Chicago		January 24, 2006	Dallas	
<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		Crawley/Hittle
<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	Chicago Jan 2006	Denver June 2005	Orlando Feb. 2005	Nashville June 2004			
	X	X	X		Abushakra	Bass	abushakr@msoe.edu
	X	X	X	X	Anderson	J.R.	jrhzal@bellsouth.net
			X		Ahmad	Mushtaq	<a href="mailto:mushtaq@esl.tamu.edu">mushtaq@esl.tamu.edu</a>
				X	Armour	Steve	sbarmour@southernco.com
X	X		X		Armstrong	Peter	<a href="mailto:Peter.armstrong@pnl.gov">Peter.armstrong@pnl.gov</a>
		X		X	Bahnfleth	Bill	wbahnfleth@psu.edu
	X				Balaras	Costas	costas@meteo.noa.gr
	X	X	X	X	Barnaby	Chip	<a href="mailto:CBarnaby@wrightsoft.com">CBarnaby@wrightsoft.com</a>
	X	X		X	Beausoleil-Morrison	Ian	IBeausol@nrca.gc.ca
	X	X	X		Bernier	Michel	michel.bernier@polymtl.ca
	X	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
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	X	X	X	X	Brandemuehl	Mike	michael.brandemuehl@colorado.edu
	X				Brown	Rob	rbrown@ductsox.com
	X	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				Culp	Charles	cculp@tamu.edu
	X	X	X	X	Degelman	Larry	<a href="mailto:larry@taz.tamu.edu">larry@taz.tamu.edu</a>
	X	X			Ellis	Peter	peter_ellis@nrel.gov
		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			Goldman	Milton	greenbuilding@???
				X	Gorwick	Susie	susan.gorwick@honeywell.com
	X				Gowri	Krishna n	krishnan.gowri@pnl.gov

Present at TC 4.7 meeting?					Last name	First name	E-mail
Add to email list	Chicago Jan 2006	Denver June 2005	Orlando Feb. 2005	Nashville June 2004			
		X			Gueymard	Chris	chris@solarconsultingservices.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
	X	X	X	X	Haves	Philip	<a href="mailto:PHaves@lbl.gov">PHaves@lbl.gov</a>
	X		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		X		Judkoff	Ron	ron_judkoff@nrel.gov
		X	X		Kootin-Sanwu	Victor	victor.kootin-sanwu@uc.edu
				X	Koran	Bill	William.koran@honeywell.com
	X	X	X	X	Kosny	Jan	kyo@ornl.gov
	X	X	X		Krarti	Moncef	krarti@colorado.edu
		X			Lemort	Vincent	vincent.lemort@ulg.ac.be
			X		Levermore	Geoff	geoff.levermore@umist.ac.uk
		X		X	Liesen	Richard	rliesen@uiuc.edu
	X	X	X	X	Lisenbee	Larry	<a href="mailto:lrlesenb@southern.com">lrlesenb@southern.com</a>
				X	Luo	Dong	luod@utrc.utc.com
		X			malone	brian	bmalon1@uic.edu
	X	X	X	X	McDowell	Tim	<a href="mailto:Mcdowell@tess-inc.com">Mcdowell@tess-inc.com</a>
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			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	X	X	X	Reddy	T. Agami	reddyta@drexel.edu
			X	X	Shirey	Don	shirey@fsec.ucf.edu
			X		Smith	Vernon	<a href="mailto:VSmith@archenergy.com">VSmith@archenergy.com</a>
	X	X	X	X	Sonderegger	Robert	Robert.sonderegger@itron.com
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	X		X	X	Strand	Rick	<a href="mailto:rkstrand@uiuc.edu">rkstrand@uiuc.edu</a>
	X	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
					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>

Present at TC 4.7 meeting?					Last name	First name	E-mail
Add to email list	Chicago Jan 2006	Denver June 2005	Orlando Feb. 2005	Nashville June 2004			
				X	Xu	Peng	pxu@lbl.gov

**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) <b>Accept final report: (01-24-06)</b>
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**

<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>
Developing internal surface convection correlations for energy and load calculations	1	0 (2004-2005)	RTAR accepted in 2005	WS under development	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)	RTAR accepted in 2005	WS under development	Agami Reddy, Vern Smith	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>
1050	Inverse Modeling TK	U Dayton, TAMU	Kansas City June 2003	<i>Kissock, J.K., J.S. Haberl, D. E. Claridge, 2003, "Inverse Modeling Toolkit - Numerical Algorithms", ASHRAE Transactions, 425-434.</i>
1050	Inverse Modeling TK	U Dayton, TAMU	Kansas City June 2003	<i>Haberl, J.S., A. Sreshthaputra, D. E. Claridge, J.K. Kissock, 2003, "Inverse Modeling Toolkit - Application and Testing", ASHRAE Transactions 435-448.</i>
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&amp;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&amp;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&amp;R Research.</i>

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

**Current as of January 2006**

**PRESENT:**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)

**PLANNED:**Québec City/June 2006

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

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

Dallas/January 2007

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

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

**PAST:**Denver/June 2005

*None.*

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)

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

**Current as of January 2006**

**PRESENT:**

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)

**PLANNED:**

Québec City/June 2006

*None*

Dallas/January 2007

*What ever happened to AI for Simulation* (Chair: Agami Reddy)

*Modeling of Double Envelope Facades and Active Windows* (Chair: Mike Brandemuehl)

*Use of 'equation solvers' for Simulation* (Chairs: Jean Lebrun/Mike Wetter)

*Applications of Computer Simulation in High Performance Buildings* (Chair: Martha Brook)

*Experience with Simulation of Standard 90.1 Code-compliant Buildings* (Chair: Carol Gardiner)

**PAST:**

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)

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 January 2006**

***PRESENT:***

Chicago/January 2006

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

***PLANNED:***

***PAST:***

*None.*

**ASHRAE TC 4.7 Energy Calculations**  
**Tuesday, January 24, 2006, 18h00 to 20h30**  
**Wasash Room, Palmer House Hilton**  
**Chicago, Illinois**

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

- The meeting convened at 18h10.
- Norford chair, Beausoleil-Morrison secretary.

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

- Agenda accepted (Haberl/Barnaby) **10-0-1 CNV**.
- Denver minutes accepted without changes (Walton/McDowell **10-0-1 CNV**).

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

- Norford reviewed the scope of TC 4.7.
- Program changes for Québec City: sessions will start at 7h45 and there will be sessions from 13h45 to 15h15. Program is also reserving the 15h30 to 17h00 time slot if needed. Back-to-back sessions will be possible, but there may be an hour chunk for forums separating two halves of a session.
- A scoping study has been conducted on the topic of measuring and reporting. Haberl helped develop the scoping document. The goal is to produce a special pub in the near-term. In the long-term there may be a standard or guideline. A Task Group will be established by TAC to monitor the work that will be conducted by a contractor. Haves volunteered to represent TC 4.7 in this undertaking.
- The Design Guide Navigator was discussed. The idea for this came from TC 4.7. The intent is to provide design guidance. TAC and Handbook are supportive of the idea. Barnaby, Fisher, Crawley, and Norford are involved. Section 7 is thinking of something similar or operations side.
- Our Handbook chapter was published in 2005. Crawley has taken over from Strand as TC 4.7 Handbook chair.
- The difficulties that some people have in attending meetings was discussed. Web-based meetings not likely to help in near future. Conference call facility may be provided in future.
- RTARs can be reviewed by RAC at each meeting. 45 days lead time required.
- TC 4.7 has a wonderful program at this meeting (4 symposia, 2 seminars, 1 forum).
- George Walton is now an ASHRAE Fellow.

**4. Membership (Norford)**

- Roster must be submitted by midnight tonight.

**5. Subcommittee reports**

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

- ASHRAE has assigned a cognizant TC to each FAQ. Three of these have been assigned to TC 4.7. These three FAQs were reviewed, all of which relate to weather data. **MOTION**—That TC 4.7 confirm the revisions made by Norford and approved by Applications SC (Barnaby/Fisher). **Motion carried 10-0-1 CNV.**
- Research topics list reviewed. No RTARs or WS that are ready. Lots of interest in modelling fenestration: SHGC and U-value not sufficient for energy modelling. Will be talking with 4.5.
- Simulation guidelines related to 90.1 ECB. Norford to liaise with 90.1 to determine how we can work more closely on this.

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

- 14 attendees at meeting.
- Seminar proposed on genetic algorithm "shoot-out".
- Datamart RTAR rejected by RAC. DDM has decided to drop this.
- RTAR on short-term building monitoring. Returned with comments by RAC. Revisions have been made. Accepted. WS under development. Hope to have WS ready for TC consideration in Québec.
- DDM to review Haberl scoping study.
- Time slot change with SCM? DDM committee supports this.

- Reddy would like to roll-off as SC chair.

1051-RP PMS (Sonderegger): Procedures for reconciling simulation results with measured data.

- Systematic methodology to calibrate simulations to measured data.
- PI has automated procedure.
- Commenced September 2003.
- Draft final report received by PMS last month. PMS has reviewed and is pleased with content. A number of editorial comments have been provided to PI. Final report should be ready by end of February.
- Two ASHRAE papers have been written (symposium at Chicago + JHVAC&R submitted).
- Outcome: problem is underdetermined. Procedure comes up with a small number of "best" simulations. Recommendation is to use all of these and to use median predicted by this set of simulations.
- **MOTION**—That TC 4.7 recommends that the final report be accepted subject to incorporation of editorial changes recommended by PMS by end of February (Sonderegger/Haberl). **Motion carried 11-0-2 CNV and Reddy (PI) abstaining.**

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

- Switch time slots with DDM?
- Internal surface convection modelling: RTAR has been accepted. Draft WS discussed. Should the scope of work include both heating and cooling? TC 4.1 has approved WS as co-sponsor. Being considered by TC 5.3 but they have deferred discussion to Québec. Hope to have WS ready for TC 4.7 vote in Québec.
- Enhancements to toolkits. RTAR approved a couple of years ago. WS discussed. Some discussion about format of models: FORTRAN or equation based solvers? Discussions to continue electronically. Hope to have revised WS to discuss in Québec.
- RTAR on natural and hybrid ventilation discussed. Good prospects for co-funding by CEC. Might be two-phase project. Comparative testing of existing models using existing data sets. Second phase: experiments in real buildings + model improvements. Would like to get RTAR approved so as not to miss CEC funding opportunity. Recommendation is to send revised RTAR to SC for review and letter ballot to TC in March.
- Draft RTAR on moisture absorption/desorption circulated but not yet discussed.
- TC 6.5 has developed an RTAR on radiant heating/cooling on its own, but is not looking for TC 4.7 comments and co-sponsorship. This had been on SCM's wish list. TC 6.5 wants to letter ballot RTAR prior to Québec. Strand coordinating.

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

- Three RTARs forwarded to RAC after Denver. Two accepted (internal convection and short-term monitoring), one rejected (datamarts).
- Two WSs under development. (Baselining at large central plants has now been dropped.)
- Two RTARs under development.
- A number of topics are also under discussion but not yet at RTAR stage.
- 1311-RP (Crawley reporting):
  - Good progress on model development.
  - Work underway to test and validate model.
  - Strong sensitivity to convection coefficient assumptions. Justification for internal convection RTAR.
  - TC 4.1 happy with progress.
- TC 5.3 request for TC 4.7 co-sponsorship of RTAR entitled "Effects of Turbulent Jet Injection into Stratified Room Air Systems". Fisher has commented previously, but many of his comments were not incorporated. Current draft does not tie work well to energy calculations (e.g. toolkits). RTAR lacks detail. No motion.
- Brandemuel (research liaison from RAC):
  - Technical and usability enhancements of toolkits has turned into a pumpkin.
  - Two policy proposals have been passed by Tech Council in Chicago. 1) Better value on bids (points per \$). 2) Conflict of interest for WS authors: authors can only be recognized as bidders if there are at least 3 authors, and there are at least 3 bidders, and as long as the work does not

require specialized facilities that are only available to the author. In addition, the author's bid must not be less than 90% of the recommended budget.

- RTAR and WS justifications must be tied to ASHRAE's long-term research plan. 45% weight placed on this.

#### **5.5 Handbook**, Crawley (chair) reporting (**Attachment F**)

- 8 attended meeting.
- Looking for volunteers to review sections.
- Wray:
  - ASHRAE will be commissioning a review of the Fundamentals volume this year. Review to be conducted by practitioners and new engineers. Comments may be forthcoming. This process will help define readership.

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

- Lots of TC 4.7 program in Chicago. Good attendance.
- New symposium review process not working efficiently. This is holding up program items.
- Symposium (carry-over from Chicago) on "How low can you go" ready for Québec. TC 4.7 is co-sponsor.
- Symposium on 140 may be ready for Québec.
- **MOTION**—To accept the program prioritization for Québec City as listed below (Haberl/Huang). **Motion carried 12-0-1 CNV.**
  - Symposium on "Validation of Building Simulation Programs Through ASHRAE Standard 140" (Chair: Chip Barnaby)
- TC 4.7 will also co-sponsor a symposium on "How Low Can You Go? Low-Energy Buildings Through Integrated Design" (Chair: Dru Crawley).
- There was some discussion on the Chicago seminar on "New simulation tools". It was stated that the space was unsuitable for a seminar: the room was too small, it was difficult to see the screen, and the attendance exceeded the fire regulations. Wray to mention this at TAC. Norford to communicate this to program committee.

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

- Judkoff reporting on 140:
  - 90.1 to reference Standard 140-2004.
  - Addendum "a" on furnace test cases (from IEA Task 22 Furnace BESTEST) has been voted by committee. Will go to public review this March.
  - Addendum "b" on unitary cooling equipment (from IEA Task 22 HVAC BESTEST II) may be ready for committee letter ballot in February and subsequent public review in March.
  - Data format ad-hoc SC to frame recommendations for protocol for posting simulation program tests following 140 to DOE web site.
- Judkoff on IEA 34/43 ground coupling:
  - Work progressing on test suite.
  - Number of models (some highly detailed) being tested.
- Judkoff on other IEA 34/43 research:
  - Multi-zone test cases, double facades, daylight interaction, hydronic systems, and others.

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

- Norford reporting for Liesen.
- Personal information being stripped from roster that is posted on web site.
- Rosters with e-mail addresses to be posted on secure area of web site.

### **6. Reports on related activities**

#### **6.1 GPC 20 XML Definitions for HVAC&R (Barnaby)**

- Leadership issues have been resolved. Barnaby now chair.
- Working on guideline.
- TC 1.5 has RP to assess available schemas that will feed into GPC 20's work.
- Looking for more members.



**6.2 TC 2.8 Sustainability (Crawley)**

- Active in program area.
- Working on update to ASHRAE Green Guide.
- Recommended development of new standard on Low Energy Green Buildings, which will be joint ASHRAE / GBC Standard.
- Call for members of this SC in near future.
- Looking for people interested in working on a water standard.

**6.3 TC 4.1 Load Calculations (Barnaby)**

- Reviewing chapter revisions.
- Approved co-sponsorship of internal surface convection work.

**6.4 TC 4.2 Climatic Information (Huang)**

- RP on tropical solar models coming to conclusion.
- Contractor just selected for RP on design day procedures, with emphasis on clear sky model. Big change is that weather data is not printed in handbook but rather in accompanying CD.
- RP multi-band clear sky model coming to conclusion.
- Developing RTAR on data filling. Idea originated from TC 4.7.
- Developing RTAR to synthesize hourly data when only monthly averages available.

**6.5 TC 4.5 Fenestration (Nobody reporting)****6.6 TC 6.5 Radiant Heating and Cooling (Strand)**

- TC reorganized after Nashville. Just getting re-organized.

**6.7 TC 7.4 Building Operation Dynamics (Brandemuehl)**

- RP 1194 recently completed on modelling of dynamic cooling coil model.
- RP on interaction of dynamic electricity rates and TES.

**6.8 TC 7.5 Smart Building Systems (Reddy)**

- Main areas: FDD, wireless communications, communications between building and control systems. First is most relevant to TC 4.7.

**6.9 TC 7.6(9.6)Systems Energy Utilization (Abushakra)**

- Timing conflict with 4.7 meetings.

**6.10 IAI International Alliance for Interoperability (Haves)**

- Nothing to report.

**6.10 IBPSA (USA, Canada, World, BS 2007)**

- IBPSA-USA (Haves):
  - Discussion in Chicago on accreditation of energy analysts for federal tax credits. Decided to focus efforts on accreditation rather than training.
  - SimBuild 2006 (2nd IBPSA-USA conference). August 2-4. Training workshops. Abstracts due end of January.
- IBPSA-Canada:
  - eSim 2006 in Toronto.
  - IBPSA-Canada now incorporated.
  - Starting to spend its proceeds from BS 2005 on student travel awards.
- IBPSA-World:
  - BS 2005 in Montréal : about 300 attendees.
  - BS 2007 to be held in Beijing at beginning of September.
  - Jan Hensen incoming president.

**7. Old Business**

- None.

**8. New business**

- None.

### **9. Executive Session**

- None required at this meeting

### **10. Adjourn**

- **MOTION**—That meeting be adjourned (Haberl/Haves). **Motion carried 12-0-1 CNV.** Meeting adjourned at 20h27.

### **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

**ASHRAE TC 4.7 Energy Calculations**

Tuesday, January 24, 2006, 6:00-8:30 p.m.

Wabash Room

Palmer House Hilton

Chicago, IL

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1. Roll call and introductions	Beausoleil-Morrison
2. Accept agenda & approve minutes of Denver meeting	Norford
3. Announcements/Liaisons	Norford
4. Membership	Norford
5. Subcommittee reports	
5.1 Applications	Barnaby
Research Wish List Update	Barnaby
5.2 Data-Driven Modeling	Reddy
Research Wish List and RTAR 1404 Update	Reddy
1051-RP Procedures for Reconciling Computer-Calculated	Sonderegger
Results with	
Measured Energy Data (Drexel Univ)	
5.3 Simulation & Component Models	Haves
Research Wish List and RTAR 1416 Update	Haves
5.4 Research	Huang
TC 4.7/ASHRAE Research Plan	Huang
Status of RTARs co-sponsored with TCs 4.2 and 5.3	Huang
1311-RP Improving Load Calculations for Fenestration with	Crawley
Shading Devices (TC 4.1/4.5/4.7; Univ. of Waterloo)	
5.5 Handbook	Crawley
5.6 Program	Haberl
5.7 Standards	Neymark
SSPC 140 SMOT for Eval Building Energy Analysis	Judkoff
Computer Programs	
IEA Annex 34/43 Test and Validation of Building Energy	Judkoff
Simulation Tools	
5.8 Web Site	Liesen
6. 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 Building Operation Dynamics	Brandemuehl
TC 7.5 Smart Building Systems	Reddy

- TC 7.6 Systems Energy Utilization --
- IAI International Alliance for Interoperability Haves
- IBPSA: USA, SimBuild 2006; Canada, eSim 2006; IBPSA, BS Haves, Beausoleil-  
Morrison, Spitler
- 2007
- 7. Old Business
- 8. New business
- 9. Executive Session
- 10. Adjourn

## ASHRAE TC 4.7 Energy Calculations

### Applications Subcommittee

Tuesday, January 24, 2006, 3:30 – 5 PM  
PDR 4, Palmer House, Chicago, IL

#### Minutes

Present: Barnaby, Beausoleil-Morrison, Brook, Degelman, Haberl, Haddad, Hensen, Huang, McDowell, Neymark, Norford, Walton, Wetter

#### Status of Denver Action Items

<i>Who</i>	<i>When</i>	<i>What</i>	<i>Status</i>
Barnaby	Meet program deadlines for Quebec	Std 140 Symposium	In process (see below)
Barnaby, Haberl, Sonderegger, Walton	July?	Comments on 1342-WS and 1343-WS	Done
Barnaby	September	Circulate ideas re SC goals / mandate / research wish list	No progress
McDowell	Chicago	Assess Building America re overlap with Representative Data project	See note below

Meeting began at 3:45 p.m. The agenda was circulated and introductions were made. Subcommittee minutes from Denver will be subject to an approval vote by the full TC, as part of the complete minutes package.

#### TC 4.7 FAQs

At the request of Les Norford, the subcommittee reviewed revisions to the ASHRAE FAQs for which TC 4.7 is the cognizant TC (FAQs # 40, 63, and 88). The update was deemed to be in good shape. The subcommittee recommended that the full TC approve the revisions and transmit them to HQ.

#### PROGRAM

Haberl presented the planned program for Quebec, Dallas and beyond. There was one new Seminar for Dallas “Applications or Computer Simulation for High Performance Buildings”. Tim McDowell offered a presentation.

Barnaby reported on the symposium, “Validation of building simulation programs through ASHRAE Standard 140.” Status: 4 papers, all reviewed at least once. Touch-and-go for Quebec.

There was also some discussion about the Seminar “equation solvers” for simulation.

These ideas will be folded into Haberl’s program report to the full TC.

**RESEARCH**

**1342-WS / 1343-WS.** The committee discussed 1342-WS (Energy Consumption of Healthcare Spaces by Function) and 1343-WS (Method of Testing and Data Collection for Energy Characteristics of Healthcare Medical Equipment). It is not clear whether TC 4.7 is being asked to co-sponsor these efforts. The committee remains luke-warm at best regarding these projects, especially 1342-WS. Our comments to this effect were transmitted in July, 2005. It was decided to take no action until TC 4.7 receives a specific request.

**Development of Enhanced Window Simulation Capability for Standard 90.1 Prescriptive Simulation.** Issues include using Windows5 or Windows6 and Standard 90.1...the problem is that one must currently have a window to use Window5, yet one only has U-factor and SHGC and an assumption about the frame to do the standard simulation for 90.1. Joe will continue to scope out this effort and communicate with TC 4.1, TC 4.5, 4.7 and 90.1

**Representative Data for Residential Energy and Load Calculations.** Tim McDowell reported that he had done some preliminary investigations on this but did not have an RTAR. Building America has a database of assumptions. Tim reported that while Building America had organized information usefully, their underlying sources were not new.

Haberl said that Energy Star was also going into this with their new BOPs (Builder Option Packages). Huang said that there were also differences in the baseline numbers from MEC...which came from FSEC, which are different that Building America and Annual Energy Performance committee of NFRC. He has not resolved where this came from.

McDowell said that there is still a need for this...Building America was actually doing some measurements, but he was not aware that he new results had made their way into the benchmark numbers.

ACTON: Huang and Barnaby will contact Building America and assess what they are doing. It may be possible to coordinate efforts so ASHRAE can fund a project that contributes info to weak areas of Building America.

**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.** The issues include how to do simulation for 90.1, including the sizing of the chillers, etc.

ACTION: L.Norford said that he would contact Jason Glazer and / or Bill Bahnfleth about how TC 4.7 could support 90.1-related applications of simulation.

**Demonstration Toolkit on Building Energy Simulation use in Building Design for Training and ASHRAE Handbook CD+ Use.** No progress. Beausoleil-Morrison suggested that there might be more impact through repeated program presentations on simulation. Drop project.

Meeting adjourned at 5:10 PM.

**Summary of action items**

<b>Who</b>	<b>When</b>	<b>What</b>
Barnaby	Meet program deadlines for Quebec	Std 140 Symposium
Huang	Before Quebec	Continue development of scope ideas for improved match between simulation applications and fenestration ratings (SHGC and U-factor)
Huang	Before Quebec	Make contact with Building America. Develop scope ideas for

Barnaby		residential representative data WS.
Norford	Before Quebec	Contact Jason Glazer and/or other 90.1 ECB participants. Attempt coordination of activities.

TC 4.7 SUBCOMMITTEE: DATA-DRIVEN MODELING

Palmer House, Chicago, IL  
7:30 to 9:00 p.m.  
Monday, January 23, 2006

MINUTES

NAME	Affiliation	email
Costas Balaras	NOA	<a href="mailto:costas@meteo.noa.gr">costas@meteo.noa.gr</a>
Mike Brandemuehl	CU	<a href="mailto:Michael.brandemuehl@colorado.edu">Michael.brandemuehl@colorado.edu</a>
Vernon Smith	AEC	<a href="mailto:vsmith@archenergy.com">vsmith@archenergy.com</a>
Robert Sonderegger	Itron	<a href="mailto:Robert.sonderegger@itron.com">Robert.sonderegger@itron.com</a>
Jeff Haberl	TAMU	<a href="mailto:jhaberl@tamu.edu">jhaberl@tamu.edu</a>
Bass Abushakra	MSOE	<a href="mailto:abushakr@msoe.edu">abushakr@msoe.edu</a>
Moncef Krarti	CU	<a href="mailto:krarti@colorado.edu">krarti@colorado.edu</a>
Joe Huang	LBNL	<a href="mailto:jhuang@lbl.gov">jhuang@lbl.gov</a>
Kris Subbarao	TAMU	<a href="mailto:ksubbarao@tamu.edu">ksubbarao@tamu.edu</a>
Larry Degelman	TAMU	<a href="mailto:ldegelman@cox.net">ldegelman@cox.net</a>
Michael Wetter	United Technologies	<a href="mailto:wetter@utrc.utc.com">wetter@utrc.utc.com</a>
Peter Armstrong	PNNL	<a href="mailto:Peter.armstrong@pnl.gov">Peter.armstrong@pnl.gov</a>

- 1) Agami Reddy (AR) started the meeting at 7:40 PM with introductions.
- 2) Agenda sheet was circulated.
- 3) The minutes from the Denver meeting were circulated to all attendees to be reviewed and approved. Joe Huang pointed out some small errors which needed to be corrected, and Larry Degelman suggested that the names of the participants should be added to the minutes. A.Reddy agreed to make these change and include a list of attendees henceforth. The minutes were then approved by voice vote.
- 4) Discussion then went on to program. Jeff Haberl presented the program. There was some discussion about new sessions for Dallas and beyond. Also, Symposium CH-06-05 was only allocated 50 min for four speakers. Haberl informed the attendees that the TC chair will write a letter to ASHRAE on this issue.

For Dallas, Bass Abushakra suggested having another shootout for genetic algorithms using the same data set as the first Predictor Shootout I. There was quite a bit of discussion about this since a certain amount of preparation and time commitment were needed to advertise, decide on the data set, describe the rules of the competition, analyze the results and prepare a summary.

**Action 1.** Abushakra to formulate an action plan for the above and report back to the SC in June.

Brandemuehl suggested the topic: for a seminar in Dallas entitled “What ever happened to AI for Computer Simulation”. After some discussion A.Reddy volunteered to chair this seminar and contact potential speakers.

**Action 2:** Reddy to contact line up 3-5 potential speakers by June.

- 5) RTARs and WS



A.Reddy reported that contrary to his promise, he did not work on the approved WS “Large Central Plants...”. Brandemuehl pointed out that this WS had rolled off the list of approved RTARs. After some discussions, it was suggested that this RTAR given a new title, updated, and resubmitted anew

**Action 3:** A.Reddy agreed to continue to work on this RTAR.

Huang announced that this RTAR for “Filling of data gaps for missing data...” has moved to TC 4.2. Joe Huang who is currently championing this work will work with Claridge, who originally suggested the topic.

Discussion then went on to the WS “Modeling, Analysis and Reporting Protocols for Predicting Annual Energy Use From Short-term Building Monitoring”, by B.Abushakra, R.Sonderegger and V.Smith. Reddy pointed out that this was a prioritized and approved RTAR. Copies of the draft WS was circulated for discussion.

There was some discussion about some new rules about WS authors. RAC may be limiting how WS can be written by an author and submitted.

The subcommittee then took a few minutes read the WS.

J.Haberl suggested that the WS needed to be expanded to include “...predicting use and demand...”. Also, J.Haberl suggested making this read “...predicting building energy performance...”.

L.Degelman suggested that there was some need to change the section that talked about “...monitoring until achieved accuracy was accomplished...”

M.Brandemuehl suggested there was a need to clarifying the tasks...task 3 didn’t seem to fit.

K.Subbarao asked why only linear or change-point models were being used.

M.Brandemuehl asked how the 4 to 6 week period would be chosen...might there be a role for simulation to help determine this.

There was then some discussion about whether or not simulation could be used in place of the measured data.

M.Brandemuehl also said that there would need to be additional information for bidders. Where is the data coming from. How is the data to be used.

M.Brandemuehl also said that the WS needed to be aligned to the “goals” of RAC. Finally, this WS needed to be reformatted to meet the new “boilerplate”.

**Action 4:** Reddy and Vern Smith to collate all the above comments and revise the draft WS for discussion at Quebec City in June 2006.

6) New RTARs.

Discussion then went on to the Scoping Study “Protocols for Measuring and Reporting the On-site...” by J.Haberl. He informed the subcommittee of this effort which required the expertise of several TC including the DDM SC.

**Action 5:** A.Reddy asked the committee to read the report and think about future research ideas for the subcommittee to be discussed at Quebec City.

Reddy solicited new ideas for RTARs. Reddy requested Sonderegger and Subbarao to prepare a draft RTAR in continuation to RP1051 which identified some future research needs for calibration of detailed simulation programs.

**Action 6.** Sonderegger and Subbarao to prepare such a draft RTAR.

7) A.Reddy then informed the SC that Phil Haves, Chair of the Simulation and Component models had suggested that the meeting time of his SC which meets in the same room from 6:00 till 7:30 pm be interchanged with DMM SC. Reddy had agreed to this change, and the attendees supported this decision.

8) Reddy then announced that he would be looking for a new chair for the subcommittee. Anyone who wanted to volunteer could throw their hat in the ring. K.Subbarao agreed to shoulder this responsibility but wanted to know the length of the SC chair tenure. Norford as TC chair to brief Subbarao on duties and responsibilities of SC chair.

Meeting adjourned at 9:05 PM

## TC4.7 Simulation and Component Models Subcommittee

### Meeting Minutes: Monday, January 23, 2006

#### Introductions and Agenda Review

The meeting was scheduled to run from 6:00pm to 7:30pm. The meeting was called to order at ~6:10 but most attendees did not arrive until ~6:30. The ultimate attendance was ~20.

#### Program

Five program items at the Chicago meeting originated in SCM:

- **Symposium** on *How Low Can You Go? Low-energy Buildings Through Integrated Design* (Chaired by Dru Crawley, sponsored by TC2.8, co-sponsored by TC4.7)
- **Symposium** on *Recent Advances in Energy Simulation* (Chaired by Dan Fisher).
- **Symposium** on *Thermal Modeling of Phase Change Materials in Building Envelopes: Old Problem, New Developments* (Chaired by Jan Kosny).
- **Seminar** on *Application and Experiences with the New Simulation Software* (Chaired by Dan Fisher).
- **Forum** on *What Controls Modeling Capabilities are Needed for Energy Simulations?* (Moderated by Philip Haves)

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

#### Work Statements

*Internal Surface Convection Modeling* (Dan Fisher, Ian Beausoleil-Morrison).

The RTAR (1416) was approved by RAC and Dan Fisher presented a Work Statement. The aim is to determine convection coefficients on the inside surface of exterior walls and windows in rooms with slot diffusers in the ceiling and in rooms with diffusers in the floor. For reasons of time/cost, the scope is limited to cooling. The Work Statement has been approved, with latitude for minor changes, by TC4.1 and is being considered by TC4.5 and TC5.3. A number of minor issues remain to be resolved and it is hoped to have the Work Statement ready for TC4.7 vote in Quebec City.

*Technical and Usability Enhancements to the Energy Calculation Toolkits* RTAR 2004-19 (Dan Fisher, Jean Lebrun)

A Work Statement exists for this project but it was not available for discussion at the meeting. This Work Statement calls for usability enhancements to the original three toolkits (HVAC Primary, HVAC Secondary, Loads), including translation from Fortran 77 to Fortran 95 and consistency of documentation. There was some discussion about whether the models should be provided in different formats, e.g. for equation-based and object-oriented environments, which led to some discussion of who the likely users would be. The Work Statement will be circulated by email and other perspectives solicited before a revised Work Statement is considered in Quebec City.

**RTAR's**

*Models for Natural and Hybrid Ventilation* (Joe Huang, Simon Rees, Philip Haves, Tim Mcdowell)

Joe Huang presented a two phase RTAR that calls for comparative testing of different models with existing sets of measured data in the first phase and testing with new data from real buildings in the second phase. There is a possibility of co-funding from the California Energy Commission. In order to involve CEC it may be desirable to get the RTAR to the point where it could be voted by email by ~May 7 so that could be considered by RAC in June.

*Moisture absorption/desorption by building materials and furnishing* (Kosny, Karagiozis, Holm).

An RTAR on this topic was distributed to limited number of attendees with a particular interest in the topic to solicit input that would lead to a revised RTAR for discussion in Quebec City.

*Develop a Radiant System Module for the Simulation and Analysis of Spaces and Systems* (Rick Strand).

TC6.5 is seeking co-sponsorship of this proposed project. Copies of a Work Statement were distributed to interested attendees.

*Create algorithms to allow mapping of manufacturer's or available data to simulation inputs* (Milorad Bojic, Bruce Billedeaux, Mike Brandemuehl). No progress was reported.

**Adjourn**

The meeting was adjourned at 7:31.

# ASHRAE

## Research Committee 4.7 Energy Calculations

### TC 4.7 research plan

#### Chicago ASHRAE meeting

submitted by Joe Huang, Research Subcommittee chair

February 2, 2006

#### Work Statements under Development

1. *Development of internal surface convection correlations for energy and load calculation methods* (SC: DFisher, IBeausoleil-Morrison) Status: RTAR approved Oct 04, draft WS circulated and extensively discussed at subcommittee meeting in Chicago, WS will be revised and recirculated at subcommittee meeting in Quebec.
2. *Development of protocol for accurate prediction of building annual energy use based on minimum short-term monitoring* (DDM: AReddy, VSmith) Status: RTAR approved Oct 04, draft WS circulated and reviewed in subcommittee at Chicago. WS will be revised and resubmitted to subcommittee by Quebec

#### RTARs drafts under development

1. *Models for natural and hybrid ventilation* (SC: Joe Huang) Status: RTAR drafts circulated and discussed in subcommittee for 2 years, latest RTAR expanded to a two-phase project with possible co-funding, will be reworked and resubmitted to subcommittee in February for vote and possible forward to full committee in March.
2. *Assessment of moisture/desorption models in whole building energy simulations* (SC: Jan Kosny) Status: RTAR drafts circulated with slight discussion in subcommittee for 1.5 years, latest RTAR draft circulated but not discussed in subcommittee at Chicago, will be resubmitted to subcommittee in Quebec.
3. *Development of a procedure for baselining energy use at large central plants* (DDM: AReddy) Status: RTAR was approved in 2003, but since no WS was ever submitted, the project fell off of ASHRAE's research plan. A new RTAR will be developed and submitted to subcommittee by Quebec

#### Co-sponsored RTARs

1. Determining standard robust procedures for filling data gaps important for energy analysis (TC 4.2 lead, DDM: YJHuang) Status: RTAR approved Oct 04, WS under development.
2. The effects of turbulent air jet introduction into stratified room air systems (TC 5.3 lead, SC: RStrand) Status: RTAR approved Jun 04, WS under development
3. "Drive-by Simulations" (TC 1.5 lead, A: JHaberl) Status: RTAR under development.

#### Other research topics under discussion

1. Development of enhanced window simulation capabilities for Standard 90.1 prescriptive simulation (A). no specific action beyond continued liaison with TC 4.1 and TC 4.5.
2. Representative data for residential energy and load calculations (A). Will evaluate Building America operating assumptions and identify additional work that can be done by TC 4.7.

3. Toolkit of energy conservation measures for ASHRAE Standard 90.1 ECB method (A). Morphed into a seminar for program in Long Beach.
4. Demonstration toolkit on building energy simulation use in building design for training and ASHRAE Handbook CD+ use (A). no activity since Denver.
5. Mapping of manufacturer's or available data to simulation inputs (A) no RTAR, no activity since Denver;. been around for years.

**Meeting Minutes**  
**Handbook Subcommittee**  
ASHRAE TC 4.7 Energy Calculations  
5:00-6:00 pm, Tuesday, January 24, 2006  
PDR 4, 3<sup>rd</sup> Floor, Palmer House Hilton Hotel  
Chicago, Illinois, USA

Present: Costas Balaras

Ian Beausoleil-Morrison  
Dru Crawley (Subc Chair)  
Jeff Haberl  
Kamel Haddad  
Ron Judkoff  
Joel Neymark  
Michael Wetter

Chair Crawley called the meeting to order at 6:05 pm. Those present introduced themselves.

Crawley indicated that electronic copies of the 2005 Fundamentals Chapter 32 were available for review. The schedule for the update of the chapter has TC 4.7 voting to approve the updated chapter by the Annual Meeting in 2008. Crawley distributed the review from the Handbook Committee, which listed a number of minor typographical changes needed in the 2005 Chapter 32 (see attached).

The group quickly reviewed the existing chapter material and suggested that work be focused on the following areas:

- Updates for recent TC 4.7 research projects including 865-RP, 1050-RP, 1092-RP, 1093-RP, etc.
- Ground heat transfer needs substantial updating including Bahnfleth and Deru.
- Table 1, Haberl students to update
- Need discussion of toolkits and updates—Loads, HVAC1, HVAC2.
- Couple airflow models (Haves/Hensen)
- Genetic algorithms/1049-RP (Wright/Nelson)
- Window blinds/shades/screens modeling/1311-RP (Barnaby)
- Bringing the validation/testing methods discussion up to date (Neymark/Judkoff)
- Comparison of simulation tools (Crawley)

It was agreed to solicit authors/reviewers at the TC 4.7 meeting.

In early spring, Crawley will put out a call for updates to the chapter on the TC 4.7 mail list.

Meeting ended at 6:45 PM.

# ASHRAE<sup>®</sup> HANDBOOK CHAPTER REVIEW FORM

Handbook Volume Reviewed: Fundamentals Volume Year: 2005 Date: 12-7-2005

Chapter No. 32 Chapter Title Energy Estimating and Modeling Methods

1. Does this chapter, in your opinion, truly reflect the state of the art? Yes  No  Somewhat

If you answered "no" or "somewhat," please indicate typical example(s) below or provide an attachment.

2. Check the description that most nearly categorizes the relevance and balance between theory and practice in this chapter:

- a. Too much theory, not enough practical application.
- b. Just about right.
- c. Too little theory to support the recommendations.
- d. Obsolete—remove this subject from ASHRAE publication.
- e. Other: \_\_\_\_\_

3. Tables in this chapter are (check all that apply):

- a. Clear and understandable.
- b. Adequately footnoted.
- c. Properly referenced in the text.
- d. Sufficient for the average user.
- e. Too voluminous for a Handbook chapter.
- f. Inadequately documented.
- g. Not required (please list specific tables):
- h. Other: \_\_\_\_\_

1. Please identify tables prompting negative comments:

2. Please suggest tables, if any, that should be added to make the chapter more useful:



4. Equations and derivations are (check all that apply):

- a. Clear and understandable.
- b. Sufficient for the average user.
- c. Properly referenced in text.
- d. Properly footnoted to identify variables.
- e. Too voluminous for a Handbook chapter.
- f. Inadequately documented.
- g. In need of improvement.
- h. Not required (please list specific equations or passages):
- i. Other: See comments at end.

1. Please identify derivations/equations prompting negative comments:
  
2. Please suggest alternatives:

5. The examples given in this chapter are (check all that apply):

- a. Clear and understandable.
- b. Adequate for the average user.
- c. Appropriately interfaced with the text.
- d. Mathematically correct.
- e. Use the tables as indicated by the text.
- f. Inappropriate.
- g. Obsolete.
- h. Too complicated.
- i. Useless.
- j. Not required (please list specific examples):
- k. Other: \_\_\_\_\_

1. Please identify examples prompting negative comments:
  
2. Please identify sections that need more explanation or examples to clarify them:

6. The figures and graphics in this chapter are (check all that apply):

- a. Clear and understandable.
- b. Adequate for the average user.
- c. Appropriately interfaced with the text.
- d. Properly footnoted.
- e. Hard to read.
- f. Inappropriate.
- g. Obsolete.
- h. Not required (please list specific figures): \_\_\_\_\_
- i. Other: \_\_\_\_\_

- 1. Please identify figures or graphics prompting negative comments:
  
- 2. Please suggest additional figures, if any, that should be added to the chapter:

7. ASHRAE maintains a reputation as the “Standard of the Industry” in HVAC&R matters, with the Handbook series serving as its “bible.” In this context, and on an ascending scale from 0 to 7, please rate your overall evaluation of this chapter as a worthy representative of and contributor to this traditional role:

- 7 Couldn't be better in any way.
- 6 Well done—only nominal review required.
- 5 Okay, but needs update more often.
- 4 Technically correct, but needs editing.
- 3 Technically acceptable, but needs amplification.
- 2 Not technically up to date, but better than nothing.
- 1 Completely revise and update or drop immediately.
- 0 Drop from Handbook or any other publication.

**COMMENTS:**

- 1) On page 32.5 in the first full paragraph, third sentence, reference to Equation (36) of Chapter 30 should be Equation (27) of Chapter 30. Also needs to be corrected from (36) to (27) in third paragraph.
- 2) On page 32.5 in the fourth paragraph, reference to Equations (35) and (34) in Chapter 30 should be Equations (26) and (25).
- 3) On page 32.16 second column second line, reference to Equation (36) should be Equation (48).
- 4) On page 32.16 second column fourth and fifth paragraphs, references to Equation (34) should be Equation 47 in three places.
- 5) The following were noted in 'References' but not found in the body of the chapter text:
  - a) Haberl et al 1997
  - b) Reddy et al 2003
- 6) Reference for Bonne and Jansen dated 1989 in 'References' and 1985 in chapter text.
- 7) Reference for Yazdanian & Klems dated 1994 in 'References' and 1993 in chapter text and under 'Empirical Validation'.

**Please check this box if you wish to receive feedback via e-mail on your comments from this chapter's TC.** (Please note that any contact information you provide will be used only for this purpose, and will not be shared with any other parties.)

**Name:** Rennie Tisdale

**E-mail:**

## TC 4.7 Program Plan

### Chicago ASHRAE Meeting

January 26th, 2006

#### Chicago/January 27-31<sup>st</sup>, 2006

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**Symposium CH-06-01** Sunday 8:00 AM

“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

**Forum 6** Sunday 11:15 AM

“What Controls Modeling Capabilities are Needed for Energy Simulations”

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

Moderated by: Phil Haves

**Symposium CH-06-05** Sunday 2:00 PM

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

**Symposium CH-06-06** Monday 8:00 AM

“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

**Seminar 41** Tuesday 8:00 AM

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

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Robert Sonderegger

**Seminar 45** Tuesday 10:15 AM

“Application and Experiences With the New Simulation Software”

Organized by: TC 4.7 (Applications)

Chaired by: Dan Fisher

Status: Moved from Orlando

**Symposium CH-06-13** Wednesday 8:00 AM

“Recent Advances in Simulation”

Organized by: TC 4.7 (Sim and Comp Models)

Chaired by: Dan Fisher

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

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**Symposium (carry-over from Chicago)**

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

Organized by: TC 2.8

Co-sponsored by: TC 4.7 (SCM) & 7.1

Chaired by: Dru Crawley

Status: 6 papers?

**Symposium (Moved from Chicago)**

“Validation of Building Simulation Programs Through ASHRAE Standard 140”

Organized by: TC 4.7 (Applications)

Chaired by: Chip Barnaby

Status: 4 papers in hand, 1 reviewed, 3 in process.

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**Dallas/January 27-31<sup>st</sup>, 2007 \*\*\* Package Due 8/4/2006 \*\*\***

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**Seminar**

“What ever happened to AI for Simulation”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Agami Reddy

Status: New

**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**

“Use of ‘equation solvers’ for Simulation”

Organized by: TC 4.7 (Simulation and Component Models)

Co-chaired by: Jean LeBrun/Mike Wetter

Status: New

**Seminar**

“Applications of Computer Simulation in High Performance Buildings”

Organized by: TC 4.7 (Applications)

Chaired by: Martha Brook, CEC

Status: New, 3 papers possible from Intermodal, Princeton, Univ. of Vermont, TESS

**Seminar**

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

Organized by: TC 4.7 (Applications)

Chaired by: Carol Gardiner

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)

**Symposium (Moved from Quebec City)**

“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

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

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**Seminar**

“Genetic Algorithms for Energy Calculations”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Bass Abushakra

Status: New

**New York January 19-23, 2008**

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No program suggestions.

**Salt Lake City June 12-25, 2008**

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No program suggestions.

## SSPC 140 Chicago Meeting Summary

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

January 23, 2006

#### Chair Announcements

- Per Jason Glazer (90.1 ECB SubC Chair) 6/30/05, Addendum L to 90.1-2004 changed the reference from 140-2001 to 140-2004. No public review comments were received. SSPC 90.1 approved publication in Denver. Likely publication in a mid-2006 supplement to 90.1.

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

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

PC approval of Addendum *a* (furnace test cases) for publication/public review on Aug 24, 2005 (approved 9-0 [one not responding]), with one comment on informative material by Knebel (along with his approval vote); submittal of the addendum and publication draft submittal report to ASHRAE on Aug 26, 2005. Addendum *a* is on track for public review (public review beginning mid-March 2006).

#### HVAC BESTEST Volume 2 (proposed Addendum b to 140-2004):

Distribution of Addendum *b* (HVAC BESTEST Volume 2 test cases) to the PC on Sep 15, 2005, and receipt of comments by the PC through Jan 9, 2006. The Vice Chair (Neymark) in consultation with the Chair (Judkoff) forwarded a compilation of the comments and proposed responses and questions to the PC on January 18, 2006. All PC comments were resolved at the SSPC 140 meeting (1/23/06). If revisions to the Addendum and publication/public review approval can be obtained from the PC in time, then Addendum *b* can make the public review period beginning mid-March 2006, otherwise it would go out for Fall 2006 public review.

#### Development of a format for 140 results data to be posted on the DOE Tools web site.

The ad-hoc SSPC 140 Data Format Subcommittee, Chaired by Neymark, met Sunday (1/22) evening. Meeting objective: Identify specific action items for developing a format for 140 results data to be posted on the DOE Tools web site. At the meeting action items were assigned so that the following activities can occur in parallel: formatting of a "postable" results spreadsheet, development of a rule base for notes accompanying the results, development of web site cover page design/content, and development of a summary subset of DOE's existing rules (specific to posting this material) for submitting content to the DOE tools page.

### 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