

TC 7.9 MEETING MINUTES

Sunday, January 30, 2011

Las Vegas, NV

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

**1791 Tullie Circle, N.E./Atlanta, GA 30329
404-636-8400**

TC/TG/TRG MINUTES COVER SHEET

(Minutes of all TC/TG/TRG Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/TRG NO TC 7.9 DATE February 20, 2011

TC/TG/TRG TITLE Building Commissioning

DATE OF MEETING January 30, 2011 LOCATION Las Vegas, NV

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Ken Peet Chair	2008 - 10	Richard Causault	2010 - 14	Ken Chappel
Walter Grondzik Vice Chair	2008 - 09	Quinn Hart	2010 - 14	Michael King
Thomas Cappellin Secretary	2007 - 11	Mike Eardley	2010 - 14	Jim Vallort - CM
John Castelvechi Handbook	2008 - 12	William Pienta	2009 - 13	Paul Levy - CM
Sarah Maston Programs	2009 - 13			Justin Seter - CM
David Shipley Research	2008 - 12			Bradley Brooks
Gerald Kettler Long Range	2007 - 11			J. R. Anderson - CM
Abderrazak Alazazi	2010 - 14			A. B. Blalock - CM
David Allen	2010 - 14			Dennis Jones
Timothy Corbett	2010 - 14			Bishara Mogannam
Jay Enck	2007 - 11			James D. Mascard
Roger Lautz	2009 - 13			Greg Kowalski
Holly Townes	2008 - 12			Fiona Aldous
Jeff Traylor	2008 - 12			Wayne Webster
				Mike Kuk - CM
				John Gibb... - CM
				Matt Nelson - CM
				Brian Dobbs
				Kyle Larson
				Manus McDevitt
				Michal Khaw
				Bill McCartney
				Harvey Brickman
				David Eldridge
				David Wylie
				Ben Pollard
				John Varley
				J. B. Singh
				Don Blacklock
				David Rogers
				John Evarts

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				Andrew Wiaszczyk
				Justin Garner
				Bob Linder
				Adam Mangrich
				Steve Wiggins
				John Gibbsmeyor
				John Hamilton
				Breesa Kassing
				James Parsaud - CM
				Mathew J. Grice - CM
				Thurston Simonsen - CM
				John Rieka - CM
				Michael Amstadt - CM
				Billy Austin - CM?
				Mark Terzigni - CM
				Eli Howard
				David Bornside
				Scott Gordon - CM
				Thomas Anderson - CM?
				David Claridge
				Charlie Culp
				Mohd Zaidi Ilamdin
				John Bade

DISTRIBUTION

All Members of TC/TG/TRG plus the following:

TAC Section Head: Drury Crawley	SH7@ashrae.net
TAC Chair: Charles Wilkin	TACChair@ashrae.net
All Committee Liaisons As Shown On TC/TG/TRG Rosters:	
Manager Of Standards: Stephanie Reiniche	sreiniche@ashrae.org
Manager Of Research & Technical Services: Mike Vaughn	MORTS@ashrae.net

Call to Order / Scope / Introduction

Ken Peet (Chair) called the meeting to order at 3:00 PM. The Scope of the Committee was read. Attendees that were present introduced themselves. An attendance sign-in sheet was circulated.

Voting Member Roll Call

14 of the eighteen (18) voting members were present. A quorum was established.

Approval of the Agenda

The agenda for the meeting was presented for approval. There were no requests for revision to the agenda.

Society Liaison and Guest Presentation

None.

Approval of Albuquerque, NM Meeting Minutes

The draft meeting minutes from Albuquerque, NM were reviewed. Walter Grondzik moved for approval, seconded by Jay Enck. Motion passed unanimously: 14 – 0 – 0 (Yea–Nay–Abstain).

ASHRAE Administrative Matters / Correspondence / Announcements

1. Section 7 Chairs Breakfast:
 - a. No Report
2. Upcoming Events:
 - a. ASHRAE Annual Meeting in Montreal
3. Upcoming Meeting Dates
 - a. Montreal, CanadaJune 25-29, 2011 Theme is “Net Zero”
 - b. Chicago, ILJanuary 21-25, 2012
 - c. San Antonio, TXJune 23-28, 2012

Sub-Committee Reports

1. Membership (Sterling): No report
2. Programs (Maston): Complete report is attached to these minutes.
3. Research (Shipley): provided attendees with a hard copy report: RTAR 1633 (TC 1.4) has conditional approval and is recommended by PES for approval. WS 1587 (TC1.4) is pending a draft narration by Steve Taylor. RTAR 2005-57 (Jay Enck) needs a re-write to address comments from RAC. There is interest in submitting an RTAR concerning development of standard functional performance testing forms that could be used by commissioning providers. This matter needs to be coordinated with GPC 1.2 due to their parallel work on FPT forms. Kristin Heinemeier asked for input on experience using “Energy Plus” to model the energy impacts of specific faults that fault detection diagnostics identify. Jay Enck advised that there is some activity in this area but it is in early stage and of small scale. Kristin will follow-up with development of an RTAR. Complete report is attached to these minutes.
4. Handbook (Castelvechchi): The Handbook Chapter proofs have been reviewed and approved for publication. Should be published in the 2011 Handbook. Next step is to check for any errata needed after publication. For the next handbook (2015) we will expand the existing building commissioning portion of the chapter. At some feature data, we may want to make this a separate chapter.
5. Long Range Planning (Kettler): No Report
6. Standards (Lewis): No report
7. Web Site (Shipley): TC7.9’s web site is presently up to date and continues to be the top site currently maintained in Section 7. Listserv needs to be updated.
8. Journal and Insights: No report
9. International: No report

Cognizant Committee Liaison Reports

1. SPGC 0 (Corbett): The committee is currently in process of reviewing the main body of GL 0 and has assigned committee members to work on each section to determine if and where updated wording is required for publication of the next version.
2. GPC 0.2 and 1.2: GL 0.2 is presently being reviewed by the committee's editing committee. There are approximately 24 Annexes currently being developed for this guideline. GL 1.2's main body is currently being developed into a full draft version.
3. GPC 1.3 (Grondzik): GPC 1.3 "Building Operation and Maintenance Training for the HVAC&R Commissioning Process" is currently being developed into a full draft version. This draft may be fully complete by the end of 2011.
4. GPC 1.4 (Kettler): GPC 1.4 "Systems Manuals for Commissioning" is organized and currently working on a draft outline of the guideline.

Other Liaison Reports

1. DASH "Database for the Analysis of Sustainable and High-Performance Buildings" (Kettler): Group needs to provide input for enhancing ASHRAE's Commissioning Process. A presentation was made by Bruce Hunn regarding DASH and "Performance Measurement Protocols Best Practices Guide," as these relate to the NIST "National Institute of standards and Technology" projects on evidence-based benefits of commissioning. See attachments
2. Standard 62.1 "Ventilation and Acceptable IAQ in Commercial, Institutional, and High-Rise Residential Buildings": No report.
3. Standard 90.1 "Energy Efficient Design of New Buildings": Checklists need to be coordinated with Guidelines 0 and 0.1. See motion below.
4. SPC 111, 180, & 11: These items need to be removed from this list.
5. TC 7.8 "Owning and Operating Costs": No report.
6. TC 9.6 "Health Care Facilities" (Lautz): No report.
7. TC 10.1 "Custom Engineered Refrigeration Systems" (Kettler): No report.
8. TC 7.7 "Testing and Balancing" (Kettler): No report.
9. AEDG "Advanced Energy Design Guides (Enck): No report.
10. BCA "Building Commissioning Association" (Kettler): No report
11. PECEI "Portland Energy Conservation Inc.": No report.
12. ACG "Associated Air Balance Council Commissioning Group" (Kettler): No report.
13. NEBB "National Environmental Balancing Bureau" (Steve Wiggins): No report.
14. USGBC "United States Green Building Council" (Enck): The next edition of LEED requirements is currently out for public review.

Standards Actions

1. Jim Vallort reported that Standards passed the following motion: "It is recommended that ASHRAE Guideline 1.1-2007 HVAC&R Technical Requirements for the Commissioning Process, be approved for revision and that SGPC 0 serves as the revision project committee."

Background: TC 7.9 voted to approve revision of ASHRAE Guideline 1.1-2007 and recommended that SGPC 0 serve as the revision project committee. SGPC 0 voted to accept responsibility for the revision and future maintenance of Guideline 1.1-2007 and that Guideline 1.1-2007 be placed on continuous maintenance upon publication of the revised edition.

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Motions

1. Motion was made by Jay Enck and seconded by Walter Grondzik: "TC7.9 SPC 90.1 liaison will convey checklists developed by the SPC 90.1 to GPC 0 and SPC 202 committees for review, comment, and coordination between SPC 90.1, GPC 0, and SPC 202 through TC 7.9 liaison. Motion passed unanimously: 13 – 0 – 0 (Yea–Nay–Abstain).
Chair not voting

Old Business

None.

New Business

None.

Action Items

1. TC 7.9 needs to provide input for enhancing ASHRAE's Commissioning Process as it relates to the Analysis of Sustainable and High-Performance Buildings.

Adjournment

Motion to adjourn was made by Jay Enck. Meeting adjourned at 5:00 P.M prevailing time.

Attachments

1. Programs Report.
2. Research Report.
3. Bruce Hunn DASH and NIST presentation to TC 7.9.
4. Description of project awarded to ASHRAE by NIST.

ATTACHMENT 1 - PROGRAMS REPORT FOR LAS VEGAS

Programs for Montreal

Conference Paper and Technical Paper deadlines have past
Submissions for seminars are due 2/14.

IF YOU WANT TO SPEAK IN MONTREAL, I NEED THE FOLLOWING FROM YOU BY MONDAY, FEBRUARY 14TH AT 4PM FOR EACH PRESENTER:

- Title of Presentation
- Abstract (4-5 sentences)
- Biography of speaker (4-5 sentences)
- Three (3) learning objectives
- Five (5) Questions & Answers that will be covered in the presentation

Session chairs will be assigned as first response/ first assignment. If you had volunteered to chair a session, please let me know if you are available for Montreal. As soon as speakers start sending me information, I will contact people who had volunteered to chair. Chairs will be responsible for uploading information onto the website on 2/14.

Looking ahead to programs for Chicago

If you were interested in speaking in Chicago, I need the following information before the Montreal meeting:

- Title of Presentation
- Abstract (4-5 sentences)
- Biography of speaker (4-5 sentences)
- Three (3) learning objectives
- Five (5) Questions & Answers that will be covered in the presentation

We will be discussing Chicago programs in Montreal, but it would be very helpful to get this information together earlier due to summer vacations.

If you are interesting in putting together a conference paper (8 pages approx.), deadlines to submit an abstract is April 18th. Once the abstract is approved, you have until the first week of August to write the paper. The paper is then reviewed and approved/ rejected for presentation in Chicago.

The following are the deadlines for Chicago:

2011

April 18 — Conference Paper Abstracts
April 18 — Conference Paper Session Requests
April 18 — Full Technical Papers Due for Review
May 6 — Conference Paper Abstract Accept/Reject Notifications
June 3 — Web Site Opens for Seminar, Forum, TPS and CPS Proposals
July 8 — Conference Papers Submitted for Review
Aug. 12 — Seminar, Forum, TPS and CPS Program Proposals Due
Aug. 12 — Technical Papers Final Reviews
Sep. 2 — Conference Papers Accept/Reject Notifications
Sep. 7 — Final Technical Papers Due/Final Conference Papers Due
Sep. 16 — Notifications of Seminar and Forum Accept/Reject Distributed
Dec. 9 — Upload of PPTs Begin

2012

Jan. 6, 2012 — All PPTs Due Online
Jan. 21 — Speaker's Lounge Opens

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ATTACHMENT 2 – RESEARCH REPORT FOR LAS VEGAS

TC 7.9 Research Subcommittee Meeting Minutes

2011 Winter Meeting

Saturday, January 29, 2010, 8:00 – 9:00 am, (H) Conference Room 14, Las Vegas

1. Call to Order: Dave Shipley

Present: Ken Peet, Kristin Heinemeier, John Hamilton, Bishara Mogannam, Daniel Choinière, JR Anderson, John Castelvechi, Natascha Milesi-Ferretti, Jay Enck

2. Planned Research Activities

Priority	Title	Author	Documents	Most recent status
1	URP 1633: Data and Interfaces for Advanced Building Maintenance and Operations	TC 1.4	RTAR	Jan 11: Kristin Heinemeier is serving on the PES/PMS for this and will keep us posted on progress. It has conditional approval. The PES has recommended that it be approved. TC 1.4 will approve it at their meeting here. We should know at this meeting if RAC approves it to go ahead. History is that the original solicitation didn't work out, but then they got an unsolicited proposal, with co-funding, that was responsive to the original RFP, so they are now going with that. <i>Jan 10: According to the report on activities of RAC at their fall meeting, this work statement is "Ready to Bid" but has not yet been put out for bid. No projects were put out to bid this fall, and there are 20 on the list of possible projects for spring of 2010. This one is on that list, but likely they will not do all 20 at this time.</i>
2	WS 1587: Improved Tools for Control Loop Performance Measurement and Evaluation	Steve Taylor, TC 1.4	RTAR RAC Comments	Jan 11: Steve Taylor is trying to get time to develop a new draft of this. May possibly have it ready for this meeting. Haven't seen it yet. <i>June 10: We have comments back from ASHRAE, but Bill has run out of time to work on this. We think it needs a champion from the co-sponsoring TC (1.4) to take it forward, because they likely know more about the topic. If that doesn't happen relatively soon, ASHRAE may drop it off the list again.</i>
3	RTAR 2005-57: Utilization of Random Sampling Technology in Performing Building Commissioning	Jay Enck	RTAR Old RTAR RAC Comments	Jan 11: Dave seems to have dropped the ball on contacting Mike Vaughn about the RAC response. He just sent an e-mail to Mike about it now, on the 18 th of January, 2011. That is now in hand and has been forwarded to Jay. Jay's next step would be to develop a new version of the RTAR that responds to the comment from RAC. He will send something out for us to look at by the 6 th of February. <i>Jan 10: Jay is willing to carry this RTAR forward with some help from Kristin. Dave met with Jay in the hall after the research subcommittee meeting and provided him with both the most recent RTAR document and the previous one, in PDF format. The RAC response to the RTAR has gone missing, so Dave will ask Mike Vaughan by e-mail if we can get a copy of that.</i>

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Priority	Title	Author	Documents	Most recent status
4	WS 1241 - Impact of Commissioning HVAC Systems on Life Cycle Cost	Natascha Milesi-Ferretti	RTAR Work Statement RAC Comments	<p>Jan 11: The final report is now done and posted on the IEA Annex 47 website – main output was the methodology. The expansion of the ASHRAE dash project is also relevant to this work – their plan is to establish measure lists and data protocols, establish web interface, populate with commissioning cost and benefit data. Work has started on some of this. Starting with an LBNL study and the Annex 47 work. Data collection will start in July. There is a meeting here in Las Vegas to coordinate the work between the ASHRAE dash project and the best practices committee. Bruce Hunn is lead contact. Our work should be to work with dash and help guide it. Ken will attend a meeting about dash in March and will bring ideas for a new scope we can talk about in Montreal.</p> <p><i>Jan 10: This WS needs to be re-scoped in light of IEA Annex 47, which now has a final report under review. Annex 47 did a review of approaches to determine cost/benefit of both initial and existing commissioning. It also developed a data protocol and now has collected data on 54 buildings, about 9 or 10 of them new buildings and the rest existing. It exists as a set of spreadsheets, with a protocol for collecting the information to add more buildings. Follow on work could include gathering more cases, and completing the data for some of the ones they have. Understanding of commissioning also varies by country. The data requirements of the protocol are extensive enough that in Canada they have usually had to pay for collection. It might be good to narrow the scope a bit, by focusing on one building type, or specific commissioning approaches. Next step for us would be to draft a new RTAR after the Annex 47 report is final. Natascha has volunteered to take this forward.</i></p>
	Human Factors in Operations-phase Commissioning	Michael Bobker		<p>Define and consider the human factors impacts on the acceptance and implementation of findings by building operators from emerging technology represented by tools and platforms for on-going commissioning, FDD, and remote monitoring. Human factors engineering can be applied for improved performance. This research can be seen as an add-on phase to the current generation of research projects and pilots that are developing and testing such tools and platforms. Early findings suggest that there are barriers to resolve on the operations staff side in making full use of the emergent technology. This work would be coordinated with TRG-7's work under the Strategic Plan Objectives.</p> <p><i>Jan 11: Kristin will follow up with him to find out more about this.</i></p>
	User Manual for SPC 0	Gerry Kettler		<p>Create a user manual for SPC 0.</p> <p><i>Jan 10: This may not be the best funding mechanism. Gerry may pursue it on his own and then have the book sold through ASHRAE, or it could get funding through pubs or through standards. If Gerry puts together an RTAR, we will consider it, but otherwise will let him pursue other options.</i></p>

3. Current Research Projects

4. Other Items

Bishara Mogannam asked whether there was any action on the part of ASHRAE to look at developing a set of standard commissioning forms for functional testing of different systems and components. He realizes there are a lot of resources out there providing examples of forms, but there are no standard ones yet. There are state mandated forms in California, but they are not very detailed, the contractors don't like them, and the inspectors don't have the knowledge or time to deal with them.

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Code enforcement's priority is life safety, and they often don't have time to go beyond that. If ASHRAE took a hand in this, it would become part of the standard of care for the industry, so even if inspectors didn't have time for it, there would be an expectation that professionals in this industry would use appropriate forms. Bishara would be willing to look at developing an RTAR for this. He should talk with Guideline 1.2 about this – they have talked at this meeting about what level of detail they should go to in specifying the steps in their guideline.

Couple of TC website tasks:

- Post a link to ASHRAE resources on research procedures and documents
- The links page in the membership area is very out of date (2003). If we want to have links there to other organizations doing research in this area, Dave would post a list if anyone sends him relevant information.

Kristin asked if anyone has done an Energy Plus simulation to model the energy impacts of specific faults that fault detection diagnostics identify. Jay is doing some work in this area, but it's a small database so far. Dave talked about experiences in Wisconsin with grad students identifying major system faults in buildings by trying (and failing) to match their performance with a TRNSYS model. Should we do a cost-benefit assessment of having a grad student assigned to each large building? Research project: Modeling of Energy Impacts of Faults found by Commissioning. Could just look at the 20 most common faults. Kristin will put something together on that.

ATTACHMENT 3 - DASH AND NIST PRESENTATION TO TC 7.9.

NIST 2010 MEASUREMENT SCIENCE AND ENGINEERING RESEARCH GRANTS PROGRAM

BUILDING RESEARCH GRANTS AND COOPERATIVE AGREEMENTS PROGRAM

EVIDENCE-BASED BENEFITS OF BUILDING COMMISSIONING AND PERFORMANCE MONITORING

A Proposal by ASHRAE and Green Building Alliance

(May 27, 2010)

(Revised June 2, 2010)

BACKGROUND

Building commissioning is increasingly seen as essential for assurance that building design intent is met, and all systems are operating properly after the building is completed and occupied. Retro-commissioning (or commissioning conducted on an on-going basis) is seen as necessary to both improve and maintain a high level of operational performance (energy, water, and indoor air quality). To be effective, commissioning results must become an integral part of the day-to-day practice of building managers and operators. Thus, operators and managers need the following:

- 1) An easy-to-use guide and tools for the operations and maintenance evaluation process, and
- 2) Assistance clearly documenting the measurement process.

Furthermore, a comprehensive database of measured building performance information, operational measures such as energy and water use, and before and after commissioning performance data, is needed to provide comparison benchmarks that facilitate ongoing building performance evaluation.

While work is underway that addresses portions of this tool and database development process, it needs to be consolidated and focused on practical end products for building operators. For example, International Energy Agency (IEA) Annex 47, *Cost-Effective Commissioning for Existing and Low Energy Buildings*, has worked for the past 5 years to enable more effective commissioning of existing and future buildings to improve their operating performance. This project recognizes that demonstrating cost effectiveness, including persistence of commissioning measures, is needed to remove a major barrier to wider market acceptance of commissioning. While the IEA Annex 47 will be complete in summer 2010, much remains to be done, to document and archive measured data that verifies the economic benefits of commissioning.

Lawrence Berkeley National Laboratory (LBNL) has conducted significant work on documenting the benefits of commissioning. Specifically, a 2009 study documented both measured and estimated energy savings data on commissioning projects in 643 new and existing buildings in 26 states, created a standardized analysis of the aggregate energy savings, cost effectiveness, and persistence of many energy efficiency measures identified during commissioning (tune ups, retrofits, etc.) (Mills 2009). A related LBNL study applied "monitoring-based commissioning" to 24 university buildings in California based on the installation of permanent energy information systems and diagnostic tools for the continuous monitoring of electricity, fuel, steam, and chilled water use before and after commissioning (Mills and Mathew 2009). Energy savings and payback periods for a series of "interventions" resulting from retro-commissioning and continuing recommissioning were documented. Monitoring-based commissioning helped identify a range of operating deficiencies and comparative benchmarking metrics and peer groups were recommended.

Another LBNL program is its web-based Action-Oriented Benchmarking service, which includes the *EnergyIQ* benchmarking diagnostic tool that provides a standardized opportunity assessment based on benchmarking results and decision-support to help refine action plans (Mathew 2009). The *EnergyIQ* tool supports both cross-sectional and longitudinal benchmarking and is tailored to preliminary screening purposes, helping lay the groundwork for investment-grade audits and engineering modeling of energy-efficiency upgrades.

STATEMENT OF NEED

As the brief summary of existing commissioning support tools above shows, while a basis for implementing commissioning exists, much work remains to be done that can further add to and expand the functionality of information gained during the commissioning process. A comprehensive database of "before and after" measured commissioning performance data that includes operational measures beyond energy, is needed to provide continuing documentation and comparison opportunities to building owners and operators who have yet to commit to ongoing commissioning. As such, creation of such a database needs to be coordinated with development of a more holistic guide to the overall commissioning process, and tools that better inform operational, maintenance, and performance enhancement decisions.

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Fortunately, a comprehensive database has been under development in recent years, but without a specific focus on commissioning results and benefits. Since 2004 ASHRAE and Green Building Alliance have been working towards development of the DASH (Database for Analyzing Sustainable and High Performance Buildings) database, which will provide a consistent set protocols for the collection, benchmarking, and reporting of measured data to characterize green, sustainable, and high performance buildings. This effort includes preliminary work on a national repository of building information that will support independent assessment and analysis of investment, operational, and occupant-related performance metrics. So far, DASH has developed preliminary reporting standard formats, protocols, and organization for four sets of metrics that define high performance buildings:

- 1) Building/site features
- 2) Operational data (*energy, water, and indoor environmental quality*)
- 3) Real estate and financial information
- 4) Occupant-based metrics (*including productivity, performance, and health*).

In 2009, DASH developed a third-party business plan based on extensive interviews with potential database users. The plan identifies the need for standard, web-based DASH reporting tools for building owners and managers. DASH formats and protocols would be tested and pre-populated with measured performance data from the U.S. Green Building Council (USGBC), General Services Administration (GSA), and Department of Energy (DOE). An executive summary of DASH activity and its proposed database architecture is provided as Attachment A. Attachment B provides DASH's action plan for the next year, which is the basis for the tasks laid out in this proposal.

In a related project, ASHRAE recently published its *Performance Measurement Protocols for Commercial Buildings* report, which specifies what to measure and how to measure it at various levels of cost and accuracy (basic, intermediate, and advanced) for the six operational performance categories of energy, water, thermal comfort, indoor air quality, lighting, and acoustics. ASHRAE's protocols will form the basis for DASH's standardized measures, creating an ideal platform for inclusion of commissioning performance data for a wide range of building types and climate zones into an existing national effort.

Moreover, ASHRAE is developing a sequel *Best Practice for Evaluating and Improving the Performance of Commercial Buildings* guide, which will nicely complement the performance protocols report. This guide will document practical implementation procedures for improving the operational performance of commercial buildings and will specifically link performance measurement to the ongoing building commissioning process. This guide will document the performance measurement process (an essential part of the commissioning process); will be based on several building case studies in which performance protocols will be implemented and tested at the basic, intermediate, and advanced levels; and will provide a process and associated tools for building owners, managers, and consultants to continuously maintain and improve building performance through measurement-based commissioning. Development of the *Best Practices Guide* is further delineated below.

PROJECT OBJECTIVES

Based on existing performance measurement tools and multiple years of collaboration, ASHRAE and GBA propose for NIST funding a project that will meet the following objectives:

- 1) Develop a comprehensive database of U.S. building performance data measured before and after commissioning, in the context of the DASH database described above. This database will provide a rich information resource for evaluating and improving building performance through commissioning.
- 2) Develop and test an overall procedure, and associated tools, to guide operation and maintenance, to be used in commissioning, especially by documenting the performance measurement process, and to identify performance enhancement opportunities. This will be accomplished through the development of the ASHRAE *Best Practice for Evaluating and Improving the Performance of Commercial Buildings* guide.

DASH and the Best Practices Guide will both be based on the ASHRAE *Performance Measurement Protocols for Commercial Buildings* (PMP), which will be tested in *Best Practices Guide* case studies that will focus on the procedure and tools for evaluating and documenting the benefits of commissioning. The ultimate goal is to archive, in the DASH database, reliable performance data gathered in the commissioning process through consistent and standardized reporting protocols from the PMP.

PROJECT SCOPE

Task 1. Develop the DASH database so that the DASH standard format, protocols, and organization includes before and after commissioning performance data for new and existing commercial buildings

Task 1A. Building on the current DASH metric lists (building/site features, operational data, real estate/financial information, and occupant performance/productivity) establish DASH protocols for acquiring, analyzing, benchmarking and reporting data in these four measure categories, with emphasis on how commissioning performance data integrates into the latter three categories. This will require establishing protocols that facilitate the analysis, reporting, and archiving of pre- and post-commissioning performance data (cost-benefit and performance level persistence) as well as appropriate benchmark comparisons; granularity levels of time and space will be explored. Protocols will be developed by building type and function. (ASHRAE, GBA)

Task 1B. Identify and screen sources of before and after commissioning performance data, for a variety of building types and functions, for inclusion in the DASH database. Likely sources will include IEA Annex 47, Lawrence Berkeley National Laboratory's monitoring-based commissioning project and commissioning of heat pump systems in Tennessee K-12 schools. A process for maintaining data anonymity and security will be developed. This task will build on the methods, tools, and information developed in IEA Annex 47. (ASHRAE, GBA)

Task 1C. Develop a web interface for standard DASH data acquisition and reporting. This will include procedures and formats for a) single building data reports and b) summary data reports of aggregate performance statistics for commercial buildings by building type and climate zone. The web interface will facilitate the transfer of data into DASH and the reporting of performance results, including commissioning cost benefits. This task will also focus on the standardization of semantics (data definitions) and data syntax. (GBA, ASHRAE)

Task 1D. Populate DASH database with commissioning cost-benefit data from the Task 1B sources, per the Task 1A protocols. This task will be conducted as part of the DASH data intake alpha phase, which will test the DASH protocols and standard reports by populating DASH from several large, existing contributory data sources such as the LBNL commissioning project; USGBC's Building Performance Initiative; GSA's high performance, green federal buildings; and DOE's High Performance Building Database, as well as data from school districts and municipalities. Measured performance data, including energy use, water use, and indoor environmental quality data, will be gathered and feedback will be solicited from constituencies as to the usefulness of the standard DASH reports. (GBA, ASHRAE).

Task 2. Prepare the ASHRAE *Best Practice for Evaluating and Improving the Performance of Commercial Buildings* guide, with emphasis on establishing the benefits of measurement techniques for the commissioning process. Develop and test the overall procedure and associated documentation tools for the performance measurement process to guide operations and maintenance, via commissioning.

Task 2A. Develop a systematic measurement procedure and associated tools to improve operations and maintenance so as to achieve a consistent, high level of building energy, water, and indoor environmental quality performance. This procedure will base commissioning on the performance measurement protocols developed in ASHRAE/USGBC/CIBSE *Performance Measurement Protocols for Commercial Buildings*, and focus on developing implementation strategies at the basic, intermediate, and advanced levels in each of the following categories:

- Energy
- Water
- Thermal comfort
- Indoor environmental quality
- Lighting
- Acoustics

This procedure will include spreadsheets and forms that will walk a building operator through the measurements required to evaluate maintenance and operations over time, for the building envelope, lighting, and HVAC systems in support of a continuous improvement process that includes appropriate performance benchmark comparisons. For each level of implementation, forms will identify:

- Who performs each step
- Basic process

- Data and/or metrics required
- Measurement methods used (subjective, instrumented, etc.)
- Performance evaluation baselines/benchmarks

This process will be integrated into the commissioning process that would be conducted by an independent commissioning agent so as to emphasize the role of performance monitoring in the commissioning process. (ASHRAE)

Task 2B. Convene a focus group of commissioning agents who will evaluate the Best Practices Guide measurement procedures. This task will process feedback regarding the suitability, feasibility, and value of measurement procedures in the commissioning, retro-commissioning, and on-going commissioning process. The following questions will be addressed:.

- How do the measurement procedures reliably quantify the benefits of commissioning?
- How well do the measurements facilitate verification of retrofit results?
- How do the procedures help to better identify cost-effective performance improvements?
- How do the procedures facilitate the persistence of retrofit improvements?
- How well do the procedures integrate benchmarks into the measured performance?

The results of the focus group will be used to refine the procedures developed in Task 2A to assure that they are useful to the commissioning process.
(ASHRAE)

Task 2C. Test Task 2A procedure and tools in a series of case study projects that include a range of building types, functions, and vintages. Building types will include:

- Small office (<20K ft²)
- Medium –size office (20K-200K ft²)
- Large office (>200K ft²)
- University or National Lab research facility
- Small retail facility (<20K ft²)
- Medium-size retail facility (20K-100K ft²)
- K-12 school

These tests will include facility manager focus group interviews to document their experiences in using the measurement process and to obtain their feedback on how the process can be improved.
(ASHRAE)

PROJECT MANAGEMENT

This proposed project will be managed by ASHRAE with Lilas Pratt as the contact person (lpratt@ashrae.org - (678) 539-1193). The Green Building Alliance (GBA) of Pittsburgh, PA, will be a major subcontractor to ASHRAE. The project will be conducted evenly over the two-year project duration, per the budget section of the original proposal.

Regarding the two major tasks ASHRAE will be fully responsible for the completion of the *ASHRAE Best Practice for Evaluating and Improving the Performance of Commercial Buildings* guide, while GBA will have primary responsibility for the DASH database development, assisted by Bruce D. Hunn. For the former task Hunn (ASHRAE) will serve as the technical manager and Lilas Pratt (ASHRAE) will serve as the administrative manager, while for the latter task Aurora Sharrard (GBA) will be the technical and administrative manager. Hunn, Director of Strategic Technical Programs, will retire from ASHRAE staff as of July 1, 2010, and will provide technical management as a consultant to ASHRAE; Pratt is Manager of Special Projects at ASHRAE. Sharrard is Director of Innovation at GBA. Their qualifications are listed below.

Qualifications of Technical Personnel

Bruce D. Hunn, PhD, *Director of Strategic Technical Programs*, ASHRAE – Manages DASH activities for ASHRAE, providing technical support and project direction for the overall project, Consortium, and various Working Groups. He provides staff direction for

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ASHRAE's technical programs such as the *Advanced Energy Design Guides* and building performance metrics. He develops strategic collaborations with several other organizations and Federal agencies; he serves as ASHRAE Liaison to the US Green Building Council Research Advisory Committee. He has conducted research and development in building energy systems for over 39 years, specializing in building energy modeling, performance assessment, building energy codes and standards, and solar applications to buildings.

Prior to joining ASHRAE, Hunn served as head of the Building Energy Systems Program, Center for Energy Studies at the University of Texas at Austin. There he directed research addressing energy use in buildings, developed a building energy standard for the state of Texas and headed a five-year study of energy use patterns in Texas state facilities.

Hunn has authored or co-authored more than 105 articles, technical reports and papers, along with eight books or chapters, including *Solar Heating Technologies: Fundamentals and Applications*. He holds a B.S., M.S., and PhD in Mechanical Engineering from Stanford University. He is a Fellow in ASHRAE and the American Solar Energy Society, having served as ASES Chair in 1986 and 1987.

Lilas Pratt, *Assistant Manager of Special Projects*, ASHRAE – Manages day-to-day activities of all ASHRAE Special Projects, including meeting support, meeting minutes and conference calls, expediting, tracking budgets, reporting to sponsoring organizations, and interfacing with ASHRAE's Special Projects Subcommittee. She holds a B.S. in Industrial Engineering from the University of Pittsburgh.

Aurora L. Sharrard, PhD, LEED AP; *Director of Innovation*, Green Building Alliance – Manages the DASH program, providing overall project direction on a day-to-day basis, interacting with ASHRAE and the DASH Corresponding Committee, Consortium, and various Working Groups.

Dr. Aurora Sharrard is the Director of Innovation for Green Building Alliance, where she manages Product Innovation Grants; focuses on green product labels, certifications, and life cycle assessment; and manages DASH: Database for Analyzing Sustainable and High Performance Buildings. Aurora also facilitates the Pittsburgh Climate Initiative, for which she convenes the Higher Education Climate Consortium. She also provides technical support to Pittsburgh projects, which currently include the David L. Lawrence Convention Center, Pittsburgh Consol Energy Center, and Phipps Conservatory's Center for Sustainable Landscapes. She is also a LEED Accredited Professional.

Dr. Sharrard currently sits on the USGBC Research Advisory Committee and holds a Master's and Ph.D. in Civil and Environmental Engineering with an emphasis in Green Design from Carnegie Mellon University. Her dissertation was titled "Greening Construction Using an Input-Output-Based Life Cycle Model for Construction Processes" and her master's paper was labeled "Towards a Sustainable Green Building Standard."

End Notes:

Mills, E., Lawrence Berkeley National Laboratory, "Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions," July 2009

<http://cx.lbl.gov>. Accessed 24 May 2010.

Mills, E. and P.A. Mathew, Lawrence Berkeley National Laboratory, "Energy Benchmarking for Buildings and Industries: Action oriented Benchmarking for Non-residential Buildings," July 2009 <http://energybenchmarking.lbl.gov/aob.html>. Accessed 24 May 2010.

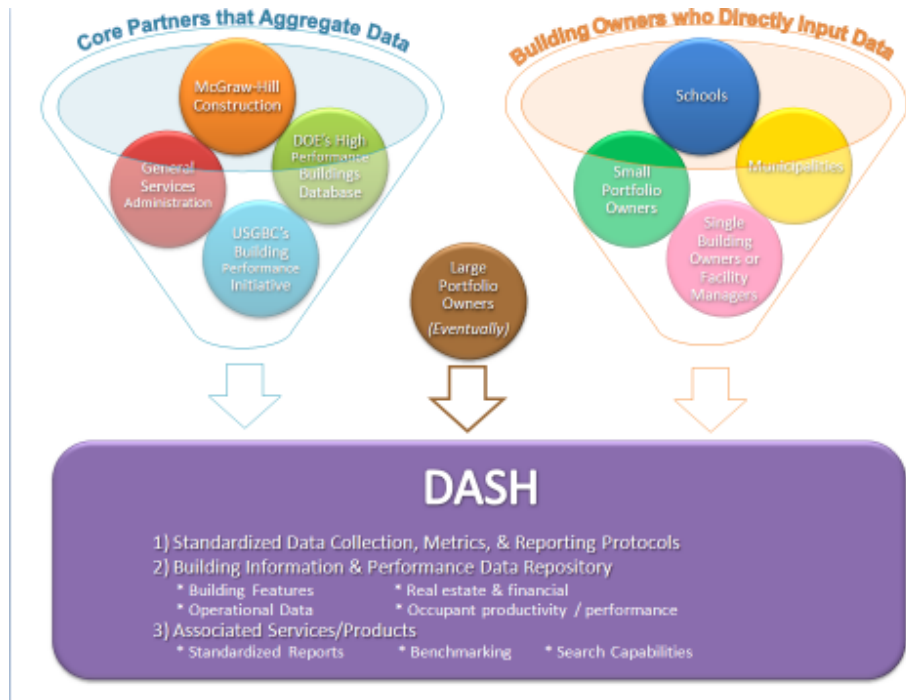
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<http://energybenchmarking.lbl.gov/aob.html>. Accessed 24 May 2010.

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ATTACHMENT A



DASH: Database for Analyzing Sustainable and High Performance Buildings

BACKGROUND:

There are currently many research efforts underway that collect robust and extensive building performance data. However:

- Existing project databases are limited in scope (by developer, owner, company, and /or region).
- Metrics are often limited to specific categories, with little or no cross-over:
 - Real estate
 - Energy / Operations
 - Productivity
- With so many existing databases and research studies, data collection methods are not consistent.

In 2004, DASH was established to help address these issues under the moniker “High Performance Building Database Protocol and Repository” (HPBDPR). The current DASH plan includes:

MISSION:

Facilitate consistent collection of quantitative data about green, sustainable, and high performance buildings through collaboration of existing building information databases, organizations, companies, and researchers.

SCOPE:

Increase the quantity of, quality of, and access to information about green, sustainable, and high performance buildings by creating an building metric information clearinghouse, identifying gaps in currently collected building data, developing consistent protocols for data collection and reporting, and establishing a national green, sustainable, and high performance building data repository that will support independent assessment and analysis of investment, operation, and occupant-related building metrics.

STRUCTURE:

Green Building Alliance (GBA) has received continued strong support for its role as a facilitator and catalyst for this much-needed project. Starting in Summer 2008, GBA transitioned into co-managing DASH, along with the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). National stakeholders from real estate, industry, consulting, academia, national laboratories, and government continue to be involved in DASH in the following engagement levels:

- DASH Consortium
- Working Groups
- Advisory Board
- Corresponding Committee

AUDIENCE:

The DASH audience includes the following stakeholders, who are listed in order of focus:

- Real Property Industry (*decision makers, developers, investors, owners, property management firms, and owner/ operators*)
- Researchers & Analysts (*colleges, universities, nonprofits, & government agencies*)
- Consultants, Services, & Products (*architects, engineers, , contractors, other specifiers, facility managers, product/ technology developers, and energy advocacy groups*)

DASH CONSORTIUM

The DASH Consortium primarily consists of organizations that host or hold existing building information databases.

- These organizations collaborate to promote clarity and consistency in building metric collection about green, sustainable, and high performance buildings, with a goal to effect improvement in how information about all buildings is collected, stored, and analyzed. The Consortium helps define consensus-based DASH policy.

DASH WORKING GROUPS

- **Clearinghouse** (Chaired by GBA and New Buildings Institute)
 - Create and make public literature review of relevant background and dataset information.
 - Determines what existing organizations are currently collecting what types of and which specific building information data, as well as who has access to this information, and at what price.
 - Provides ongoing updates to this building metric inventory.
 - Includes a mapping activity to determine what information currently exists and what real estate, operational, and occupant-related building metrics previously identified by DASH as priorities are still missing from the current breadth of building information data collection.
 - Work with the Consortium to identify and describe metric and data gaps, as well as encourage collection of this missing information.
- **Protocols / Metrics** (Chaired by ASHRAE and Pacific Northwest National Laboratory)
 - Links each building metric to a standard methodology, whether existing or created by DASH.
 - Where possible and available, benchmark data will be included.
 - May attempt to provide conversion capabilities between existing information collection systems.
 - Assists Consortium members in moving toward consistent and useable data collection).
 - Works with Consortium members to identify how existing databases can help fill current information gaps.
 - Development will most likely be tiered, with the following prioritized order:
 - Site / building features
 - Real estate/financial
 - Operational (*will heavily reference ASHRAE's forthcoming protocol*)
 - Occupant-related/productivity
- **Database/Repository** (Chaired by ASHRAE and National Renewable Energy Laboratory)
 - Will address the database architecture, structure, and operations.
 - The DASH database will be a user-friendly national repository for building data, although international information will be encouraged.
 - DASH will collect information about green, sustainable, *and* high performance buildings
 - The initial database focus will be new construction and major renovation/rehabilitation projects.
 - The database will pursue a diversity of building types, geographic locations, and delivery methods.
 - DASH will collaborate with and incorporate existing information from various agencies currently collecting building information data.
 - The DASH Database will offer data providers various levels of participation/data accuracy:
 - Basic
 - Intermediate (*opt in*)
 - Advanced (*opt in*)
 - Case study (*opt in to research*)
 - Partial data records will be accepted.
 - Building identification information will be anonymized and confidential, with partial identifying information possibly being accessible at different access levels, where appropriate and necessary,
 - An attempt will be made to cluster or group questions into categories in order to make data requests less overwhelming.
 - Overall and contributing metrics may facilitate this strategy.
 - The initial DASH database will initially be an example, not a representative sample (*i.e., a limited subset for in-depth study*).
- **Marketing and Outreach** (Chaired by GBA and USGBC)
 - DASH's marketing and outreach will be a collaborative effort to instill in building industry stakeholders the benefits of logging building performance.
 - The details of DASH and why its goals are important for its audience will be provided.
 - Consortium members will reach out to their organization's members and other partners to recruit data providers.

ATTACHMENT B

Expanding upon the October 2009 DASH Business Plan provided by Wellspring Worldwide and the DASH Consortium meeting in Washington, DC, on October 29, 2009, GBA and ASHRAE developed the following approach to effectively implement DASH in 2010. Thus, the 2010 focus of DASH will be on the following task areas:

1) DASH ORGANIZATIONAL FORMAT

GBA and ASHRAE will continue work through the DASH Working Group model, but Working Groups will be reorganized and refocused as follows:

- 1) *Metrics and Protocols Working Group* – Formerly the “Protocols Working Group,” this restructured Working Group will continue to develop a standard format and organization for the four measure lists. Will prioritize measure lists at three levels. *More detailed information is provided under the “Data, Metrics, and Protocols” section below.*
- 2) *Web Interface Working Group* – Formerly the “Repository Working Group,” this newly focused Working Group Will begin to focus on required organization and interface for web portion of DASH buildout. *More detailed information is provided under the “Web Interface Development” section below.*
- 3) *Data Intake Working Group* – Formerly the “Clearinghouse Working Group,” this reorganized Working Group will begin to focus on how to integrate existing data sources into an eventual DASH database. *More detailed information is provided under the “Data Intake” section below.*
- 4) *Outreach Working Group* – Formerly the “Marketing & Outreach Working Group,” this simplified Working Group will be convened in early 2010 to further discuss what types of tasks they think that would they be most useful on. *Until an expanded need arises, current marketing & fundraising tasks will be handled by GBA, ASHRAE, or DASH staff.*

- **The DASH Consortium will continue to have quarterly conference calls.**

2) DATA, METRICS, and PROTOCOLS

Establish prioritized measure and metric lists in standard format that define building information for sustainable, high performance, and/or green buildings in four categories:

- Building/site features
- Operational data (energy, water, IEQ)
- Real estate & financial information
- Occupant-based metrics, including productivity, comfort, and performance

Establish preliminary DASH protocols for acquiring, analyzing, benchmarking, and reporting data in the four categories listed above.

- DASH protocols will begin with the following existing protocols documents
 - ASHRAE/USGBC/CIBSE *Performance Measurement Protocols for Commercial Buildings.*
 - PNNL’s “Building Cost and Performance Metrics: Data Collection Protocol, Revision 1.0.” PNNL-15217
- Initial foci will be building features and operational data. Operations will focus on energy, water, thermal comfort, IAQ, lighting, and acoustics.
- Through the test process of populating the DASH database with real data from existing sources (Data Intake task below), DASH will solicit feedback from constituencies as to the usefulness of the standard protocols.

3) WEB INTERFACE DEVELOPMENT

Develop web interface for standard DASH reporting tool (for single building owners or facility managers) based on measure lists and protocols in four categories specified above. Standard reports from this interface will include:

- Standard Reports
 - Level 1 – Single building detailed data report.
 - Level 2 – Single building summary data report related to appropriate benchmarks.

Web interface development will progress through several focus group scenarios, which will be developed ad hoc.

4) IMPLEMENT ALPHA PHASE OF DATA INTAKE

Test DASH protocols and standards reports by populating the DASH database and issuing related reports for up to 100 buildings from each of the following:

- Contributory Large Data Sources
 - USGBC Building Performance Initiative for LEED buildings (annual indices plus monthly profiles)

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- GSA's high performance green federal buildings (including PNNL data for 12 GSA buildings)
- DOE's High Performance Buildings Database (DOE/NREL/BuildingGreen)
- McGraw-Hill Construction?
- Interested single building owner/operators of facility managers
- Small Portfolio Managers, *possibly from*
 - Selected municipalities
 - School districts
 - Federal buildings
- **Feedback**
 - DASH will probably initially perform data intake for building/site features and operational data only.
 - Through the test process of populating the DASH database with real data from existing sources, DASH will solicit feedback from constituencies as to the usefulness of the standard reports.
 - DASH will also seek to better understand the amount of time and cost required to populate a single building record.

ATTACHMENT 4 - NIST GRANT TO ASHRAE ON PERFORMANCE MONITORING AND COMMISSIONING

J.R. Anderson, Chair TC 7.9
Anderson Engineering

As of October 2010 ASHRAE was awarded a two-year grant from the National Institute of Standards and Technology (NIST) for a study entitled "Evidence-Based Benefits of Building Commissioning and Performance Monitoring", a copy of which is attached. This proposal was written in consultation with Jim Bochat, Terry Townsend, and others who are active participants in ongoing ASHRAE projects, such as development of the *Best Practice for Evaluating and Improving the Performance of Commercial Buildings*, which is being chaired by Bochat. This Best Practices Guide is a sequel to the *Performance Measurement Protocols for Commercial Buildings* guide that was published by ASHRAE last summer. I am a consultant to ASHRAE to implement the technical activities in this proposal.

As you will note from the attached, which governs our contract with NIST, the work is built upon two ASHRAE projects that have been underway under the Building Performance Metrics Steering Committee, chaired by Terry Townsend: 1) Development of the Best Practices Guide mentioned above, and 2) the DASH (Database for Analyzing Sustainable and High Performance Buildings). The project is being conducted jointly by ASHRAE and the Green Building Alliance of Pittsburgh, PA. Because establishing the benefits of building commissioning is of great interest to NIST, we built this project on connecting the Best Practices Guide and the DASH projects directly to documenting the evidence-based benefits of commissioning (Task 2 and Task 1 in the attached, respectively).

As you can see this project is intended to be conducted in coordination with relevant ASHRAE TCs, especially TC 7.9. Input and advice from TC 7.9 members, as well as TPC 1.2 members, is vital to the success of this project. While both the Best Practices Guide and DASH tasks will need this input over the course of the project, the near-term tasks are primarily Tasks 2A (Develop measurement procedure and associated tools), 2B (Convene focus group of commissioning agents), and 1A (Establish DASH protocols for performance measurement). These three tasks particularly need TC 7.9 input to assure that an appropriate commissioning perspective and benefit is included in the results. Task 2A involves the development of the Best Practices Guide measurement procedures, which are in the early stages of development. The commissioning agent focus group of Task 2B is now being formulated and is scheduled for February 18. Task 1A is being address by a Working Group within DASH that is reviewing a set of performance measures in the categories of Building-Site Features, Operational (energy, water, and IEQ), Real Estate-Financial, and Occupant Performance. While the tasks are underway, there is ample time for TC 7.9 input to influence the process and we welcome that input.

Therefore, I am requesting that TC 7.9 appoint a liaison to this project. Jim Bochat and Jay Enck are familiar with elements of the project and Gerald Kettler was closely involved in the development of the *Performance Measurement Protocols for Commercial Buildings* document. However, we leave the choice up to you. While a single liaison is needed, we welcome the input of a small group of other interested persons as well.

I will be attending the Las Vegas meeting but unfortunately I have a conflict (the BPM Steering Committee) with your TC 7.9 meeting on Sunday, 3:00-5:00. Nonetheless, I could probably arrange to visit the TC to explain all this between 4:00 and 5:00 that day. Since I do not arrive in Las Vegas until around noon Saturday, I might be able to attend the Long Range Planning Subcommittee from 2:00-3:00 on Saturday. Please advise as to how I can best establish contact with TC 7.9 at the meeting.

We greatly look forward to working closely with TC 7.9 in this important ASHRAE project. I look forward to hearing from you as to how we can best accomplish this.

Bruce D. Hunn
ASHRAE Fellow
hunnbuildingenergy@gmail.com
(404) 455-9735

Retired June 30, 2010, as ASHRAE Director of Strategic Technical Programs, and prior to that as Director of Technology.