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DRAFT

TC/TG/MTG/TRG MINUTES COVER SHEET

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

TC/TG/MTG/TRG No. TC7.5 DATE 03/11/2019

TC/TG/MTG/TRG TITLE Smart Building Systems

DATE OF MEETING 1/15/2019 LOCATION GWCC 4TH Floor, Building A, A405

| Members Present | Appt | Ex-Officio Members and Additional Attendance |
|------------------------------|-------------|---|
| Jin Wen, Chair. (V) | 2017 | Daniel SuLlivan |
| David Yuill, Vice Chair (V) | 2017 | Kimberly Barker |
| Zheng O'Neill, Secretary (V) | 2017 | Wayne Stoppelmoor |
| Li Song, Research Subc (V) | 2017 | Mohamed Ouf |
| Carol Lomonaco, Subc (V) | 2015 | Christie Kjellman |
| Kristen Cetin, Subc (V) | 2017 | Aaron Opatz |
| Peter R Armstrong (V) | 2015 | Tony Bruno |
| Eric Young, Subc (CM) | 2017 | Bob Snol |
| Mike Brambley (CM) | 2002 | Mohammad heidarinejad |
| Bach D Tsan, Subc (CM) | 2017 | Darrys Deangelis |
| Gregory S. Pavlak, Subc (CM) | 2017 | Costa Kapsis |
| Xiaohui Zhou, Subc (CM) | 2017 | Vasken Dermardiros |
| Glenn T Remington (CM) | 2012 | Jian Sun |
| Zixiao Shi (P.CM) | 2018 | Alexi Miller |
| David F Shipley (CM) | 2017 | Lei Wang |
| Edward Ka Cheung Tsui (CM) | 2011 | ZhengLei Liu |
| Chariti Young, (CM) | 2002 | Rui Zhang |
| Andrew L Hjortland (CM) | | Helia Zandi |
| Curtis Fong (CM) | 2018 | |
| Guanjing Lin (CM) | 2017 | |

| | | |
|-------------------------|------|--|
| John M House (CM) | 2008 | |
| Mayumi Miura Azbil (CM) | 2013 | |

(V) = voting member

(CM) = corresponding member

(PCM) = provisional corresponding member

Note: The complete attendance list from TC 7.5 is enclosed.

| DISTRIBUTION: All Members of TC/TG/MTG/TRG plus the following: | |
|---|--|
| Larry A Smith | SH7@ashrae.net |
| Rich M Heiden (Standard Liaison) | rheiden@train.com |
| David A Ballard (Chapter Technology Transfer Chair) | dballard@tcco.com |
| Bryan Becker (Handbook Liaison) | beckerb@umkc.edu |
| Mike Vaughn, Manager Of Research & Technical Services | MORTS@ashrae.net |

Note: These draft minutes have not been approved and not the official, approved record until approved by the TC.

**ASHRAE TC 7.5, Smart Building Systems
2019 Winter Meeting
Meeting Minutes
Atlanta, GA**

Location: GWCC 4TH Floor, Building A, A405

Date: Tuesday, January 15th, 2019

Time: 3:30 - 6:00 p.m.

1. Welcome

Chair Jin called for meeting at 3:00pm

Jin made a statement that ASHRAE members can use the ASHRAE website to join in the TC as the PM, then move to CM after two years.

2. Roll Call and Introductions. Review VMs, CMs, and PCMs after July 1, 2019 changes

- Roll call
Seven voting members (out of 8 voting members) are attending this meeting:
Kristen Cetin; Carol Lomonaco; Zheng O'Neill; Li Song (left earlier); David Yuill; Jin Wen;
Peter Armstrong
- Current voting member list: Peter Armstrong; Kristen Cetin; Xin Hu; Carol Lomonaco;
Zheng O'Neill; Li Song; David Yuill; Jin Wen; Tea Zakula (Non-Quorum)
- Three VM rolling off: Carol Lomonaco; Peter Armstrong; Xin Hu
- Five VM rolling on: Srinivas Katipamula; Glenn Remington; Liping Wang; Eric Young;
Joe Zhou

3. Scope

- Jin read the TC 7.5 scope and the code of ethics commitment

TC 7.5 is concerned with the performance and interactions of smart building systems, the impact of smart systems on the total building performance, methods for achieving more intelligent control and operation of building processes, interactions of smart buildings with utilities, and documentation of the benefits of smart buildings and smart building systems as they relate to energy consumption, cost of operation, maintenance, occupant comfort, building commissioning, operations, and impact of the SBS on utilities and natural resources.

ASHRAE Code of Ethics Commitment – Chair

In this and all other ASHRAE meetings, we will act with honesty, fairness, courtesy, competence, integrity and respect for others, and we shall avoid all real or perceived conflicts of interests. (See full Code of Ethics:

<https://www.ashrae.org/about-ashrae/ashrae-code-of-ethics.>)

4. Discussion/Approval of Houston Minutes

- The draft was distributed to the TC and was posted on the basecamp. If the member needs the access, please contact Jin.
- At 3:38pm, Li motion to approve the minute, Zheng second
- Vote: 6-0-0 (chair not vote) approved

5. Announcements

- New TWG reorganization
 - 1) Jin announced that the TC will have detailed discussions at the end of meeting at 5:30pm. Jin briefly talked about the letter about new TWG reorganization. The letter and other related documents are on the basecamp
 - 2) The TC needs to have a consolidated document from discussions. TC members who cannot stay after 5:30pm are encouraged to send emails directly to the TC chair. The goal is to have discussion documents from the section 7 at the end of Jan.
 - 3) Mike Brambley asked whether this message is from TAC only. Jin said this message is from a special committee.
 - 4) There is a question about whether members can see the survey questions
 - 5) Jin stopped the discussion and encourage members to stay till the discussion to 5:30pm.
- New version of TC Manual of Procedures – Needs approval if using TC or ASHRAE names.
- Anything sending on behalf of TC will need the TC approval, and anything sending out on behalf of ASHRAE – may need the approval from ASHRAE president.
 - 1) Glenn: Does the research PMS communication need approval or not? Jin: probably not, need to check the Manual
- Residential Building Committee (RBC) interested in co-sponsoring related TC research. Research chair Li will talk more on this.
- CEC’s standing request for future society meeting program track suggestions. CEC decides on the program track.
- Jin is asking whether there are announcements

6. Research

- Research subcommittee Chair Li Song
- WS and RP updates
 - 1) PTAR: Publication Topic Acceptance Request. PTAT will take a different track review
 - 2) RP 1661 “Development and validation of dynamic models for the evaluation of chilled water system control strategies in the ASHRAE handbook”: The contractor is asking for one year non-cost extension

- 3) RP1756 “Evaluation of low-cost particulate sensors for building”. no update since neither PMS liaison: The PMSC member is not presented. Glenn agreed to check on the email for the updates
- 4) Working document
 - WS 1783 – “Develop cost and performance indices to evaluate effectiveness of virtual sensors in HVAC applications”. The WS was submitted in December 2018, but the WS number was changed to 1875. Bill (Section research liaison) will forward the feedback from RAC to our TC right after this conference.
 - WS 1781 – “Methods to Evaluate AFDD Methods for Air Handling Unit Systems”. The WS was submitted once and received comments. Jin will get revised version submitted before
- WS-1809 “Updating Reference Guide for Dynamic Models of HVAC Equipment”.
 - 1) co-sponsorship approved by the TC 1.4
 - 2) Peter motion to move the WS-1809 to RAC. Li second
 - 3) 6-0-0 (chair note vote) approved.
- WS-1812 “Detection and Diagnosis of the Circulating Fluid Leakage for Hydronic Systems”
 - 1) Zheng briefly talked about the co-sponsorship from TC 6.8 (7-0-0)
 - 2) Dave motion to move the WS-1912 to RAC. Li second
 - 3) 6-0-0 (chair not vote) approved.
- Collaboration with 90.2 committee
 - 1) New business: SSPC 90.2 – Residential buildings. New version just published
 - 2) Seek for new research topic
 - How smart-connected thermostat can impact the home energy consumption? How much thermal comfort /energy can be achieved from field and survey studies? Develop matrix through simulation to generate performance matrix.
 - Need to develop the RTAR with SSPC 90.2
 - Glenn: utility perspective
 - Jin: Smart grid or enabling technologies subcommittee will be good places to get involved.
 - “Kristen, Glenn, Jin and Li” interested be a part of the team to help RTAR.
- TC 6.7 seek for the co-sponsorship
 - 1) Contact: Konstantions Kapsis from CanmetEnergy Konstantiono.kapsis @canada.ca
 - 2) Solar PV design guide for the building professional: Including HVAC and building interaction
 - 3) RATR/WS Lead: James Leidel:
 - 4) Glenn: ASHRAE has an ongoing research project to publish the smart grid guideline in 6-7 months.

7. Fault Detection and Diagnosis Subcommittee

- Li Song ran the FDD subcommittee meeting for Liping Wang
- Li needs to leave. Jin talked about the discussions in the FDD subcommittee
 - 1) FDD: sponsor two conference paper sessions and one seminar
 - 2) Guanjin Lin from LBNL talked about FDD work in nat. labs
 - 3) WS and RP updates, and RTAR ideas –see research summary
 - Collect, clean, and label existing data: Shawn Zhao will work on this.
 - Automated alarm management: Carol suggested to go for the seminar first, then collect information to inform research idea. Glenn has some experience and will talk with Carlo

8. Enabling Technologies Subcommittee

- Carlo gave a report on behalf of Enabling Technologies Subcommittee Chair John Wallace
- WS and RTAR updates, and new ideas (see details from subcommittee minutes)
 - 1) Data tagging and meta data
 - 2) Dennis Gregor
 - 3) Scrabble from UCSD
 - 4) IOT sensors – Jin mentioned she mentioned this discussion in TC1.4
- Discuss ideas to have a seminar on best practices related to monitoring and instrumentation.
 - 1) Jin: There should be two parts: first part needs to focus on the sensing technology
 - 2) Glenn: Smart meters are not working well when they are integrated together.
 - 3) Seminar Chair—Edward Tsui will be chair. David Yuill will find a speaker from TC 1.2
 - 4) Co-sponsorship: TC 1.4, TC 1.2 and TC 7.6
- Carol will consider to have a seminar for IOT sensing for the KS meeting or future meeting

9. Smart Grid Subcommittee

- Smart Grid Subcommittee Chair Kristen Cetin gave a report
- WS and RP updates (See subcommittee minutes for details)
- Program ideas (see subcommittee minutes for details)
 - 1) Sensor and smart meters → John Wallace will collaborate with Tsui for the proposed seminar.
 - Start to put a list of controlled related program ideas
 - i. Building-to-grid ideas → 1-2 seminar
 - ii. Smart building interaction
 - iii. Smart products
 - iv. Building envelope for grid integration (for Orlando)
 - v. Battery (Eric Yang is working on this)
- ASHRAE Guide on building-grid integration (see subcommittee minutes for details):
 - 1) Christie Kjellman talked about the need for a guideline for grid-interactive smart building to support the smart buildings.

- Building a new energy future -> publish information to inform designer, manufacturers.
- Market moves so fast, so target on the guide.
- Time frame: as soon as possible.
- 2) Bach from Edison: a white paper to be finished before the end of the year
- 3) Glen: we should leverage ongoing ASHRAE guide project. Glen: Maybe Edison may help on the guideline as well.
- 4) Jin: TC wanted to TC members to be involved
- 5) Chariti Young: Whether this is aligned with TC's interests, support the development work
- 6) Carol made a motion:TC75 support the development of the proposed guide, and participate in and moving forward. David Second
- 7) Discussion: Carol: Do we have the people who have the time to support? Joe, Glen, Srinivas Katipamula. Jin, Zheng, Kristen, are willing to help
- 8) 6-0-0 (Chair vote)
- Kristen talked with ARPA-E SENSOR project

10. Buildings Operations Dynamics Subcommittee

- Building Operation Dynamics Subcommittee Chair Bach Tsan gave a report
- WS and RP updates (see subcommittee minutes for details)
 - 1) RTAR: If you had “perfect information” on occupant’s comfort preferences and their location within a conditioned space then how would you optimize control and how much value would you be able to realize. It is on the basecamp and ready for vote
 - 2) RTAR: Design guideline to consider unmeasured disturbance for an implementable MPC . Need to check with RTAR author Donghun for the updates
- Programs (See subcommittee minutes for details)
 - 1) Pressure independent smart valves: co-sponsorship from TC 1. 4 and TC 6. 1
- Research (See subcommittee minutes for details)

11. Program

- Program chair Eric Yang provided the report
- Kansas City program submission plan (See subcommittee minutes for details)
 - 1) Glen: the operator training will be fitting into the professional development track
 - 2) Everything due by 02.08.2019
- 2020 Orlando track: Two tracks related to TC 7.5

12. Handbook

- Handbook co-chairs Joe Zhou and Gregory Pavlak provided the report
 - 1) Two chapters in 2020 application handbook

- 2) Next 6 months: form a team to edit, review the chapters, start a framework, identify the gaps
- 3) TC members have the access to the ASHRAE author portal
- 4) Question. Whether there is a plan to develop a smart grid chapter
- 5) Electric version does not a page limit, but the printed version has a limit
- 6) Joe Zhou circulated a sign-up sheet for handbook chapter reviewers/editors

13. Standards

No updates

14. Web Page (Mike Galler)

Webmaster Mike Galler is not here since NIST is shutdown. There are no updates.

15. Liaison Reports: TC 1.4, TC 1.5, TC 1.6, TC 7.3, SPC 207P

- TC1.4: Chariti Young provided the updates:
 - 1) Guideline 13 to include cybersecurity and FDD
 - 2) If merged TC 1.4 to choose TC 75
- TC 1.5: Carol Provided the updates
 - 1) Unified control specifics
 - 2) Cybersecurity
 - 3) Look for YEA in TC 7.5
- TC1.6: No updates
- TC7.3: Mike discussed TC reorganization
- SPC 207P: Dave provided the updates
 - 1) There were more than 50 comments for the public review
 - 2) Plan to have a RTRA for the testing of the SPC 207P

16. Old Business

- YEA: Shawn Zhao will chair this YEA subcommittee in TC 7.5
- Awards: Carol will chair and she requested the time for the next meeting to talk about/review awards
- Track Suggestions: none
- Old Publications (FDD and Dynamic Building Models): none

17. New Business

- New TWG reorganization
 - 1) Craig TC 7 section head
 - TAC is seeking for inputs for this reorganization
 - Reasons: decrease silo and now there are more than 300 meetings. Increase collaborations, and things need to move fast at TCs. Now there are too many

meetings and people cannot have the time for programs. There are also concerns on the financial cost associated with meeting room request.

- There is no choice and we need to make it work
 - Seek for inputs from TC and individuals
 - Details are not finalized, and we cannot change the concept. There will be total 32 FTG with some subcommittees.
- 2) Jin:
- Large group meeting is not effective for discussions. Suggest to have the main meeting to be hold online if ASHRAE wants to reduce the cost.
 - Numbers: 75-200 is really large → A meeting with 30-40 participants is preferred since the meeting will be interactive and everyone can be engaged.
 - YEA members are unlikely to talk in a large group, so it will be hard for them to move the leadership. We need to provide mentorship for YEA.
 - Employer concern
- 3) Mike Brambley:
- Create another layer. Large organization is not moving faster
 - What is the problem? Identify the problem first, then move to solve the problem/issues
 - No reorganization
- 4) Dave Shipley: How many voting members for the TFG? If not a voting member, someone will stop coming to the ASHRAE meeting
- 5) What are the actual reasons that we are doing this? ASHRAE Program need to be correlated with TC meetings better.
- 6) ASHRAE is having 3-year deficit. Don't take on the TC to solve this.
- 7) Joe: keep big one, and merge small ones
- 8) Jin: how to evaluate the performance of this reorganization?
- 9) Dave Yuill: negative impact on membership. For the people who only go to program., then what they will do? This will be less efficient for the meeting
- 10) Carol: If TCs takes a long time to take action, then we need to do some analysis to see where the problems are
- 11) Close the international office

18. Adjournment

At 6:10pm, Zheng made a motion to end the meeting. Dave second
6-0-0 (Chair vote)



Minutes

TC 7.5 Fault Detection and Diagnostics

2:30-3:15 pm, Sunday, January 13, 2019

Prepared by Liping Wang, * Li Song will lead the meeting*

Subcommittee Scope: explore and develop technologies to help detecting and diagnosing common faults in both commercial and residential buildings. The scope of this subcommittee includes (a) identifying and sponsoring research projects to develop new FDD technologies, evaluate existing FDD technologies; provide recommendations to building operators and practical engineers; and develop supporting tools for researchers in FDD areas; and b) organizing programs to disseminate research findings and advancements in FDD areas among ASHRAE members.

Agenda:

| | | |
|--------|--|--|
| 0:00 | Call to Order | |
| | Circulate Sign In sheet, self-introduction, announce the subcommittee scope. | |
| 5 min | Sessions at current ASHARE conference | |
| | <i>Conference Paper Session 4: Presentation 2: Model-based and Data-driven Anomaly Detection for Heating and Cooling Demands in Office Buildings (AT-2019-C011)</i> Sunday, 11:20AM–11:40AM, GWCC, 3rd Floor, Building A303 | Update in Atlanta: great turned out, full audience attendees. |
| | <i>Conference Paper Session 10: Presentation 3: Next-Generation Residential Space Conditioning System for California (AT-2019-C035)</i> Monday, 10:25AM–10:45AM, GWCC, 3rd Floor, Building A, A303 | |
| | <i>Seminar 71: Presentation 4: Persistence of Savings Isn't a Side Issue: Using New Tech to Make Sure Savings Show Up at the Meter</i> Wednesday, 12:00PM–12:20PM, GWCC, 3rd Floor, Building B, B315 | |
| 20 min | LBNL AFDD research project (presentation) | Guanjing Lin Update in Atlanta: Guanjing provided a 20-minutes presentation and introduced 4 ongoing LBNL projects. |
| 5 min | Annual ASHRAE conference seminar ideas | No updates! |
| | DOE/New AFDD activities | Wen Jin Updated by Jin: Guanjing Lin's presentation is one of the outcomes toward this effort. Jin will continue to work on it and maybe put together a seminar for Kansas February 8 th . |
| | Other ideas? | |

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| 10 min | Update/Discussion of Active project/RTARs/Work Statement | |
| | Methods to evaluate AFDD strategies for air handling unit systems (work statement) | Jin Wen, David Yuill Jin updated: is revising it by Thursday |
| | Development of AFDD for leakage of ground-source heat pumps (WS) | Zheng O'Neill and Kristen Cetin Update: revised and sent it out for voting on Tuesday |
| | New Research Ideas | |
| | RTAR idea: collect, clean, and label existing data for FDD research. | Xiwang Li, Liping Wang, Kristen Cetin. Shawn Shi Update: Guanjing will communicate with Xiwang Li for an update. |
| | Automated Alarm Management: DDC alarms used for FDD? (automated analytics to correct alarms or utilize alarms) – retune the threshold to reduce false alarms in an automated process | Carol Lomonaco; Reinhard Seidl, Li Song, Te Qi, John Wallace Carol updated that she wanted to prepare a seminar first and lead it to a RTAR. Mostly Kansas, but maybe Orlando. |
| | Other ideas? | Guanjing asked about how the status of integrating the FDD into 90.1 and 189.1. Economizer FDD is already embedded in the 90.1. RTAR: fault prevalence study is necessary to justify the FDD value to 90.1. More discussion will be made in Research subcommittee due to time constraint. |
| 5 min | Other ideas and discussions | |
| Adjourn | | |

Detailed Meeting Notes

Call to Order

- New members – name – affiliation, new member
- Read scope

Sessions at current ASHARE conference

- *Conference Paper Session 4: Presentation 2: Model-based and Data-driven Anomaly Detection for Heating and Cooling Demands in Office Buildings (AT-2019-C011), Sunday, 11:20AM–11:40AM, GWCC, 3rd Floor, Building A, A303*
- *Monday, 10:25AM–10:45AM, GWCC, 3rd Floor, Building A, A303*
- **Seminar 71: Presentation 4: Persistence of Savings Isn't a Side Issue: Using New Tech to Make Sure Savings Show Up at the Meter, Wednesday, 12:00PM–12:20PM, GWCC, 3rd Floor, Building B, B315**

Presentations by Guanjing Lin on LBNL AFDD research project.

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ASHRAE conference ideas

Summer 2019

- Tracks
 1. Systems and Equipment in the Built Environment
 2. Fundamentals and Applications
 3. Optimization in HVAC & R
 4. Commissioning New and Existing Buildings
 5. Occupant Health and Safety
 6. Modeling Throughout the Building Life Cycle
 7. Professional Development
 8. Research Summit
 9. Radiant Heating and Cooling Mini-Track
- Ideas
 - DOE/New AFDD activities (Wen Jin)

Winter 2020 – will discuss next time

Update/Discussion of RTARs/Work Statement ideas

- Work statement
 - Methods to evaluate AFDD strategies for air handling unit systems (Jin Wen, David Yuill)
- RTAR
 - Development of AFDD for leakage of ground-source heat pumps (Zheng O'Neill and Kristen Cetin)
- RTAR ideas
 - a. Collect, clean, and label existing data for FDD research.
Collect and organize experimental dataset for ASHRAE research projects (RP-1020, RP-1043, RP-1312) related to fault detection and diagnosis.
 - b. Automated Alarm Management: DDC alarms used for FDD? (automated analytics to correct alarms or utilize alarms) – retune the threshold to reduce false alarms in an automated process
There is a paper this morning that prioritize alarms, and utilizing alarms for faults (author-Taylor)
 - c. Other ideas?



Minutes – Atlanta Winter Meeting

TC 7.5 Enabling Technologies Subcommittee

3:15-4:00 pm, Sunday, January 13, 2019

B301/GWCC 3rd Floor, Bldg B

Prepared by John Wallace

Objective for this Meeting: Generate ideas for research and program related to Enabling Technologies and assign owners.

Subcommittee Scope: The Enabling Technologies Subcommittee of TC 7.5: Smart Building Systems aims at exploring and developing technologies which will enable the development, implementation and commercialization of smart building applications such as fault detection and diagnostics, model-predictive control and optimization, and smart grid applications such as automated demand response. Three focal points of this subcommittee are i) smart transducers, such as sensors and actuators which provide diagnostic information, ii) communications, such as wireless devices and protocols enabling greater data exchange, and iii) embedded metadata, such as embedded equipment and system information to enable smart building applications. On these topics, the scope of this subcommittee includes identifying and sponsoring research projects, evaluating existing technologies, providing recommendations to building operators and practicing engineers, developing supporting tools for researchers in these areas, and organizing programs to disseminate research findings and advancements among ASHRAE members.

Related Committee activities: BACnet SSPC 135 committee AP data modeling working group, Facility Smart Grid Information Model, Computer Applications, Emerging Technologies, SGPC 20 HVAC process data exchange requirements and SPC 205 Standard Representation of packaged unit models.

| Time | Item |
|------|---|
| 3:15 | Call to order; Introductions; Agenda Overview |
| 3:20 | Review existing RTAR's and research ideas |
| 3:40 | Call for new ideas to investigate & discuss |
| 4:00 | Wrap Up/Adjourn |

Minutes:

Existing RTAR's and research ideas

- 1) We discussed the interest in data tagging and meta data associated with point which was introduced at the last meeting. There is a BACNET committee (223) that is considering haystack and how to include elements of it. Brick has also been mentioned as a possibility to include in the committee work.
- 2) Dennis had mentioned that he may be able to provide names and point data from several sites that could potentially be used as part of a training or research project.
- 3) Scrabble is a project at UCSD which could lessen the "human effort" required to map metadata into a usable format. This could enable FDD to be applied on existing building with much less effort.

New Ideas to investigate and discuss

- 1) Several members discussed the concept of including Gas and/or Water sensing in a building to create a wholistic view of the building. Regulation on water usage is becoming more important and would fit into

the idea of a monitoring system that provides broad building information. We decided to introduce the topic at the Smart Grid subcommittee as well.

- 2) IOT and new types of sensors could be an interesting topic (possibly in conjunction with TC1.4). We could include how new sensors create opportunities for monitoring and controlling potentially at a more granular level. Potentially include as part of the wholistic building. This could include information on system integration and the value of including different types of data into a monitoring system.
- 3) We discussed the idea of having a seminar on best practices related to monitoring and instrumentation (potentially with TC1.2 or TC1.4). This could be split into a basic and advanced part with the advance covering smart sensors, IOT, etc.



Minutes

TC 7.5 Smart Grid Subcommittee
 4:00-4:45 pm, Sunday, January 13, 2019
 Prepared by Kristen S. Cetin

Subcommittee Scope: This subcommittee will explore and develop ideas and research work statements to improve the building and utility interactions (and more specifically the electric grid). The research will focus on developing enabling technologies for seamless interaction of smart building components and utilities and other building services. An important aspect of this work is to identify the information that is necessary to support smart building technologies, and to identify the requirements of communication protocols to support the exchange of this information between different building services buildings and utilities, between multiple buildings, with outside service providers.

The importance of a stable and reliable electric power grid to life and the economy in the 21st century has been underscored by two major events over the last decade: a major black out on the east coast of North America and wildly varying electricity prices in California during an attempt at restructuring the electricity marketplace. In response to these events many organization (DOE, EPRI, and CEC) have started research activities to find ways to modernize the grid. However, there a significant gaps in the research activities, especially as they relate to buildings. Since buildings consume over 70% of the electric in the U.S., they have to part of the solution to modernize the grid. ASHRAE has traditionally developed technologies, standards, and guidelines for buildings. Therefore, this subcommittee can play a major role in continuing this effort.

Agenda:

| | | |
|--------|---|---|
| 0:00 | Call to Order | |
| | Circulate Sign In sheet, self-introduction, announce the subcommittee scope. | |
| 5 min | Relevant sessions at current ASHRAE conference | |
| | Seminar 22 – 3:15-4:45 pm – Sunday - <i>Building Energy Storage: The Future of the Smart Grid</i> | Guy Frankenfield, Ram Narayanamurthy, Mark MacCracken |
| | Seminar 11 – 11 am – 12:30 pm – Sunday - <i>Building HVAC System Control Strategies to Interact with the Modern Electric Grid (TC 7.5 sponsored)</i> | Carlos Haiad, Jie Cai, Tom Lawrence, Glenn Remington |
| | Seminar 70 – 11 am – 12:30 pm – Wednesday - <i>Development of High-Reliability, Low-Cost, Occupancy Presence, Counting and CO2 Sensor Technologies and ASHRAE Testing Standards/Guidelines (TC 7.5 sponsored)</i> | Kristen Cetin, Zheng O’Neill, Jenny Gerbi, Jeff Rhoades |
| | Seminar 4 – 8-9 am – Sunday - <i>Thermal Energy Storage in the Cold Chain</i> | Collin Coker, John Lerch |
| 25 min | Summer ASHRAE conference seminar ideas | |
| | Forum Discussion - Demand Side Management (DSM) – resubmission | Kristen Cetin/Glenn Remington |
| | 2 ideas for seminars (<i>overlap from discussions in Enabling Technology</i>) (1) Sensor systems, smart meters: Training of use of monitoring equipment (2) Smart sensors for buildings (Energy, water, gas, IEQ) | John Wallace/Glenn Remington /Kristen Cetin |

| | | |
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| | Transactive Control/Building/Grid integration – differences in different locations (<i>speakers from NREL, PNNL</i>) | Jin Wen, Helia Zandi |
| | Control of grid-interactive buildings (<i>focus on the control side</i>) – looking towards the future (not constrained by existing rules) | Mike Brambly (speakers already identified)/Jin Wen /Christie |
| | Cybersecurity & Smart Grid (plan for Orlando) | Glenn Remington |
| | Fundamentals of smart building integration | Carlos/David Blum/Scott Hackel |
| | Smart products for residential and commercial buildings | Kristen Cetin/Zheng O’Neill |
| | Smart Grid – Building Envelope Interaction/Dynamic Facades | Piljae Im, Diana Hun, Jie Cai, Donghun Kim, Paulo Tabares |
| | Utility Grid Battery Control Strategies and impact on O&M, LCA | Eric Yang |
| 10 min | Discussion on Formation of new Standard/Guideline committee on “A guide for grid-interactive Smart Buildings) (<i>request for TC 7.5 to discussion/sponsor, request for interested parties to participate – please see uploaded documents on Basecamp</i>) | Bach Tsan/Christie |
| 10 min | Discussion on Formation of new Standard/Guideline committee on “Laboratory performance testing of occupancy sensor systems”) (<i>request for TC 7.5 to discussion/sponsor, request for interested parties to participate – please see uploaded documents on Basecamp</i>) | Kristen Cetin/Zheng O’Neill |
| Adjourn | | |

Detailed Meeting Minutes

Call to Order

- Sign in Sheet
- New members – name – affiliation, new member
- Read scope

Sessions at current ASHARE conference

- Seminar 4 – 8-9 am – Sunday - Thermal Energy Storage in the Cold Chain; Collin Coker, John Lerch
 - Well attended
- Seminar 22 – 3:15-4:45 pm – Sunday - Building Energy Storage: The Future of the Smart Grid; Guy Frankenfield, Ram Narayanamurthy, Mark MacCracken
- Seminar 11 – 11 am – 12:30 pm – Sunday - Building HVAC System Control Strategies to Interact with the Modern Electric Grid (TC 7.5 sponsored); Carlos Haiad, Jie Cai, Tom Lawrence, Glenn Remington
 - Significant number of people in attendance (50-100)
- Seminar 70 – 11 am – 12:30 pm – Wednesday - Development of High-Reliability, Low-Cost, Occupancy Presence, Counting and CO2 Sensor Technologies and ASHRAE Testing Standards/Guidelines (TC 7.5 sponsored); Kristen Cetin, Zheng O’Neill, Jenny Gerbi, Jeff Rhoades

ASHRAE conference ideas

Summer 2019 – Kansas City, MO – June 22-26

- Tracks (potentially relevant tracks)
 - 10. Optimization in HVAC&R**
 - 11. Commissioning of New & Existing Buildings**
 - 12. Modeling Through the Building Lifecycle**
 - 13. Research Summit**
- Ideas
 - o Smart building systems in code – Demand Response – **Glenn Remington/Kristen Cetin**
 - Previous submission (plan to submit again, perhaps focus on residential)
 - *Demand Response: Impact on ASHRAE members and the path forward*
 - *Description: Demand response (DR) programs and technologies are becoming more complex and widespread. A key component of DR includes adjustments from the normal operation of building systems to reduce electricity demand and help improve grid reliability and stability. Demand response is already included in high-performance building programs such as Standard 189.1, the IGCC and LEED. This forum will work to: summarize how the need for DR capabilities is affecting the ASHRAE community; what challenges are associated with*
 - Suggestion to change from DR to DER (Distributed energy resources) to make it more of interest to the ASHRAE community
 - o Enabling Technologies seminar ideas (please see meeting minutes from Enabling Technologies) – **John Wallace/Glenn Remington/Kristen Cetin**
 - Discussion on potential topic associated with two ideas
 - 1) Sensor systems & smart meters: training on the use of monitoring equipment
 - 2) smart sensors for buildings (e.g. cover energy, water, gas, IEQ)
 - o Transitive Control/Building-Grid integration – Jin Wen., Helia, Mike Brambly, Christie
 - Much discussion regarding this topic among many members
 - **Mike Brambly** is already planning to submit a seminar on “Control of grid-interactive buildings, focusing on the control side of this and looking towards the future (i.e. not constrained by existing rules)
 - **Jin Wen, and Helia Zandi** also expressed interest in Transactive Controls & Building/grid integration in different locations of the U.S. with potential interest from various national labs as being speakers.
 - o Cybersecurity & Smart Grid (discussed at last meeting) –**Glenn Remington** (chair)
 - potential collaboration with TC 1.5
 - need to resubmit (not selected for this conference)
 - We will plan to submit for **Orlando** (more appropriate track)
 - o Fundamental of smart building integration – for presentation – **Carlos/David Blum/Scott Hackel**
 - Submitted several sessions ago (no discussion the past two meetings)
 - Scott indicated interest in being a speaker for this area
 - o Smart products for residential and commercial buildings - **Kristen, Zheng?**
 - talk with residential TC – net zero building committee
 -
 - o Smart grid and building envelope interaction (from 4.4) - as an energy storage feature – **Diana Hun, Piljae Im, Jie Cai, Donghun Kim, Paulo Tabares**
 - **Diana & Piljae** indicated interest in this topic (*Atlanta 2019*)
 - How building envelope can impact or interplay with smart grid contributions from buildings
 - Something discussed at DoE meeting last January in Chicago
 - Dynamic facades
 - o Utility Grid Battery Control Strategies and Impacts on O&M & LCA – Eric Yang
 - New idea (*Atlanta 2019*)

Winter 2020 – will discuss next time

Discussion on Formation of new Standard/Guideline committee on “A guide for grid-interactive Smart Buildings)

- request for TC 7.5 to discussion/sponsor
- request for interested parties to participate
- please see uploaded documents on Basecamp
- Christie provided a brief presentation and discussion on this idea
- Looking for people who are interested in participating in this effort.
- **Glenn Remington/Joe Zhou** suggested potential synergies between this effort and the recent guide development (funded ASHRAE project this winter/spring)

Discussion on Formation of new Standard/Guideline committee on “Laboratory performance testing of occupancy sensor systems”

- request for TC 7.5 to discussion/sponsor
- request for interested parties to participate
- please see uploaded documents on Basecamp
- Mike Brambly suggested/cautioned about creating a guideline/standard before all the ARPA-E efforts are complete
- Other comments included potentially proposing additional research as an RTAR to test the standard test method ideas thru ASHRAE funding to determine what methods are best of different ideas
- Follow up discussions will continue to occur at future meetings
- Looking for feedback and members interested in participating in this effort
- Kristen Cetin and Zheng O’neill will discuss with MTG.OBB on Monday.

Update/Discussion of RTARs/Work Statement ideas (We did not get a chance to discuss this in Atlanta 2019 due to time constraints – we will resume in Kansas City)

- *Create recommendations for HVACR cyber security best practices and cyber security reference architectures - **Glenn Gasmen***
 - o *Shared with TC (uploaded on basecamp previously)*
- *Guidance on smart building equipment / IoT – (something that came up from forum discussion)*
 - o *what are you getting, functionality, products*
 - o *what program functions are necessary to work in different environments*
- *Development of models for better peak load predictions (**Michael Bobker**)*
 - o *City-scale model validation for predicting demand response - some models exist*
 - o *Need an evaluation of the state of the art, perhaps useful for new city planning*
 - o *Need some more research on demand response capacity prediction*
 - o *Existing software – GridLabD – developed to designing rate cases - Snirvas*
 - o *Peaks at annual, monthly, daily, hourly, 15 min, 1 min?*
- *Instantaneous voltage and current load from buildings (**Ralph Muehleisen**)*
- *Energy demand prediction of multiple building scale*
- *Linking building modeling to grid modeling (**Donghun Kim**)*
 - o *Some existing efforts*
 - *Cider – DOE Sunshot program – linking transmission and building modeling, heavy use of smi*
 - *CEC – put out public request for comment on possibly funding*
 - *IEA Annex 60 – electrical and building linking efforts with Modellica*
 - o *End user of this work would be policy recommendations for ISOs*
 - o *How to validate models?*

Interest in continuation of Demand Response guideline (We did not discuss at this meeting)

- *Previous efforts from Randall, Carlos*
- *Suggested to form at multidisciplinary task group (MTG)*

- *Suggestion by Larry Markel –*
 - o *Addendum to 189.1*
 - o *See how 189.1 is merging with IGCC & integrating demand response*
 - o *Volunteer effort to join Working Group for DR – Andy Persily*
- *Continued interest among TC for continuing this effort????*
 - o *Interest in more focus – focusing on ASHRAE related interests – e.g. HVAC capabilities needed to participate in demand response*
 - o *If there is a demand response program, how would a building/equipment manufacture be able to contribute*
 - o *What kind of equipment to install to make a building DR ready?*
 - o *Recommend to engage TC 1.4*
 - o *Currently there are rules of thumb....*

ASHRAE TC 7.5 Smart Building Systems
2019 Winter Conference - Atlanta

Agenda/Minutes of Building Operations Dynamics Subcommittee Meeting

Date: Monday, January 14, 2019
Time: 4:15-5:15 p.m.
Location: B301 (GWCC)

19. Roll Call and Introductions

20. Mission Statement

- The Building Operations Dynamics Subcommittee of TC 7.5 is concerned with the dynamic characteristics and interactions of comfort conditions, the active components of HVAC systems, the passive components of HVAC systems, control systems and operation strategies and the building. The committee is concerned with the methods of building system operation which minimize energy used through the consideration of dynamics and interactions. It is also concerned with methods which consider dynamic and interactive characteristics in the design or comfort conditioning systems.

21. Announcements

- New Subcommittee Chair

22. Program Proposals

| Program | Title | Lead | Newest update |
|---------|---|--------------------|--|
| 1 | What to do with optimal control? | Peter Armstrong | Peter was lack of one of the speakers. Updates after St. Louis meeting: Abstract was submitted – Updates after LV: It will be submitted for Winter 2018 Updates at Long Beach: Peter is not here. |
| 2 | Model accuracy impact study on model predictive control | Andreas Athienitis | Orlando---It is already a well-funded project. Andreas will provide a seminar for the work he has done in the area. For Las Vegas. Updates after St. Louis meeting: It was not accepted for LV. Update after LV: Control tracks for long beach and joe suggested to communicate with track chair in order to improve the chance. Update at Long Beach: Andreas is not here. David Blum is willing to contribute. Accepted for Chicago meeting |
| 3 | Smart products for residential and commercial | Josh and Kristen | Update after LV: Suggested to talk with residential TC and net zero building committee and a link from Zeng was shared. |

| | | | |
|------------|------------------------------|--|--|
| | | | Update at Long Beach: Christen wanted to push this to Houston. |
| 4 | Training plan for facilities | | Update after LV: TC7.3 and commissioning - provide somehow continuous information; Jin recommends forming a MTG. Update at Long Beach: Park |
| New ideas? | | | See Notes |

23. Research

| Research | Title | Lead | Newest updates |
|----------|--|----------------------------|--|
| RP-1661 | RP- 1661: Development and Validation of Dynamic Models for the Evaluation of Chilled-Water System Control Strategies in the ASHRAE Handbook | TBD | University of Miami is selected as the contractor. TC 7.5 PMS member: Li Song provided progress report |
| WS | WS- 1809: Updating reference guide for dynamic models of HVAC equipment | Heejin Cho | Updates after St. Louis meeting: RTAT is recommended by RAC. Now Heejin is working on the WS. He plans to have it ready for review in Long Beach. Updates after LV: Heejin is working on the WS; need a status update. Update at Long Beach: Heejin will send the WS by Chicago Meeting. Note: This WS has to be submitted by August, 2018 |
| RTAR? | If you had “perfect information” on occupant’s comfort preferences and their location within a conditioned space then how would you optimize control and how much value would you be able to realize | Rich Hackner? Li Song? | St. Louise update: An RTAR is prepared by Li and will be discussed in the committee meeting for comments. Rich will lead on WS if the RTAR is accepted. Need inputs to improve the RTAR. Two volunteers: James Sweeney and Gary Shamshoian. Updates after St. Louis meeting: James provided many inputs in details and the RTAT is revised accordingly. It is ready for committee discussion in LV. Update after LV: March 1 st is the deadline. Withdraw? Update at Long Beach: Park <u>Speak with LBNL - Tianzhen</u> |
| RTAR | Explore and Quantify Behavior-Driven Building Energy | Zheng O’Neill Bing Dong | This is a new RTAR from MTG:OBB. Look for the co-sponsorship from TC7.5 Rejected by RAC. |

| | | | |
|-------|--|----------------------------------|-----|
| RTAR? | How IoT impacts operators | Carol Liping Wang | TBD |
| RTAR? | Link the productivity with occupancy based control | Ivo Martinac | TBD |
| RTAR? | Smart management of moisture and energy consumption in residential houses, smart ventilation, optimal location for dryer, heat pump water heater, etc. | Andrew Windham; Kristen Cetin | TBD |
| RTAR? | Design guideline to consider unmeasured disturbance for an implementable MPC | Donghun Kim, David Blum | TBD |

24. New Business

- ~~Develop A Guide for Grid Interactive Smart Buildings~~

25. Other topics:

- Suggestion: Sponsor a program at the next ASHRAE winter conference on EE/DR Building operation dynamics -
- Co-sponsor work with
 - Sspc 135 BACnet
 - Effective Energy Management in new and existing Buildings ASHRAE SPEC 100
 - Operations and Maintenance of High Performance Buildings
 - GPC 36P High performance sequence of operations for HVAC Systems
- Occupancy Based Modeling with feedback to control systems - LBNL

26. Adjournment:

Detailed Meeting Minutes

Call to Order

- Sign in Sheet
- Roll Call
- Read scope
- New Committee Chair Announcement

Review of the Program Proposals:

- *What to do with optimal control?*
 - *Bach will connect with Peter Armstrong to review program proposal*
- *Model accuracy impact study on model predictive control*
 - *Funded and developed via sponsorship from DOE, Seminar was completed. This will be removed from the agenda.*
- *Smart products for residential and commercial*
 - *This is an on-going project proposal. Kristen will coordinate with Josh and provide update to the Building Operation Dynamic subcommittee chair.*
- *Training plan for facilities*
 - *Update information on the agenda to reflect new information*
 - *Operator training through BOD. Contract with DOD to form training for facility managers. Webinar and physical training. Joe Zhou will provide update at next meeting regarding the formal development of this program. Expected initiation is May 2019. Duration of this program is expected to be 2 years, with on-line webinars and speakers for the DOD.*
 - *This program was developed to respond to a need for operator training. The facility operators can improve building performance by understanding their building operation dynamics. Ex: why SP pressure controls. Understanding operation reactions to obtain response.*

New Program Ideas:

- *Organize training for operation controls*
 - *Guanjing Lin, LBNL initiated request for research paper development.*
 - *with TC 1.4 Research relating to SP reset., propose for Kansas City.*
 - *Research information from Field optimization – Paul R at UC Berkeley.*
 - *Abstract to be submitted for Feb 8. Information needed : Speakers, Questions, Learning goals.*
 - *Guanjing Lin; Hwakong Cheng, P.E. Taylor Engineering. To develop this information.*
 - *2 speakers possible from activity led by Taylor Engineering.*
 - *Additional speakers to be coordinated with Greg – Buildings and Grid*
 - *Send abstract cc Wen.*
- *Pressure independent Smart Valves.*
 - *Seminar Idea – Joe Zhou*
 - *Sensors to calculate energy not only to control flow.*
 - *Cross reference with TC 1.4*

Research:

- *RP- 1661: Development and Validation of Dynamic Models for the Evaluation of Chilled-Water System Control Strategies in the ASHRAE Handbook*
 - *Li Song and Wangda Zuo provided update to the research project, developed 9 different control sequence models and have run 18,000 simulations. Simulations are on-going. Current progress is running debugging of the simulations. Project expected to end April 2019- request PMS / TC 4.7 to extend 1 year. Discuss if extension could be granted. 6 months extension then consider another 6 months.*
- *WS- 1809: Updating reference guide for dynamic models of HVAC equipment*
 - *Work Statement – Intent to vote at TC 7.5, Reference guide.*
 - *Discussion on the scope of this work statement. Consider modifying “update”*
 - *Standard Research Report then another task to update the reference guide.*
 - *Request expedited process.*
 - *Project was expected to be a literature review.*
 - *Send out to RAC before the RTAR rules changed PTAR (Publication TAR).*
- *RTAR : If you had “perfect information” on occupant’s comfort preferences and their location within a conditioned space then how would you optimize control and how much value would you be able to realize.*
 - *RTAR completed but did not submit.*
 - *Internal TC review, and started to award, but search for co-sponsorship.*
 - *Should check with occupant behavior group.*
 - *Coordinate with TC 1.4?*
 - *Circulate the document again via e-mail and repost by Li Song.*
 - *Wen to communicate with Rich Hackner*
- *RTAR : Explore and Quantify Behavior-Driven Building Energy*
 - *Complete, remove from Agenda table.*
- *RTAR : How IoT impacts operators*
 - *Carol Lomonaco, Li Song and Joe Zou to discuss and develop further*
 - *Seeking additional support from TC 7.5 members.*
 - *Example provided : Viewing vav boxes in the IP network.*
 - *Carol working on outline.*
 - *How to quantify impact – Li Song*
 - *Dovetailing with enabling technologies.*
 - *Update the title*
- *RTAR : Link the productivity with occupancy based control*
 - *Ivo Martinac – professor developing idea.*
 - *Professor did not have bandwidth.*
 - *Interested in the idea but need to develop the team.*
- *RTAR: Smart management of moisture and energy consumption in residential houses, smart ventilation, optimal location for dryer, heat pump water heater, etc.*
 - *Kristen will follow up with Andrew Windham*
- *RTAR : Design guideline to consider unmeasured disturbance for an implementable MPC*
 - *RTAR available and sent in Chicago.*
 - *Completed RTAR but has not been voted.*
 - *Donghun seek assistance to upload.*
 - *Wen Jin’s records show and updated draft between Donghun and David.*

- *Wen to forward to Li and process.*

Other Topics :

- *TC 7.5 is the main sponsor of Seminar 47, Co – Sponsoring with TC 1.4. Tuesday January 15, 8:00 – 9:30 am.*

Adjournment.

**ASHRAE TC 7.5: Smart Building Systems Research Subcommittee Meeting
Monday, January 14, 2019, 5:15 – 6:00 p.m, B301 (GWCC)**

Minutes

1. Roll Call and Introduction 5:15 - 5:18
2. Announcements 5:18 – 5:20
 - a. AHSRAE is in the effort of implementing a new research review procedure for special publications, such as guide and user book. A different (PTAR not RTAR) form will be used and PTARs will be reviewed mainly by the publication committee. However, it will still take some time to get the new procedure in place.
 - b. The research funding is tight now. The new bid release might be slowed down, but the RAC will continue reviewing RTAR and WS in a normal pace.
 - c. The WS writers can bid on the project they initiated without receiving penalty. It might be problematic if the WS writer is the only bidder though.
3. Status of current Research Projects (Detailed current research plan is attached in next pages) 5:20 – 5:40
 - 3.1 Two ongoing research projects that are co-sponsored by TC75.
 - a. RP 1661 – “Development and validation of dynamic models for the evaluation of chilled water system control strategies in the ASHRAE handbook”. The PI has progressed to Task 3, conducting large scale simulation and debugging. The PMS thinks 12 month no-cost extension would be needed.
 - b. RP 1756 – “evaluation of low-cost particulate sensors for building”. no update since neither PMS liaison, Liping nor Glen, showed up.
 - 3.2 Four active work statements.
 - a. WS 1781 – “Methods to Evaluate AFDD Methods for Air Handling Unit Systems”. The WS was submitted once and received comments. Jin will get revised version submitted before February deadline.
 - b. WS 1783 – “Develop cost and performance indices to evaluate effectiveness of virtual sensors in HVAC applications”. The WS was submitted in December 2018, but the WS number was changed to 1875. Bill will forward the feedback from RAC to our TC right after this conference.
 - c. WS 1809 – “Updating Reference Guide for Dynamic Models of HVAC Equipment”. The WS was distributed to the TC a couple weeks before the Atlanta conference and it is ready for TC review and vote today.
 - d. WS 1812 – “Detection and Diagnosis of the Circulating Fluid Leakage for Hydronic Systems”. First draft was submitted after Chicago meeting. Received comments in May 2018. TC 6.8

research committee has approved revised version. The WS is revised and is ready for vote.

3.3 Four active RTAR (one of them is co-sponsor)

3.4 New WS candidates

3.5 RTARs/WS underdevelopment

- | | |
|--|--------|
| 4. TC 7.5 research new ideas and topics | 5:40 – |
| <p>We did not have time to discuss this in the research subcommittee meeting but would like to have some discussion in the main meeting. SSPC 90.2 is interested in a study of the energy performance impact of connected/smart thermostats on residential buildings with an expectation of useful outcome to enhance the next version 90.2. They have three volunteers to work with TC75 on developing and RTAR. I am happy to lead this effort but would like to see any interests from our TC members to form a RTAR working group.</p> | 5:55 |
| 5. New Business | 5:55 – |
| | 6:00 |
| 6. Adjourn | 6:00 |

ASHRAE TC 7.5: Smart Building Systems Research Plan
Active Project: 0; Co-sponsor Project: 2; Active WS: 4; Active RTAR:12; Co-sponsor
WS/RTAR: 2

| Subc | Project | Contributors/PI | Status |
|------------|---|--|---|
| Co-Sponsor | (TC 4.7) RP 1661- Development and validation of dynamic models for the evaluation of chilled water system control strategies in the ASHRAE handbook | PMS Liaison: Li Song | Co-sponsoring with TC – 4.7 and 1.4 WS is returned with comments. Wangda will provide updated WS for TC review during Orlando. STL: the TC voted Yes and submitted to RAC. RAC conditional approved. Las Vegas – Selected a bidder. Miami is the winner Long Beach – contract is being signed. Project starts on August 1 st . Wangda is the PI (will be at Boulder) Chicago: The project has begun, and the PMS met with the contractor. Task 1 is complete. Conference call is complete. Houston: The PI gave a report on the progress. Updated by Wangda: PMS meeting was on Sunday. Identified 9 sequences rather than 3 sequences. Large scale simulation and debugging is ongoing. 12- month extension is requested. |
| Co-Sponsor | TC 2.4: RP-1756 evaluation of low-cost particulate sensors for building | Brent Stephens (2.4) 7.5 PMS: Glenn Remington and Liping Wang | ORL: – need co-authorship too – against lab-grade equipment to review their performances... STL: the TC voted YES and submitted to RAC. No feedback yet. Las Vegas – resubmit a WS. Need 1-2 PES volunteers Long Beach – PES met and is selecting winner. Chicago: Project was awarded to Jordan Clark at Ohio State University, and has commenced. There are some initial adjustments to scope requested. Houston: The PMS had their second meeting. Update: Li will follow up with Remington or Li Ping Wang for an update before the main TC meeting. |
| WS | | | |
| FDD | WS 1781: – Methods to Evaluate AFDD Methods for Air Handling Unit Systems | Jin Wen | CHI – Jin Wen has new version for submission. Atlanta – Voted; submitted to RAC. RAC accepted with comments for WS. ORL – WS in preparation STL – WS in preparation; 7.3 will co-sponsor. Might seek co-sponsorship with 9.1 Las Vegas – WS in development. Will seek a vote in between meetings. Long Beach - WS is ready to be voted. Aim at submitting it by August deadline Chicago: WS was submitted after vote in LB. RAC returned with comments. Jin, Michael, and David met with Chris Wilkins, RAC liaison, and discussed revisions and resubmitting. Houston: No update. It times out within the next year, but we're still interested in pursuing this. Update by Jin: WS was inspired by the difficulties of the evaluation of RTU FDD algorithms. The WS was submitted once and comments were collected. Jin will get it done before the February 2019. |

| Subc | Project | Contributors/PI | Status |
|-------------|--|--------------------------------|--|
| FDD | WS-1812 – Detection and Diagnosis of the Circulating Fluid Leakage for Hydronic Systems | Zheng O’Neill Kristen Cetin | STL: RTART discussed in sub-committee. Will be voted in mid-July. Committee voted approval. RAC approved. Need to develop WS. Las Vegas: WS in development. Long Beach: WS is ready to be voted. Aim at August deadline. Chicago: TC 6.8 was approached as co-sponsor. They were initially uncertain, but after a visit, they requested a change in title. TC 6.8 voted 9-1-1-1 CNV. Houston: WS was returned with comments. They aim to revise for August 15 th deadline. Update by Zheng: First draft was submitted after Chicago meeting. Received comments in May 2018. TC 6.8 research committee has approved revised version. The WS is revised and is ready for vote. |
| ET | WS-1783 : Develop cost and performance indices to evaluate effectiveness of virtual sensors in HVAC applications | Li Song | Voted in Atlanta; Submitted for RAC to review. RAC accepted with comments. ORL – WS in preparation STL - WS in preparation Las Vegas – no update Long Beach – no update Chicago: there is still an interest in submitting a WS. Houston: Li will submit WS to RAC by August 15. Update by Li: |
| BOD | WS-1809 – Updating Reference Guide for Dynamic Models of HVAC Equipment | Heejin Cho | SEA --Is this tech transfer? Update of Jean LeBrun’s work from 1990’s All kinds of tech transfer hurdles to leap over. Would this be better as a tool kit? BOD discussion on toolkit option, changing scope and budget and timing of research. ATL – need to be revised completely. ORL – Heejin will give a revised version tonight. STL: The revised RTAR is ready for committee to review and vote. Committee voted approval. RAC approved. Need to develop WS. Las Vegas: WS in development. Long Beach: WS in development. Aim at Chicago meeting Chicago: a draft WS has been developed and sent to Zheng. It still needs some significant development. Attendees at the meeting were supportive of continuing this topic. Houston: Heejin expects to get a draft to us by mid-July. Updated by Zeng: WS is being distributed and ready for vote tomorrow. |
| RTAR | | | |
| BOD | Draft RTAR : If you had “perfect information” on occupants comfort preferences and their location within a conditioned space then how would you optimize control and how much value would you be able to realized | Rich Hackner Li Song | STL: An RTAR is prepared by Li and will be discussed in the committee meeting for comments. Rich will lead on WS if the RTAR is accepted. Need inputs to improve the RTAR. Two volunteers: James Sweeney and Gary Shamshoian. Las Vegas: In development Long Beach: In development Chicago: No update. Houston: Li plans to submit to RAC by August 15. The chair of MTG.OBB has agreed to cosponsor. We hope to vote at the main meeting to submit the RTAR. Update by Song: Li will upload the RTAR on basecamp and circulate among the TC |

| Subc | Project | Contributors/PI | Status |
|--------|---|----------------------------------|---|
| ET/FDD | Draft RTAR: Metadata and Taxonomy to Support FDD in Smart Buildings | Nick Gayeski Charity Young | SEA NEW submitted for consideration by Subcomms CHI – Nick discussed wants feedback. Explained purpose ATL- Phil did not think the need and significance to ASHRAE are clear. Had discussion in ET subcommittee. Nick will revise ORL – Nick is continuously updating it. Las Vegas – Nick is continuously updating it. Long Beach – no update Chicago: No update. Houston: Dennis Krieger will pick this up to see if there’s potential to move forward. He’s unfamiliar with ASHRAE processes. Update from John Wallace: Will follow up with Dennis Krieger |
| BOD | Draft RTAR - Design guideline to consider unmeasured disturbance for an implementable MPC | Donghun Kim, David Blum | New at Long Beach Chicago: Still in progress Houston: Still in progress. Update by Zeng: The RTAR draft was prepared by Donghun Kim. David Yuill sent the comments back to Donghun Kim and no updates since then. Li will follow up. |
| SG | RTAR - Development of models for better peak load predictions for building clusters/neighborhood/city | Michael Bobker Kristen Cetin | Long Beach – initiated the idea Houston: No update Update by Kristen: still interested in working on. Helps are welcome. Helia Zandi with Oak Ridge will help Kristen work on it. TC4.1 is interested in co-sponsorship. |
| SG | Guideline on smart building equipment | | Chicago: New idea Houston: Not discussed. Park |
| SG | RTAR - - Linking building modeling to grid modeling | Donghun Kim | Long Beach – initiated the idea Chicago: was discussed, there’s still interest. Chicago: Not discussed. Update by Kristen: Kristen will follow up with Donghun Kim. Jie Cai volunteer to participate. Ellen Franconi with PNNL will facilitate the project leaning toward to providing simulation capacity for enhancing code. |
| SG | RTAR - continuation of Demand Response guideline | Need Champion | Long Beach – initiated the idea, need to seek 1.4 inputs (there are interests from 1.4-Kim is the contact; Joseph Kilcoyne (joseph@scengineers.net Shadpour Consulting) – Guideline 13 and 36 could be related) Update by Kristen: it was meant to form a working group. |
| BOD | RTAR - How IoT impacts operators | Carol Lomonaco Liping Wang | New at Long Beach Houston: There was discussion about the topic, and there’s still interest in it. A written RTAR is not planned before Atlanta. Update by Carol: Carol is still interested in working on this RTAR. Joe and Li are interested to help. |
| BOD | RTAR - Link the productivity with occupant-in-loop control | Ivo Martinac | New at Long Beach Houston: Topic was discussed. Ivo was not present, but there is general interest among those present. Update by Zeng: update before Houston meeting “no time to get the work done”. Carol added that it was meant for a mini system for local air condition control, personal comfort. |
| BOD | RTAR - Smart management of moisture and energy consumption in residential houses, smart ventilation, optimal location for dryer, heat pump water heater, etc. | Andrew Windham; Kristen Cetin | New at Long Beach Houston: Not discussed Update by Kristen: still interested in working on it. |

| Subc | Project | Contributors/PI | Status |
|--------------------|--|--|--|
| FDD | RTAR: Self-fixing faults once it is diagnosed | Andrew Windham windhamaw@apps.tate.edu; Jin Wen will help) | New at Long Beach Houston: no update |
| FDD | RTAR: collect, clean, and label existing data for FDD research | Xiwang Li, Liping Wang, Kristen. Shawn Shi (Carleton) | Las Vegas: new idea Long Beach: no update Houston: No update |
| Co-Sponsor | TC 1.4 RTAR Current title: "Night setback effectiveness" possible change to "Night preconditioning effectiveness" | Peter Armstrong | ORL: Seek co-authorship. Objective: show how to credibly model energy and comfort impacts of night preconditioning. (also effectiveness of simple through MPC controls?) Las Vegas – continue development Long Beach: no update Houston: No update |
| Co-Sponsor | TC 1.4 RTAR: HVAC Control Loop Performance Diagnosis | Zheng O'Neill | Long Beach: RTAR distributed. Look for co-sponsorship. Houston: No update |
| Co-Sponsor | Draft: Low-cost indoor pollutant sensor metrics for data-driven control of ventilation in smart buildings | Jordan Clark, Brent Stephens, Kristen Cetin | Houston: In progress. Update by Kristen: RTAR is ready by Jordan. It is built off their existing project. Comments are welcome after TC review. Jin comments TC needs more time to review and vote. Zheng asked for difference between this project and prior project. Li will forward the questions to Jordan and request Jordan to present and answer the questions. Liping is the PMS of the prior project and should be consulted. |
| Parking Lot | | | |
| FDD | Idea - What is the most effective way to present results to operators- monthly meetings, weekly emails- in a way that they take action. (related to dashboard- 'data and interfaces- RP) | | |
| FDD | Idea - FDD for datacenters | | |
| FDD | Literature Review and Survey of existing FDD methods and data | Nick Gayeski, Jin Wen | ATL - FDD literature review and central location for download data/methods etc. (collection of methods) – existing Not only compiling but assessment of new technologies (indicating last large scale study is 2005) Characterization (qualitatively) evaluate. IEA 34. |
| FDD | Idea - Whole Building FDD through smart-meters (champion?) | | |
| ET | Ideas -- Connectivity in the home? | Nick Gayeski | CHI – Much discussion no resolution |
| SG | Development of models for better peak load predictions | Kristine; Mike, Srinivas will review | CHI—New idea. |
| SG | Idea – DR guideline related ideas | | ATL – estimate thermal response etc. |
| SG | Idea --Instantaneous voltage and current load from bldgs. For SG | Ralph Muehleisen Argonne NL | CHI – New Idea |
| Co-Sponsor | Idea - | TC 7.3 | ATL – Mike Brambly mentioned an idea about building maintenance and FDD |

| Subc | Project | Contributors/PI | Status |
|------|---|-----------------------------|---|
| ET | RTAR -1782: "Learning occupancy presence in residential buildings through smart meter data" | Bing Dong and Zheng O'Neill | <p>Voted in Atlanta; Submitted for RAC to review. RAC rejected.</p> <p>"it is not clear if ASHRAE should lead or others (EPRI, etc.) and how much research is needed to detect or model the occupancy based on smart meter data..."</p> <p>ORL – discussed with Phil and solicited comments (comments on whether available technologies and other literatures have been integrated in the RTAR). Smart thermostat might learn occupancy.</p> <p>Behavior based action from Utility company – if you know occupancy patterns then send messages etc.</p> |

**TC 7.5 Smart Building Systems
Program Subcommittee Meeting Minutes**

Atlanta

Sunday (6/24) 5:30 pm - 6:00 pm Sunday (1/13) GWCC, Building B,
B301

Announcements

1. Eric presented some Atlanta program statistic:
TC 7.5 submitted 6 seminars including cosponsors. 3 of 6 were accepted.

Programs presented at Atlanta

| Sponsoring Committee | Program Time | Session Chair | Session Title | Co-Sponsoring Committee |
|----------------------------|---|----------------|---|--|
| 7.5 Smart Building Systems | Seminar 11 Sunday, 11:00 AM -12:30 PM | Carlos Haiad, | Building HVAC System Control Strategies to Interact with the Modern Electric Grid | |
| 7.5 Smart Building Systems | Seminar 47 Tuesday, 8:00 AM -9:30 AM | Carol Lomonaco | Securing BACnet Networks: Present and Future | 1.4 - Control Theory and Application |
| 6.9 Thermal Storage | Seminar 65 Wednesday, 8:00 AM - 09:30 AM | Paulo Tabares | The Role of Energy Storage for Buildings Integrated with Renewable Energy Systems | 7.5 Smart Building Systems |
| 7.5 Smart Building Systems | Seminar 27 Wednesday 11:00 AM - 12:30 PM | Kristen Cetin | Development of High-Reliability, Low-Cost, Occupancy Presence, Counting and CO2 Sensor Technologies and ASHRAE Testing Standards/Guidelines | MTG.OBB - Occupant Behavior in Buildings |

Program tracks and timelines for Kansas City, MO

1. Systems & Equipment in the Built Environment: Selection of equipment and systems is paramount to HVAC&R design. Papers and programs in this track will assist designers, engineers,

and operators in the design, selection, and operation of HVAC&R systems and equipment.

Track Chair: Kimberly Pierson

kdpwildcat@gmail.com

2. Fundamentals and Applications: Fundamentals are the foundation for understanding applications in engineering. Key components of ASHRAE fundamentals include thermodynamics, psychrometrics, fluid and mass flow. This track provides opportunities for papers and presentations of varying levels across a large topic base. Concepts, design elements and shared experiences for theoretical and applied concepts of HVAC&R design are included.

Track Chair: Gary Debes

gary.debes@comcast.net

3. Optimization in HVAC&R: The application of systematic optimization techniques is gaining ground in the field of HVAC&R, resulting in significant cost and performance benefits. This track seeks programs focused on using models to inform decision-making for design and operation of HVAC&R and High Performance Buildings. Topics of interest include but are not limited to: novel optimization techniques and their application to HVAC&R, optimization of heat transfer surfaces, component optimization, system optimization, optimization of high performance buildings, model-predictive control and other methods focusing on minimizing first and operating costs of these systems.

Track Chair: Vikrant Aute

vikrant@umd.edu

4. Commissioning New & Existing Buildings: With low energy and zero energy buildings becoming more prevalent, there are many issues that arise with installation, startup, commissioning and O&M. Making sure that the design intent of these more complicated HVAC systems is understood by all team members and building operators is key to the building's success. This track will address an array of topics including lessons learned, improvement of process and team communications and effort to improve the installation, startup, O&M and commissioning of HVAC systems.

Track Chair: Raul Simonetti

raul.simonetti@carel.com

5. Occupant Health & Safety: Indoor air quality has become a vital consideration during all phases of a building's life as it is closely linked to comfort, occupant satisfaction, productivity and health. Proper design of fire and smoke control is another crucial method in protecting building occupants. This track seeks presentations and papers that explore these links, particularly in ways that make the case for high levels of indoor air quality compelling to building owners. Topics including (but not limited to): filtration, change-overs, best practices for maintainability, fire ratings/dampers, detection and ventilation for toxic gases, operator safety in equipment rooms, OSHA requirements, industrial and hazardous spaces, and many other design aspects directly related to occupant health & safety.

Track Chair: Christine Reinders

christinereinders@gmail.com

6. Modeling Throughout the Building Life Cycle: Modeling was originally concerned primarily with building and system design specifications. The demands of energy efficient operation brought about the need for modeling of part-load operation for a variety of off-design conditions. The explosion of computational capacity and data collection capability is rapidly expanding the scope, complexity and practical applications of modeling both during design, but even more so for fault detection, diagnostics and operational optimization. Presentations and papers are solicited related to all aspects of building modeling, with a particular interest in successful applications that have extended modeling into operational phases of the building life cycle.

Track Chair: Nivedita Jadhav
nivi2307@gmail.com

7. Professional Development: As members of a professional organization, we not only participate for the great value of technical exchange, but also the interpersonal exchange. We recognize that the single greatest strength of our organization is its membership. This track is designed to allow those professionals an opportunity to develop in the areas of presentation skills, leadership, team-building, understanding various business operations, interpersonal skills, etc. In short, the Professional Development Track will cover all aspects of business outside of engineering/technical applications and lends itself to interactive session types such as workshops and forums.

Track Chair: Rupesh Iyengar
rupesh_iyengar@yahoo.com

8. Research Summit: Active research, and the exchange of those research findings, are critical to the development of our HVAC&R industry and built environment. The seventh annual research summit invites researchers to share those results, including ASHRAE-sponsored research and research of interest to the ASHRAE community. Researchers are invited to present papers, seminars, forums or participate in panel discussions. The Research Summit includes a partnership with ASHRAE's archival journal, Science and Technology for the Built Environment.

Track Chair: Bing Liu
bliu@neea.org

9. Radiant Heating & Cooling Mini-Track: As more and more jurisdictions and building owners are answering the call to establish higher energy-use standards for their construction projects, design teams are looking beyond traditional HVAC solutions to provide energy efficiency while maintaining occupant comfort and safety. A system that continues to gain momentum in North America is radiant heating and cooling. A radiant design strategy embodies the integration of architectural design and HVAC systems design with overall energy efficiency and comfort in mind. The papers and presentations in this track will explore the fundamental concepts of how different radiant systems work (high mass vs. low mass), how they are designed, constructed and optimally controlled, and where they have been used in the past, with lessons learned and documented performance data.

Track Chair: Devin Abellon
devin.abellon@yahoo.com

Timelines

Friday, February 8, 2019 - Program (Seminar, Forum, Workshop, Debate and Panel)
Proposals Due

Program ideas for Kansas City and the future

| Type | Session Chair / Speakers | Proposed Title | Status | Updates |
|-----------------------------|--|--|-----------------|---|
| Seminar | Jin Wen | DOE/New AFDD activities (Wen Jin) | For Kansas City | |
| Seminar | Michael Brambly | Control – Look toward to the future -Smart Grid three series: 1. Control 2. Modeling 3. Application | For Kansas City | |
| Seminar | Guanjing Lin | Evaluating performance of optimal control of HVAC | For Kansas City | |
| Seminar | | California Requirement of FDD | For Kansas City | |
| Seminar | Carol Lomonaco | Cx with Cybersecurity in mind | For Kansas City | |
| Seminar | Edward Tsui | Best practice of monitoring and instrumentation | | Glenn Remington; TC 7.6 and 1.2 will sponsor |
| Seminar | Kristen Cetin | Forum Discussion - Demand Response Guideline – resubmission (proposal previously rejected) – maybe propose as seminar instead? | | |
| Seminar | Wen Jin | Transactive Control – speakers from NREL, PNNL | | |
| Seminar | Eric Yang | Battery Control Strategies and its impact to life cycle cost | | |
| Seminar | Carlos/David | Fundamentals of smart building integration | | |
| Seminar | Smart products for residential and commercial buildings | Josh Rhodes, Kristen Cetin, Zheng O'Neill | | |
| Seminar | Smart Grid – Building Envelope Interaction/Dynamic Facades | Jie Cai, Donghun Kim, Paulo Tabares | | |
| Seminar | Carol Lomonaco / Sherry Hu | The role of cloud-based communication on smart meter technology. | | What the procedure to get the data and what people can do with the data. Sherry Hu can be a speaker. To find more speakers. |
| Seminar | | IOT sensor/calibration | | |
| TBD | Carol Lomonaco | Strong password for BAS | | |
| Seminar Sponsored by TC 1.5 | Carol Lomonaco | Cyber security red team | For Kansas City | TC 1.5 seeking for co-sponsoring |

| | | | | |
|----------------------------|--|--|------------|---------------------------------------|
| TBD | TBD | What data the lawyer would like to know –needs to define scope | In future | |
| Seminar | Carlos Haiad & Glenn Remington | Cyber Security on Building Systems | For Future | |
| Seminar | Peter Armstrong & Li Song | Building optimal / predictive control | For Future | |
| Seminar, co-sponsor TC 7.9 | Li Song & Carol Lomonaco | How BAS can Enhance Existing Building Commissioning | For Future | |
| Seminar | Srinivas Katipamula | Improving Energy Efficiency of Commercial Buildings thru Data Analytics | For future | |
| Seminar | Armstrong | Edge computing, Cloud Analytics, and On-Premise Systems – Architectures for Smart Building Systems | For future | |
| Seminar | Nick Gayeski / Speakers from Armstrong | Smart Transducers with Embedded Diagnostics | For future | |
| Seminar | Kristin Heinemeier / Kristin & Jon Douglas, someone from TC 7.9? | Fault Detection and Retro-commissioning: Where is the Line and Does it Matter? | For future | |
| Workshop | Kristin Heinemeier | Lab Methods for verifying that FDD tools for RTUs really work: Will Standard 2007 really work? | For future | |
| Seminar | Glenn Remington | Case Studies: Using FDD for smarter facility operations / Lessons Learned from FDD implementation | For future | The project has been done for a while |
| Seminar | Chris Kinney/Michael Munroe/Glenn Remington | FDD and Clouds? | For future | |
| Seminar | Jin Wen / Zheng O'Neil | Occupancy-based control sensor | For Future | To invite speakers |
| Seminar | Xiaohui Zhou/Srinivas Katipamula/Jin Wen | Open source platforms for HVAC, VOLTRON | For future | |

NEXT IN-PERSON MEETING: June, 2019 – Kansas City, MO