

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: December 6, 2006

TC/TG/TRG TITLE: Energy Calculations

DATE OF MEETING: June 27, 2006 LOCATION: Québec City

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

## QUÉBEC CITY MEETING

## ACTION ITEMS

1. **MOTION**—That TC 4.7 accept the following research plan (Brandemuehl/Haberl):
  - 1st priority: 1416 (convection).
  - 2nd priority: 1404 (short-term monitoring)
  - 3rd priority: 1456 (natural and hybrid ventilation).
  - unprioritized: BIM
  - unprioritized: moisture absorption/desorption.
  - unprioritized: DDM chillers.
  - unprioritized: DDM large chiller plants.**Motion carried 10-0-0 CVN.**
2. **MOTION**—That TC 4.7 express interest to TC 1.5 in Development of Reference Building Information (BIM) for Thermal Modelling RTAR (Barnaby/Liesen).  
**Motion carried 10-0-0 CVN.**
3. **MOTION**—To accept the program prioritization for Dallas as listed below (Barnaby/McDowell).
  - 1st priority: equation solvers seminar
  - 2nd priority: high-performance buildings seminar
  - 3rd priority: what happen to AI seminar
  - 4th priority: double envelope facades seminar
  - 5th priority: simulation support for solar decathlon seminar
  - 6th priority: co-sponsor of seminar fenestration data needs
  - 7th priority: co-sponsor of Carol Gardiner's seminar**Motion carried 10-0-0 CVN.**
4. **MOTION:** That TC 4.7 accept the PES recommendation on the URP on improvement of conduction calculation procedures in ASHRAE Loads Toolkit from Yuanan University with sub-contract to OSU (Barnaby/McDowell). **Motion carried 10-0-0 CNV.**

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DATE OF MEETING: June 27, 2006 LOCATION: Québec City

<b>TC/TG/TRG MEETING SCHEDULE</b>					
<b>LOCATION – past 12 months</b>		<b>DATE</b>	<b>LOCATION - planned next 12 months</b>		<b>DATE</b>
Chicago		January 24, 2006	Dallas		January 30, 2007
Québec City		June 27, 2006	Long Beach		June 26, 2007
<b>TC/TG/TRG SUBCOMMITTEES</b>					
<b>Function</b>			<b>Chair</b>		
Simulation and Component Models Applications Data-Driven Modeling			Tim McDowell Chip Barnaby Kris Subbarao		
<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	Québec City June 2006	Chicago Jan 2006	Denver June 2005	Orlando Feb. 2005			
	X	X	X	X	Abushakra	Bass	abushakr@msoe.edu
		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		X	Armstrong	Peter	<a href="mailto:Peter.armstrong@pnl.gov">Peter.armstrong@pnl.gov</a>
			X		Bahnfleth	Bill	wbahnfleth@psu.edu
	X	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@nrcan.gc.ca
		X	X	X	Bernier	Michel	michel.bernier@polymtl.ca
		X	X		Black	Al	ablack@mcc lureeng.com
				X	Bojic	Milorad	<a href="mailto:bojic@nq.ac.yu">bojic@nq.ac.yu</a>
			X		Bourassa	Norman	njbouras@energy.state.ca.us
	X	X	X	X	Brandemuehl	Mike	michael.brandemuehl@colorado.edu
		X			Brown	Rob	rbrown@ductsox.com
	X	X	X	X	Carpenter	J Patrick	pcarpenter@vanderweil.com
			X		Chantrasrisalai	Chanvit	<a href="mailto:chanvit@okstate.edu">chanvit@okstate.edu</a>
	X	X	X		Claridge	David	<a href="mailto:dclaridge@tamu.edu">dclaridge@tamu.edu</a>
X	X				Cornick	Steve	steve.cornick@nrc.ca
	X	X	X	X	Crawley	Dru	<a href="mailto:Drury.Crawley@ee.doe.gov">Drury.Crawley@ee.doe.gov</a>
		X			Culp	Charles	cculp@tamu.edu
	X	X	X	X	Degelman	Larry	<a href="mailto:rdegelman@cox.net">rdegelman@cox.net</a>
		X	X		Ellis	Peter	peter_ellis@nrel.gov
			X		Filler	Mike	mike.filler@york.com
		X	X	X	Fisher	Dan	<a href="mailto:DFisher@okstate.edu">DFisher@okstate.edu</a>
			X		Firrantello	Joseph	jxf282@psu.edu
			X		Goldman	Milton	greenbuilding@???
		X			Gowri	Krishnan	krishnan.gowri@pnl.gov
			X		Gueymard	Chris	chris@solarconsultingservices.com
	X	X	X	X	Haberl	Jeff	<a href="mailto:JHaberl@tamu.edu">JHaberl@tamu.edu</a>
		X	X		Haddad	Kamel	khaddad@nrcan.gc.ca
		X	X	X	Haves	Philip	<a href="mailto:PHaves@lbl.gov">PHaves@lbl.gov</a>

Present at TC 4.7 meeting?					Last name	First name	E-mail
Add to email list	Québec City June 2006	Chicago Jan 2006	Denver June 2005	Orlando Feb. 2005			
		X		X	Hensen	Jan	<a href="mailto:j.hensen@tue.nl">j.hensen@tue.nl</a>
	X	X	X	X	Huang	Joe	<a href="mailto:YJHuang@lbl.gov">YJHuang@lbl.gov</a>
	X	X		X	Judkoff	Ron	<a href="mailto:ron_judkoff@nrel.gov">ron_judkoff@nrel.gov</a>
			X	X	Kootin-Sanwu	Victor	<a href="mailto:victor.kootin-sanwu@uc.edu">victor.kootin-sanwu@uc.edu</a>
	X	X	X	X	Kosny	Jan	<a href="mailto:kyo@ornl.gov">kyo@ornl.gov</a>
		X	X	X	Krarti	Moncef	<a href="mailto:krarti@colorado.edu">krarti@colorado.edu</a>
X	X				Kummert	Michaël	<a href="mailto:Michael.kummert@polymtl.ca">Michael.kummert@polymtl.ca</a>
X	X				Laouadi	Aziz	<a href="mailto:Aziz.laouadi@nrc.ca">Aziz.laouadi@nrc.ca</a>
	X		X		Lemort	Vincent	<a href="mailto:vincent.lemort@ulg.ac.be">vincent.lemort@ulg.ac.be</a>
				X	Levermore	Geoff	<a href="mailto:geoff.levermore@umist.ac.uk">geoff.levermore@umist.ac.uk</a>
X	X				Levisieur	Suzanne	<a href="mailto:slevisieur@blueheronengineering.com">slevisieur@blueheronengineering.com</a>
	X		X		Liesen	Richard	<a href="mailto:Richard.J.Liesen@owenscorning.com">Richard.J.Liesen@owenscorning.com</a>
		X	X	X	Lisenbee	Larry	<a href="mailto:lrlesenb@southern.com">lrlesenb@southern.com</a>
X	X				Ljungquist	Damian	<a href="mailto:damian@jdlbs.com">damian@jdlbs.com</a>
			X		malone	brian	<a href="mailto:bmalon1@uic.edu">bmalon1@uic.edu</a>
	X	X	X	X	McDowell	Tim	<a href="mailto:Mcdowell@tess-inc.com">Mcdowell@tess-inc.com</a>
	X	X	X	X	Neymark	Joel	<a href="mailto:neymarkj@msn.com">neymarkj@msn.com</a>
		X			Nigusse	Bereket	<a href="mailto:bereket.nigusse@akstate.edu">bereket.nigusse@akstate.edu</a>
	X	X	X		Norford	Les	<a href="mailto:lnorford@mit.edu">lnorford@mit.edu</a>
				X	Pinel	Patrice	<a href="mailto:ppinel@nrca.gc.ca">ppinel@nrca.gc.ca</a>
	X	X	X	X	Pedersen	Curt	<a href="mailto:cpederse@uiuc.edu">cpederse@uiuc.edu</a>
					Radosevic	Marija	<a href="mailto:m.radosevic@bwk.tve.nl">m.radosevic@bwk.tve.nl</a>
	X	X	X	X	Reddy	T. Agami	<a href="mailto:reddyta@drexel.edu">reddyta@drexel.edu</a>
	X				Rees	Simon	<a href="mailto:sjrees@dmu.ac.uk">sjrees@dmu.ac.uk</a>
X	X				Roth	Stephen	<a href="mailto:sroth@carmelsoft.com">sroth@carmelsoft.com</a>
				X	Shirey	Don	<a href="mailto:shirey@fsec.ucf.edu">shirey@fsec.ucf.edu</a>
				X	Smith	Vernon	<a href="mailto:VSmith@archenergy.com">VSmith@archenergy.com</a>
		X	X	X	Sonderegger	Robert	<a href="mailto:Robert.sonderegger@itron.com">Robert.sonderegger@itron.com</a>
	X	X		X	Spitler	Jeffrey	<a href="mailto:Spitler@okstate.edu">Spitler@okstate.edu</a>
X	X				Strachan	Paul	<a href="mailto:paul@esru.strach.ac.uk">paul@esru.strach.ac.uk</a>
		X		X	Strand	Rick	<a href="mailto:rkstrand@uiuc.edu">rkstrand@uiuc.edu</a>
X	X	X	X		Subbarao	Kris	<a href="mailto:ksubbarao@tamu.edu">ksubbarao@tamu.edu</a>
			X		Theios	Jason	<a href="mailto:jtheios@guardian.com">jtheios@guardian.com</a>
			X		Thomaston	Bill	<a href="mailto:bhomast@energen.com">bhomast@energen.com</a>
		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	X	X			Wetter	Michael	<a href="mailto:wetterm@utrc.utc.com">wetterm@utrc.utc.com</a>
	X	X	X	X	Wray	Craig	<a href="mailto:CPWray@lbl.gov">CPWray@lbl.gov</a>

Present at TC 4.7 meeting?					Last name	First name	E-mail
Add to email list	Québec City June 2006	Chicago Jan 2006	Denver June 2005	Orlando Feb. 2005			
		X			Wright	Jonathan	<a href="mailto:J.A.Wright@lboro.ac.uk">J.A.Wright@lboro.ac.uk</a>
X	X				Xiaobing	Liu	<a href="mailto:xliu@climatemaster.com">xliu@climatemaster.com</a>

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



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

<b>Title</b>	<b>TC Priority 2005-2006</b>	<b>Prior TC priority</b>	<b>Society status</b>	<b>TC Status</b>	<b>Authors or Prime Contact</b>	<b>Sub com.</b>
<b>Prioritized</b>						
1416-RTAR Developing internal surface convection correlations for energy and load calculations	1	1 (2005-2006)	RTAR accepted 05, WS due before Aug 07	WS draft being revised	DFisher, IBeausoleil-Morrison	SCM
1404-RTAR Development of protocol for accurate prediction of building annual energy use based on minimum short-term monitoring	2	2 (2005-2006)	RTAR accepted 05, WS due before Aug 07	WS draft being revised	AReddy	DDM
1456-RTAR Models for Natural and Hybrid Ventilation	3	0 (2005-2006)	RTAR accepted Jun 06, WS due before Jun 08	WS under development	YJHuang, PHaves, GWalton, SRees	SCM
<b>Unprioritized</b>						
Assessment of the potential for application of moisture absorption/desorption models in whole building energy simulations to evaluate possible energy savings caused by moisture buffering effects in building enclosure and furnishings				RTAR draft under revision	JKosny	SCM
Characterizing of building secondary thermal loads from chiller electric use data				Old RTAR under revision	RSonderreger, AReddy	DDM
Development of a procedure for baselining energy use at large central plants				Old WS being turned into RTAR	AReddy	DDM
Development of reference Building Information Model (BIM) for thermal model compliance testing				Expression of interest to work with TC 1.5	LNorford	A

SCM = Simulations and Component Models

DDM = Data Driven Modeling (formerly Inverse Methods)

A = Applications

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

RP	Title	Contractor	Approved	Paper
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>
1093	Compilation of Diversity Factors and Schedules for Energy and Cooling Load Calculations	TAMU	Cincinnati June 2001	<i>Claridge, D., Abushakra, B., Haberl, J. 2003. "Electricity Diversity Profiles for Energy Simulation of Office Buildings (1093-RP)," ASHRAE Transactions-Research, Vol. 110, Pt. 1 (February), pp. 365-377.</i>
1093	Compilation of Diversity Factors and Schedules for Energy and Cooling Load Calculations	TAMU	Cincinnati June 2001	<i>Abushakra, B., Haberl, J., Claridge, D. 2004. "Overview of Literature on Diversity Factors and Schedules for Energy and Cooling Load Calculations (1093-RP)," ASHRAE Transactions, Vol. 110, Pt. ).</i>
865	Accuracy Tests for Mechanical System Simulation	PSU, TAMU	Honolulu June 2002	<i>Yuill, G., Haberl, J. 2006. "Accuracy Tests for Simulations of VAV Dual Duct, Single Zone, Four Pipe Fan Coil and Four Pipe Induction Air Handling Systems (4796)," ASHRAE Transactions-Research, (accepted for publication).</i>
865	Accuracy Tests for Mechanical System Simulation	PSU, TAMU	Honolulu June 2002	<i>Yuill, G., Haberl, J. 2005. "Accuracy Tests for Simulations of Constant Volume, Dual Duct and Variable Volume Air Handling Systems (4796)," ASHRAE Transactions-Research, Vol. 111, Pt. 2, pp. 137-153, (June).</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	Drexel	Chicago January 2006	<i>Sun J. and Reddy T.A., 2006, "Calibration of Building Energy Simulation Programs Using the Analytic Optimization Approach (RP-</i>

	Data			<i>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 June 2006**

***PRESENT:***

Québec City/June 2006

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

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

***PLANNED:***

Dallas/January 2007

*How and Why to Calibrate a Simulation to Measured Data* (Chair: Carol Gardiner)

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

Long Beach/June 2007

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

*Modeling and Experimental Validation of Active/Phase Change Building Envelope Components* (Chair: Jan Kosny)

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

***PAST:***

Chicago/January 2006

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

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

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

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

Denver/June 2005

*None.*

Orlando/February 2005

*None.*

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)

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

**Current as of June 2006**

**PRESENT:**

Québec City/June 2006

None

**PLANNED:**

Dallas/January 2007

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

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

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

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

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

*Fenestration Data Needs for Energy and Loads Calculations (Co-sponsored by TC 4.7) (Chair: Glenn Friedman)*

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

Long Beach/June 2007

*Genetic Algorithms for Energy Calculations (Chair: Bass Abushakra)*

*Web-based Programs for Calculating Code-Compliance (Chair: Norm Bourassa)*

**PAST:**

Chicago/January 2006

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

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

Denver/June 2005

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

Orlando/January 2005

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

Nashville/June 2004

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

Anaheim / January 2004

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

Kansas City, June-July 2003

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

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

**Current as of June 2006**

***PRESENT:***

*None.*

***PLANNED:***

*None.*

***PAST:***

*Chicago/January 2006*

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



**ASHRAE TC 4.7 Energy Calculations**  
**Tuesday, June 27, 2006, 18h00 to 20h30**  
**Room 2000B, Convention Centre**  
**Québec City, Québec**

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

- The meeting convened at 18h05.
- Norford chair, Beausoleil-Morrison secretary.
- Quorum with 11 voting members present (10 + 1 international) out of 16 non-international.
- Introductions.

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

- Agenda accepted (Haberl/McDowell). **Approved by voice vote.**
- Minutes accepted with following changes (Rees/Reddy). **Approved by voice vote.**
  - Start and end times of Handbook meeting need to be reduced by one hour.

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

- Headline article: ASHRAE's Board of Directors recently approved a strategic plan for the Society. It contains four directions:
  - ASHRAE will lead the advancement of sustainable building design and operations. Tech Council
  - ASHRAE will be a world-class provider of education and certification programs. Publication/Education Council
  - ASHRAE will position itself as a premier provider of HVAC&R expertise. Executive Committee
  - ASHRAE will be a global leader in the HVAC&R community. Members Council
- TCs in sections 4 and 7 will be heavily involved with the first directive. It has eight strategies that have been organized into three groups:
  - Design guidance for sustainable buildings
  - Design, construction and operation of net-zero-energy buildings
  - Performance metrics
  - Training
  - Maintenance
  - Life-cycle costing
  - Integration of HVAC&R with other building systems
  - Equipment and systems for sustainable buildings
- Mike Vaughn is populating a spreadsheet that maps TC research activities to the plan. TC chairs will be asked to help with other TC activities, prior to Tech Weekend.
- Craig Wray rolling off as section head and rolling on as TAC vice chair. Suzanne Laviseur is new section head.
- Craig Wray:
  - Action plans will be in place by September. Changes to be in place by Dallas meeting.
  - Research ideas should be demonstrated to be well aligned with strategic plan.
  - More collaboration between TC's expected. Sections 4 and 7 already meeting.
  - Handbook may be made available via web in future. Discussions underway.
  - Accountability plan coming from on high. List of accomplishments and objectives to be provided to demonstrate success at TC level.
  - Certificate of appreciation presented to Norford by Wray.
- Help wanted:
  - Volunteers are sought to review the Society's existing position document on energy to determine if significant changes are required before the document is re-affirmed at the Dallas meeting. Contact Mike Vaughn at [morts@ashrae.net](mailto:morts@ashrae.net).
  - Volunteers are sought to respond to questions from university students competing in the Solar Decathlon competition. An ASHRAE moderator will filter the questions, which are expected to come during the 2006-2007 Society year and will require a one-week turn-around. Contact Mike Vaughn.

- SSB in Liège (Belgium) in December 2006.
- Clima in Helsinki.
- www.iaq2007.org.
- ASME's session on energy issues to be piggybacked onto ASHRAE Long Beach meeting.
- Local news:
  - ASHRAE is providing a password-protected link to TC/TG rosters. Check your email in coming weeks and contact Tara Thomas, tthomas@ashrae.net, if there are problems.
  - Nominations for the 2006-2007 George B. Hightower Award are due to our section head by September 30, 2007. The award is for service to the TC in all areas except research and standards: program, handbook, officers, technical inquiries and special assignments.
  - Pres. Burgett is again offering to send thank-you letters to employers of ASHRAE members. Please sign up on the distributed sheet.
  - Scope of TC 4.7: "TC 4.7 is concerned with identifying, evaluating, developing, and recommending procedures for calculating energy performance of buildings."
  - Additional news concerning program, handbook and research will be given later in the meeting.

#### **4. Membership (Norford)**

- New roster circulated by Les Norford via TC 4.7 listserv.
- Fisher rolling on as chair; Beausoleil-Morrison as vice-chair; Haves as secretary.
- Subbarao to take over as chair of DDM; McDowell to take over as chair of SCM; Barnaby to continue to chair Applications.
- Strand to take over as chair of Program; Crawley to continue as chair of Handbook; Liesen to continue as Webmaster; Neymark to continue as chair of Standards; Huang to continue as chair of Research.
- Joining as voting members: Beausoleil-Morrison, Degelman, Ellis, and Kosny.
- Voting members rolling off: Griffith, Haberl, McDowell, Norford, Sonderegger.

#### **5. Subcommittee reports**

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

- Norford has been talking with 90.1 Energy Cost Budget subcommittee. No specific plan to formalize linkages between subcommittees. Norford to contact Glazer (chair of ECB) to identify topics that could be pursued as joint research.
- RTAR from TC 1.5 discussed in detail within SC. Related to extracting a thermal model from detailed Building Information Model maintained by a CAD system. Applications interested in topic but would like model reduction to be treated as well as data transfer.
- Fenestration modelling discussed in detail. Of potential relevance to TC 4.1 as well. Huang will circulate some notes on this.
- A number of other research items treated as well.

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

- WS on characterizing building cooling thermal loads from short-term monitoring nearing completion. Should be ready for TC to vote on in Dallas.
- Other RTAR's under development.

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

- Lively meeting.
- RTAR on moisture absorption/desorption discussed. Volunteers found to help develop into final RTAR for Dallas.
- Hybrid ventilation RTAR accepted by TC 4.7 by letter ballot prior to Québec. Potential co-funding by CEC. Hope to have a WS draft to discuss in Dallas.
- Internal surface convection WS briefly discussed. Some issues to resolve on scope. Hope to have final WS to consider in Dallas.
- Other potential RTAR's also discussed.
- Many new ideas for research discussed as well.

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

- 3 RTAR's have been approved and assigned numbers: internal surface convection (1416-RTAR), short-term monitoring (1404-RTAR), natural and hybrid ventilation (1456-RTAR).
  - URP 1452 improvement of conduction calculation procedures in toolkit. PES (Huang, Pedersen, Walton, and Wilkins) has reviewed the URP and met to discuss it. A recommendation to TC 4.7 has been made. This was discussed in executive session (see item 10 below).
  - Brandemuehl:
    - Strategic plan versus research strategic plan. RTAR's and WS's still being evaluated using research strategic plan. Many older RTAR's and WS's are written in old format. These should be cast in new format, which is available on ASHRAE web site.
    - TC 4.7 research topics fit well within strategic plan.
    - Rolling off as section 4 research liaison. Hugh Henderson rolling on.
  - Should TC's have long-term research plans? RAC opinions split on value of this. Brandemuehl sees value in long-term research plan. RAC guide says this should be done. But RAC does not consider TC priority ranking in its review of RTAR's and WS's. There should be clarification in future on necessity of this.
  - **MOTION:** That TC 4.7 accept the following research plan proposed by Huang (Brandemuehl/Haberl):
    - 1st priority: 1416 (convection).
    - 2nd priority: 1404 (short-term monitoring).
    - 3rd priority: 1456 (natural and hybrid ventilation).
  - Request by Barnaby to amend above motion to add fourth priority on TC 1.5 BIM idea.
  - Request by Reddy to amend above motion to add DDM chillers and DDM large chiller plants.
  - Request by McDowell to amend above motion to add moisture absorption.
  - Friendly amendments accepted by Huang. The research plan voted upon is therefore as follows:
    - 1st priority: 1416 (convection).
    - 2nd priority: 1404 (short-term monitoring)
    - 3rd priority: 1456 (natural and hybrid ventilation).
    - unprioritized: BIM
    - unprioritized: moisture absorption/desorption.
    - unprioritized: DDM chillers.
    - unprioritized: DDM large chiller plants.
- Motion already moved and seconded. **Motion carried 10-0-0 CNV.**
- **MOTION:** That TC 4.7 express our interest to TC 1.5 in Development of Reference Building Information (BIM) for Thermal Modelling RTAR (Barnaby/Liesen). **Motion carried 10-0-0 CNV.**
  - 1311-RP Load calculations with shading devices (report by Crawley):
    - 4.1 lead, 4.7 and 4.5 co-sponsoring.
    - 3 technical papers presented in Québec City.
    - testing work to be done this fall.
    - progressing well.
    - to update tables on shading by blinds and drapes.
    - draft report due in Dallas.

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

- Met briefly.
- No progress since last meeting.
- Updated plan for required revisions.
- Call for potential updates to be distributed.
- Straw man outline to be discussed at next meeting.

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

- Transactions session on validation in Québec well attended (about 40 people).
- TC 4.7 should have been listed as a co-sponsor for TC 2.8 transactions session on "How low can you go?".
- Dallas theme is energy efficiency/low-energy buildings. 30 programme slots being reserved for items that correspond closely to theme.
- **MOTION:** That TC 4.7 accept the programme plan proposed by Haberl (Barnaby/McDowell):
  - 1st priority: equation solvers seminar
  - 2nd priority: high-performance buildings seminar

- 3rd priority: what happen to AI seminar
- 4th priority: double envelope facades seminar
- 5th priority: simulation support for solar decathlon seminar
- 6th priority: co-sponsor of seminar fenestration data needs
- 7th priority: co-sponsor of Carol Gardiner's seminar

**Motion carried 10-0-0 CNV.**

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

- SPC 140 (Judkoff reporting).
- Addendum "a" has passed public review and will be published within coming months.
- Addendum "b" to go to public review in September.
- IRS tax credit legislation references Stanard 140.
- "Valley of Death" issue. Good test suites, including ASHRAE-sponsored research (RP-865 and RP-1052) have not gone into Standard 140 due to lack of resources. Approximately 2-6 person months of effort required to convert these into Standard 140. Can ASHRAE fund efforts to move these into Standard 140. Wray: if a case can be made that this is aligned with strategic plan then funding might be possible. Brandemuehl: this is worth consideration by Technical Council. Some lobbying will be required. Definitely worth pursuing. Spittler: RAC is accepting RTAR's from SSPC's. Litmus test is whether it is a research project or special publications. TC 4.7 chair to work with SPC 140 chair on this issue.
- Same issue applies to research projects that have created toolkits that have not become special publications. Haberl to provide list to Norford and TC 4.7 chair to request to ASHRAE to turn these into special pubs.
- IEA 34/43 ground-coupling BESTEST advancing for uninsulated slabs-on-grade.
- IEA 34/43 multi-zone test cases under development.
- IEA 34/43 daylighting/HVAC interaction empirical test cases.
- IEA 34/43 double-facade empirical test cases.

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

- Spittler to take down old TC 4.7 web site at OSU. (The site has been removed and has been replaced with a link to the new TC 4.7 site.)

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

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

- Draft guideline in moderate shape.
- TC 1.5 RP to analyzing and comparing three available schemas.
- Looking for members.

#### **6.2 TC 2.8 Sustainability (Crawley)**

- New ASHRAE/IES/GBC standard under development: "High-Performance Green Buidings". Hoping to have draft standard in one year.

#### **6.3 TC 4.1 Load Calculations (Pedersen)**

- Beginning to work on revising handbook chapter.

#### **6.4 TC 4.2 Climatic Information (Barnaby)**

- Ramping up for 2009 handbook.
- All solar intensity related topics to be moved into climate data chapter.
- New RP on available sky models.

#### **6.5 TC 4.5 Fenestration (Brandemuehl)**

- Very small meeting.
- Wray: difficulty in having quorum due to funding constraints on members of TC.
- Programme item that they would like to coordinate with TC 4.7 and TC 4.1 on use of climate data on load and energy calculations. Looking for a speaker from TC 4.7.

#### **6.6 TC 6.5 Radiant Heating and Cooling (Nobody reporting)**

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

- Cooling coil modelling RP wrapping up.
- Use of thermal mass RP wrapping up.
- Rethinking its research direction.

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

- New subcommittees should have relevance to TC 4.7 Applications and DDM subcommittees.

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

- RFP for new project to be released shortly.
- Three RTAR's under development that are of interest to DDM subcommittee.

**6.10 IAI International Alliance for Interoperability (Nobody reporting)****6.11 90.1 (Liesen)**

- Being called upon to make 90.1 more stringent by 30% by 2010.
- Examining ways to streamline process.

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

- IBPSA-USA (Brandemuehl):
  - SimBuild 2006 in August at MIT in Boston.
  - Interaction with US GBC and tax rebates.
  - IBPSA-USA challenged to become more involved in certification of simulators.
- IBPSA-Canada (Beausoleil-Morrison):
  - Fourth eSim conference was held in University of Toronto in May. 2 day conference with peer-reviewed papers + 1 day tools training workshops. Well attended.
  - Starting to think about eSim 2008.
- IBPSA-World (Spitler):
  - Building Simulation 2007 to be held in Beijing (China). Call for abstracts is out. Due September 15.
  - Building Simulation 2009 to be held in Glasgow (Scotland) in July.
  - Clearing out old stock of proceedings.

**7. Old Business**

- Design Guide proposal. Ample room for anyone with interest in this to help move it forward. Needs to be developed into a WS. Volunteers should see Barnaby or Norford. TAC and Handbook are supportive of the concept.

**8. New business**

- 2006 conference on buildings in hot and humid climates in Orlando in August.
- 2006 conference on buildings operations in China.
- Barnaby, Spitler, and Balaras received awards

**9. Adjourn**

- Meeting adjourned at 20h20.

**10. Executive Session**

- URP on improvement of conduction calculation procedures in ASHRAE Loads Toolkit from Yuanan University with sub-contract to OSU.
- TC 4.7 cognizant TC with TC 4.1 participation.
- PES: Huang, Pedersen, Walton, Wilkins (TC 4.1).
- PES has made recommendation.
- **MOTION:** That PES recommendation be accepted (Barnaby/McDowell). **Motion carried 10-0-0 CNV.**
- Executive session adjourned at 20h30.

**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, June 27, 2006, 6:00-8:30 p.m.

Room 2000B

Convention Center

Quebec City, Quebec

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1. Roll call and introductions	Beausoleil-Morrison
2. Accept agenda & approve minutes of Chicago meeting	Norford
3. Announcements/Liaisons	Norford
4. Membership	Norford
5. Subcommittee reports	
5.1 Applications	Barnaby
5.2 Data-Driven Modeling	Reddy
5.3 Simulation & Component Models	subst. for 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; Univ. of Waterloo)	Crawley
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	Barnaby
TC 2.8 Building Environmental Impacts and Sustainability	Crawley
TC 4.1 Load Calculation Data and Procedures	Fisher
TC 4.2 Climate Information	Barnaby
TC 4.5 Fenestration	---
TC 6.5 Radiant Heating and Cooling	Strand
TC 7.4 Building Operation Dynamics	Brandemuehl
TC 7.5 Smart Building Systems	Reddy
TC 7.6 Systems Energy Utilization	Abushakra
IAI International Alliance for Interoperability	---
IBPSA: USA, SimBuild 2006; Canada, eSim 2006; IBPSA, BS 2007	Brandemuehl, Beausoleil-Morrison, Hensen
7. Old Business	

8. New business
9. Executive Session
10. Adjourn



ASHRAE TC 4.7 Energy Calculations  
**Applications Subcommittee**  
Tuesday, June 27, 2006, 3:30 – 5 PM  
Convention Center 2000B, 2<sup>nd</sup> level, Québec City

Minutes

Attendee List

NAME	Affiliation	email
Kamel Haddad	NRC – Canada	<a href="mailto:khaddad@nrcangc.ca">khaddad@nrcangc.ca</a>
Curt Pedersen	Univ. of Illinois	<a href="mailto:cpederse@uiuc.edu">cpederse@uiuc.edu</a>
Chip Barnaby	Wrightsoft	<a href="mailto:cbarnaby@wrightsoft.com">cbarnaby@wrightsoft.com</a>
Les Norford	MIT	<a href="mailto:lnorford@mit.edu">lnorford@mit.edu</a>
Jeff Haberl	TAMU	<a href="mailto:jhaberl@tamu.edu">jhaberl@tamu.edu</a>
Dru Crawley	DOE	<a href="mailto:drurycrawley@ee.doe.gov">drurycrawley@ee.doe.gov</a>
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Paul Strachan	Univ. of Strathclyde	<a href="mailto:paul@esru.strath.ac.uk">paul@esru.strath.ac.uk</a>
Ron Judkoff	NREL	<a href="mailto:Ron_judkoff@nrel.gov">Ron_judkoff@nrel.gov</a>
Michael Wetter	United Technologies	<a href="mailto:wetter@utrc.utc.com">wetter@utrc.utc.com</a>
Tim McDowell	TESS	<a href="mailto:mcdowell@tess-inc.com">mcdowell@tess-inc.com</a>
Joel Neymark	J.Neymark and Assc	<a href="mailto:neymarkj@msn.com">neymarkj@msn.com</a>
Ian Beausoleil-Morrison	NRCan	<a href="mailto:Ian.beauseleil-morrison@nrcan.gc.ca">Ian.beauseleil-morrison@nrcan.gc.ca</a>
Michael Kummert	Ecole Polytechnique de Montreal	<a href="mailto:Michael.kummert@polymtl.ca">Michael.kummert@polymtl.ca</a>
Jian Zhang	Concordia University	<a href="mailto:zhangjian1977@yahoo.com">zhangjian1977@yahoo.com</a>

Chip Barnaby started the meeting at 3:45 PM with introductions and approval of agenda.

**PROGRAM**

Haberl distributed the TC 4.7 Program plan for discussion.

A new seminar item was added: “Simulation Support for the 2007 Solar Decathlon”, chaired by Kamel Haddad, with proposed papers from TAMU, CU, Cornell.

Applications also recommends that TC 4.7 co-sponsor the seminar by TC 4.1, “Fenestration Data Needs for Energy and Loads Calculations”. Haberl will add this to the program plan to be discussed at the full TC meeting.

**STANDARD 90 ECB COORDINATION**

Norford reported on how TC 4.7 might work with SSPC 90.1 Energy Cost Budget (ECB) subcommittee. He reported on his meeting with the subcommittee and conversations with Jason Glazer, ECB chair. ECB is receptive to the possibility of joint work.

In the discussion that followed, the consensus was that research is the most promising area for cooperation. Norford agreed to continue discussion with Jason Glazer and the ECB subcommittee to identify research topics of mutual interest.

## RESEARCH

**BIM data translation.** Barnaby presented an RTAR that has been passed to 4.7 by TC 1.5: “Development of Reference Building Information Model (BIM) for Thermal Model Compliance Testing”. This RTAR proposes research to define procedures for automated generation of simulation thermal models from CAD applications and to develop tests to verify correctness of such generation.

An extended discussion ensued regarding whether the RTAR concerns TC 4.7. The conclusion was that non-trivial rules are required for translation of detailed BIM data to a thermal model. The rules involve knowledge of building simulation applications, so TC 4.7 has a role to play. In addition, it was agreed that test cases for BIM data translation would be very helpful for both developers and users.

One problem not included in the RTAR is “model reduction” (conversion of a full-detail model derived one-for-one from BIM data to a model that is less complex). It was generally felt that results from a simpler model often offer more insight. Model reduction is probably best addressed in a separate project.

Ultimately it was decided that TC 4.7 should express support for the topic. Wetter, Neymark, Beausoleil-Morrison, and Barnaby expressed interest in working with TC 1.5 to refine the RTAR and contribute to the WS. Norford agreed to notify TC 1.5 of our support.

**Simulation of fenestration when only ratings data is available.** Huang said that this has had some movement, that he was developed a proposed procedure for the CEC. Barnaby noted that Jeff Spitler is trying to work out an approach for load calculations in the 1326-RP loads manual project. Also noted is the TC 4.5 plan to organize a seminar around this topic.

No specific progress. Joe Huang agreed to circulate a brief description of his CEC procedure.

**Other Research Topics.** Barnaby asked about the Build America residential assumptions. McDowell said that their work is very complete and there is little TC 4.7 can contribute. Huang said that there were still issues with set points and foundation conduction. Haberl noted that their info on DHW pilot lights needs improvements.

Barnaby quickly reviewed the remaining research topics and urged their champions to make progress.

## OTHER BUSINESS

TAC Section Chair wanted a list of accomplishments, objectives, and criteria. No coherent suggestions were forthcoming.

Meeting adjourned 5:10 PM.

## ACTION ITEMS

<b>Who</b>	<b>When</b>	<b>What</b>
Haberl	Immediately	Contact Glenn Friedman, TC 4.1 program chair, regarding seminar on fenestration data
Norford	(Well) before Dallas	Work with Jason Glazer to develop joint TC 4.7 / ECB research ideas
Wetter, Neymark, Beausoleil-Morrison	As RTAR develops	Contribute to TC 1.5 RTAR / WS on thermal model extraction from BIM
Norford	Immediately	Communicate with TC 1.5; indicate support for BIM RTAR / WS
Huang	Immediately	Distribute CEC write-up on modeling fenestration given standard ratings

## **TC4.7 Data-Driven Modeling Subcommittee**

**Monday, June 26 2006,**

**6:30 to 7:30 p.m.**

**Quebec City, Quebec, Canada**

**Chair: Agami Reddy**

### AGENDA

1. Introductions
2. Approval of the minutes from the Chicago, IL meeting, January 23, 2006
3. Program
4. Discussion of WS and RTARs
  - WS- Characterizing building cooling thermal loads from short-term monitoring- Abushakara
  - RTAR- Old draft RTAR “Characterizing of Building Secondary Thermal Loads from Chiller Electric Use Data”- proposed about 4 years back by Sonderegger and Reddy,
  - RTAR- Old draft RTAR “Use of Evolutionary Computation for Inverse Problems” – proposed by Ron Nelson
  - New: continuation of RP1051 on calibration of detailed energy simulation programs (assigned to Subbarao and Sonderegger)
  - WS- Development of a procedure for baselining energy use at large central plants - Reddy
5. Discussion on:
  - 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
6. Old Business
7. New Business
8. Adjourn

**MINUTES**

NAME	Affiliation	email
John Kennedy	Green Building Studio, Inc	<a href="mailto:jfk@greenbuildingstudio.com">jfk@greenbuildingstudio.com</a>
Mike Brandemuehl	CU	<a href="mailto:Michael.brandemuehl@colorado.edu">Michael.brandemuehl@colorado.edu</a>
Vincent Lemort	Univ. of Liege, Belgium	<a href="mailto:Vincent.lemort@ulg.ac.be">Vincent.lemort@ulg.ac.be</a>
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Jin Wen	Drexel Univ	<a href="mailto:jinwen@drexel.edu">jinwen@drexel.edu</a>
Tim McDowell	TESS	<a href="mailto:mcdowell@tess-inc.com">mcdowell@tess-inc.com</a>

- 1) Agami Reddy (AR) started the meeting at 6:30 PM with introductions.
- 2) Agenda sheet was circulated.
- 3) The minutes from the Chicago meeting were circulated to all attendees to be reviewed and approved. Joe Huang and Mike Wetter’s email addresses had small typos in them.
- 4) Discussion of the WS developed by A. Reddy and V. Smith, based on the approved RTAR 1404 (Modeling, Analysis and Reporting Protocols for Predicting Annual Energy Performance from Short-term Building Energy Monitoring):
  - a. The title itself was debated (energy and/or demand). The term “demand” in the text should be dropped. Everybody agreed.
  - b. Subbarao asked about specifying the length of the short-term period, and whether the user should instead keep the data monitoring going and stops it when reaching satisfactory results.
  - c. The value of the research to Guideline 14, and whether more benefits would results to practice outside Guideline 14.
  - d. Brandemuehl talked about developing metrics and baseline information, and benchmarking. Developing benchmarks for building categories.
  - e. Haberl noted that the annual performance based on short-term monitoring has the advantage of being cost-effective.
  - f. Replacing the term “protocol” by “procedure” in the title and anywhere in the text.
  - g. Scope: define it to one or two building types. “Office” buildings should be enough.
  - h. Add the 1093RP’s monitored data as a reference in the research project, that can also be used in the work.
  - i. Remove the idea of “defining savings”; “baselining” should be enough.
  - j. To make it clear to the contractor whether to use synthetic or monitored data: how many synthetic data sets, and how many monitored.
  - k. Haberl and Norford suggested that the results should target the public domain.
  - l. Subbarao emphasized that the contractor should be able to determine what variables should be used in the modeling.

- m. **Action item** : Reddy to revise the WS and send to Subbarao, the incoming TC Chair. Subbarao to circulate the WS about 2 weeks before the January ASHRAE meeting to members for further discussion. The comments will be collected and the WS will be put for vote in the general committee meeting in Dallas, January 2007. The WS should be submitted to RAC no later than August 2007.

5) Program: Haberl distributed the program plan:

- 3 Abstracts were received for the Dallas Seminar. “what ever happened to AI for simulation”.
- Dallas symposium: Deadline is August 4. (Claridge/Liu, Reddy, Smith, Abushakra).
- Possible seminar or merge the Dallas symposium on Genetic Algorithm with the Quebec seminar on Genetic Algorithms.
- Members are encouraged to come forward with program items for future meetings.

6) Discussion of the RTAR by Reddy and Sonderegger (Chiller electric data use). Reddy briefly presented (and circulated) an old draft RTAR which involved using the electric power (which can be measured accurately) and the two fluid temperatures to back out the thermal load (which is a much more difficult and expensive measurement). Some discussion ensued about its validity and application. Several of the attendees expressed strong interest in pursuing this concept further, and preparing a full RTAR.

**Action Item:** Kris Subbarao to pursue this effort.

7) Discussion of the RTAR by Nelson (Evolutionary computation for Inverse problems). Reddy also circulated an old RTAR on this aspect and sought feedback from the members present as to its relevance. Reddy basically opined that several of the papers on soft computing were really applied to applications which did not warrant them, but that the flexibility offered by soft computing techniques is attractive. After some discussion, it was decided that this RTAR be put on the back burner till such time when the application of this tool to HVAC data analysis was more mature.

- Meeting was adjourned at 7:30 pm.

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

Quebec City June 26, 2006

Chair: Tim McDowell (Acting for Phil Haves)

Meeting Called to Order 7:35 pm

**Attendance**

Tim McDowell	TESS	<a href="mailto:mcdowell@tess-inc.com">mcdowell@tess-inc.com</a>
Ian Beausoleil-Morrison	Natural Resources Canada	<a href="mailto:Ian.Beausoleil-Morrison@nrcan.gc.ca">Ian.Beausoleil-Morrison@nrcan.gc.ca</a>
Vincent Lemont	U. Liege, Belgium	<a href="mailto:Vincent.Lemont@ulg.ac.be">Vincent.Lemont@ulg.ac.be</a>
Joel Neymark	J. Neymark & Assoc	<a href="mailto:neymarkj@msn.com">neymarkj@msn.com</a>
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**Program:**

Dallas (January 2007)

- **Seminar** on *Modeling of Double Envelope Facades and Active Windows* (Chaired by: Mike Brandemuehl) Mike reported that this will be pulled together
- **Seminar** on *Use of 'Equation Solvers' for Simulation* (Chaired by: Mike Wetter) Mike reported that four abstracts have been received

Long Beach (June 2007)

- **Symposium** on *Modeling and Experimental Validation of Active Building Components* (Chaired by: Jan Kosny)

New York (January 2008)

- **Symposium** on *Use of 'Equation Solvers' for Simulation* (Chaired by: Mike Wetter)

**Research:**

**RTAR:** *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). (a HIGHEST priority item) There were insufficient copies to distribute. No unanimous agreement on the scope. Rich Liesen and Ian Beausoleil-Morrison volunteered to provide detailed review and help Jan prepare a draft RTAR for subcommittee action in Dallas.

**RTAR:** *Models for Natural and Hybrid Ventilation* (Joe Huang). Letter ballot of TC4.7 approved RTAR prior to meeting and RAC approved at the meeting. Workstatement is now to be developed. It is a two phase project with co-funding interest from the CEC. Lots of input is needed to help develop a workstatement for subcommittee action in Dallas. Volunteers should contact Joe Huang.

**WS:** *Internal Surface Convection Modelling* (Dan Fisher, Ian Beausoleil-Morrison). Dan was unable to attend meeting due to family reasons. He did email a new version just before the subcommittee meeting. The committee was unable to discuss as the workstatement authors still have some issues to resolve. The workstatement should be completed and circulated prior to the Dallas meeting for subcommittee action at that meeting.

**WS:** *Technical and Usability Enhancements to the Energy Calculation Toolkits RTAR 2004-19* (Dan Fisher, Jean Lebrun). This workstatement has run out of time and has fallen off the ASHRAE research plan. To be continued it must be resubmitted as an RTAR.

**WS:** *Develop a Radiant System Module for the Simulation and Analysis of Spaces and Systems* (Peter Simmonds, Rick Strand, Dan Fisher). Mike Brandemuehl reported that this has been around for a long time. TC 6.5 is going to start over with this topic. Looking for volunteers to help with this.

Research plan prioritization: Internal surface coefficient first priority and hybrid ventilation second priority.

**New RTAR topics:**

*Development of Reference Building Information Model (BIM) for Thermal Modeling Compliance Testing* (John Kennedy). TC1.5 has ranked this priority 1. Development of a method to reduce 3D building model into a thermal model for simulation programs to use. This fits more in the scope of the Applications subcommittee and will be passed along.

*Development of Integrated Models for Liquid Dessicant Dehumidification Driven by Heat Recovery or Renewable Energy* (Jeff Haberl). Do we have a good understanding of latent loads in simulation programs? What is energy performance of these systems? How can they be simulated? Products are emerging but can they be simulated?

*Thermal Mass Toolkit: Optimization of the Calculation of the Thermal Mass Energy Benefits for Residential and Commercial Buildings* (Jan Kosny). Letter sent to 90.2 on this topic a long time ago? Development of a simple toolkit to calculate energy benefits of thermal mass required?

*Development of Humidistat-Driven Air-Conditioner Model for Residential Applications* (Jeff Haberl)..

**New Business:**

Jeff Haberl: Integrated solar building design tool. What are the needs? No one tool can model all aspects of buildings for solar decathlon. It was suggested that this topic is a better fit for Applications subcommittee.

Meeting Adjourned at 9:03 pm

**ASHRAE**  
**Technical Committee 4.7 Energy Calculations**  
**2005-2006 Research Plan**  
**(June 27, 2006)**

Title	TC Priority 2005-2006	Prior TC priority	Society status	TC Status	Authors or Prime Contact	Sub com.
<b>Prioritized</b>						
1416-RTAR Developing internal surface convection correlations for energy and load calculations	1	1 (2005-2006)	RTAR accepted 05, WS due before Aug 07	WS draft being revised	DFisher, IBeausoleil-Morrison	SCM
1404-RTAR Development of protocol for accurate prediction of building annual energy use based on minimum short-term monitoring	2	2 (2005-2006)	RTAR accepted 05, WS due before Aug 07	WS draft being revised	AReddy	DDM
1456-RTAR Models for Natural and Hybrid Ventilation	3	0 (2005-2006)	RTAR accepted Jun 06, WS due before Jun 08	WS under development	YJHuang,, PHaves, GWalton, SRees	SCM
<b>Unprioritized</b>						
Assessment of the potential for application of moisture absorption/desorption models in whole building energy simulations to evaluate possible energy savings caused by moisture buffering effects in building enclosure and furnishings				RTAR draft under revision	JKosny	SCM
Characterizing of building secondary thermal loads from chiller electric use data				Old RTAR under revision	RSonderreger, AReddy	DDM
Development of a procedure for baselining energy use at large central plants				Old WS being turned into RTAR	AReddy	DDM
Development of reference Building Information Model (BIM) for thermal model compliance testing				Expression of interest to work with TC 1.5	LNorford	A



SCM = Simulations and Component Models

DDM = Data Driven Modeling (formerly Inverse Methods)

A = Applications

**Meeting Minutes**  
**Handbook Subcommittee**  
ASHRAE TC 4.7 Energy Calculations  
5:00-6:00 pm, Tuesday, June 27, 2006  
Quebec Convention Center 2000B  
Québec City, Québec, Canada

Present:

Costas Balaras  
Ian Beausoleil-Morrison  
Dru Crawley (Subc Chair)  
Jeff Haberl  
Ron Judkoff  
Michaél Kummert  
Aziz Laouadi  
Joel Neymark  
Michael Wetter

Chair Crawley called the meeting to order at 5:15 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.

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. (1051-RP)
- Ground heat transfer needs substantial updating including Beausoleil-Morrison, Bahnfleth and Deru. Need revisions to Krarti...
- 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)
- Look at ASHRAE-HQ as possible example-- (1093 example?) (Haberl)

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

Crawley will email those present to ask if they want a copy of the current chapter in electronic form to those present.

By August 1, Crawley will put out a call for topic areas/updates to the chapter on the TC 4.7 mail list.

Crawley will include a strawman of a proposed outline with annotation of existing text/needing updates/new sections /text.

A review of Chapter 32 (2005 F) received from the Handbook Committee in January is attached. The review shows a number of minor typographical changes needed.

Meeting ended at 5:30 PM.

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

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Handbook Volume Reviewed: Fundamentals Volume Year: \_\_\_\_\_ Date: \_\_\_\_\_

Chapter No. \_\_\_\_\_ Chapter Title \_\_\_\_\_

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: \_\_\_\_\_

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:**

**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:**

**E-mail:**



**TC 4.7 Program Plan  
Quebec ASHRAE Meeting  
June 27th, 2006**

**Quebec City/June 24-28<sup>th</sup>, 2006**

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**Transactions 12, Tuesday, June 27<sup>th</sup>, 10:45 am – 12:15 pm (Co-sponsor with TC 2.8)**

“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:** 4 papers (Turner & Tovey, Anderson et al., Genest et al., Deru et al.)

**Transactions 13, Tuesday, June 27<sup>th</sup>, 10:45 am – 12:15 pm**

“Validation of Building Simulation Programs Through ASHRAE Standard 140”

Organized by: TC 4.7 (Applications)

Chaired by: Chip Barnaby

**Status:** 4 papers (Judkoff & Neymark, Yuill & Haberl, Stachan et al., Loutzenhiser & Maxwell).

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

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**#1 Seminar**

“Use of ‘Equation Solvers’ for Simulation”

Organized by: TC 4.7 (Simulation and Component Models)

Co-chaired by: Jean LeBrun/Mike Wetter

**Status:** 4 abstracts received

**#2 Seminar**

“Applications of Computer Simulation in High Performance Buildings”

Organized by: TC 4.7 (Applications)

Chaired by: Martha Brook, CEC

**Status:** New, 3 abstracts received (Intermodal, Princeton, Univ. of Vermont)

**#3 Seminar**

“What Ever Happened to AI for Simulation”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Agami Reddy

**Status:** 3 abstracts received (Cal Poly; PNNL, ISU)

**#4 Seminar**

“Modeling of Double Envelope Facades and Active Windows”

Organized by: TC 4.7 (Simulation and Component Models)

Chaired by: Mike Brandemuehl

**Status:** 1 abstract, 2 promised

**#5 Seminar**

“Simulation Support for the 2007 Solar Decathlon”



Organized by: TC 4.7 (Application)

Chaired by: Kamel Haddad

**Status:** New (possible papers by TAMU, CU, Cornell)

**#6 Seminar**

“Fenestration Data Needs for Energy and Loads Calculations”

Organized by: TC 4.1 Loads

Co-Sponsored by TC 4.7 (Application)

Chaired by: Glen Friedman

**Status:** New

**#7 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:** In progress, 2 papers (Claridge and Liu from 1092-RP, 2 papers; Reddy from 1051-RP, 2 papers)

**Symposium**

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

Organized by: TC 2.8 (Co-sponsor)

Chaired by: Dru Crawley

**Status:** 4 papers in review

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**Long Beach June 23-27<sup>th</sup>, 2007 \*\*\*Package Due 2/2007 \*\*\***

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**Seminar**

“Genetic Algorithms for Energy Calculations”

Organized by: TC 4.7 (Data Driven Models)

Chaired by: Bass Abushakra

**Status:** New, may merge/purge with Symposium by Norford.

**Seminar**

“Web-based Programs for Calculating Code-Compliance”

Organized by: TC 34.7 (Applications)

Chaired by: Norm Bourassa, CEC

**Status:** New, would focus on web-based, XML or IFC applications

**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. May merge/purge with Symposium by Norford.

**Symposium**

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

Organized by: TC 2.8 (Co-sponsor)

Chaired by: Dru Crawley

**Status:** 4 papers in review

**Symposium**

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

Organized by: TC 4.7 (Simulation and Component Models)

Chaired by: Jan Kosny

**Status:** New

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

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**Symposium**

“Use of ‘equation solvers’ for Simulation”

Organized by: TC 4.7 (Simulation and Component Models)

Co-chaired by: Jean LeBrun/Mike Wetter

**Status:** New, would be based on 4 abstracts from Dallas

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

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**No program suggestions.**

## SSPC 140 Quebec City Meeting Summary June 26, 2006

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

#### Chair Announcements

- **Addendum a (furnace test cases)** passed through public review with no comments. Per ASHRAE Staff, publication of the addendum by ASHRAE is expected after January 2007 (Dallas meeting), with the next supplement/reprints of code intended standards
- PC approval of **Addendum b (HVAC BESTEST Volume 2, unitary cooling equipment dynamic comparative test cases)** for publication/public review on March 20, 2006; submittal of the addendum and publication draft submittal report to ASHRAE on May 17, 2006; 45-day public review to begin Sep 22, 2006
- **Federal Tax Deduction for Energy Efficient Commercial buildings**, released Jun 2, 2006, cites ANSI/ASHRAE Standard 140-2004 for approving software used for certifying deductions.
- **The 140 meeting was very well attended** (17 even with Dru and George absent), was several more than we've had at the last 4 meetings (10-14 at previous meetings). Could be a sign of growing interest as the work is cited for software approval by more and more code documents in North America and internationally ....

As we are waiting for Addendum B to go out for public review ... this meeting focused on ...

#### 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 (6/26) evening. Meeting objective: Continue with developing a format for Std-140 results data to be posted on the DOE Tools web site. The SubC is developing data format, submittal, and posting recommendations that can also be applied for tax-deductions related software approvals, as much as possible. **Progress:**

- Jim Pegues developing Web Cover Page content and layout, and rules for submitting results, including how submitted material will be posted or otherwise be available from vendors. .
- Mike Witte is working on spreadsheet development, and presented a preliminary format
- SubC and full PC comments to be incorporated in next draft
- DOE is requesting that we have a format available for their use in the next couple months.

### 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. 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