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

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.___TC 9.9_____DATE____June 25, 2023___

TC/TG/MTG/TRG TITLE Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment____

_____

DATE OF MEETING__June 25, 2023___LOCATION__Marriot Waterside Tampa, FL_____

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

VOTING MEMBERS PRESENT	VOTING MEMBERS ABSENT
Paul Fitch	Mark Monroe
John Groenewold	Lixia Wu
John Gross	
David Kelley	
Matt Koukl	
Jason Matteson	
Bob McFarlane	
David Moss	
Rick Pavlak	
Joe Prisco	
David Quirk	
Mark Seymour	
Mark Steinke	

CORRESPONDING MEMBERS PRESENT	PROVISIONAL MEMBERS PRESENT
Gerardo Alfonso	Dustin Bremner
Mukul Anand	Elai Dankner Dvash
John Bean	Mark MacDonald
Chris Campbell	Duane Warren
Brad Cochran	Lang Yuan
Dustin Demetriou	Dustin Bremner
Benedict Dolcich	Elai Dankner Dvash
Dan Donahoe	Mark MacDonald
Ecton English	Duane Warren
CORRESPONDING MEMBERS PRESENT	**PROVISIONAL MEMBERS PRESENT**

Hamza Salih Erden	Lang Yuan
Mark Fisher	
Steve Greenbery	
Hugh Hudson	
Alexandre Kontoyanis	
Mark Malkin	
David McGlocklin	
Chris Muller	
Shlomo Novotny	
John Peterson	
Benjamin Petschke	
Terry Rodgers	
Jeff Rutt	
Tim Shedd	
Russ Tipton	
Jim VanGilder	
Jonell Watson	
Eric Yang	
Philip Yu	

GUESTS PRESENT	
Mohammad Alkiswani	Ryan Enright
Liz Balke	Marcus Hassen
Michael Boucher	Vinod Narayanan
Roland Charneux	John Sasser

PUBLISHED AGENDA

Sunday, June 25, 2023
TC 9.9 Programs, Research, Handbook & Publications
6:00 PM – 8:00 PM EDT
Location: Tampa Marriott Waterside, Grand Salon ABC (2)

Microsoft Teams Meeting
https://www.microsoft.com/microsoft-teams/join-a-meeting
Meeting ID: 275 911 663 998
Passcode: 26xton

Attendance
https://forms.gle/TnV1uhvR2NLH2RxS7

Topic		Time	Presenter	In-Person or Virtual
Introduction	Welcome and Introductions	10	John Groenewold	IP
Programs	2023 Summer Tampa & 2024 Winter Chicago	10	Eric Yang	IP
Research	Research Update	20	Mark Seymour	IP
Handbook	Handbook Update	10	Robert McFarlane	IP
Publications	Publications Update	20	Don Beaty	IP
Publications	Publications Workshop - Online Datacom Service	50	Don Beaty	IP
	Total Time:	120	Minutes	

In Person	48
Online	24

CALL TO ORDER: 06/25/23 6:07 pm EDT - John Groenewold

INTRODUCTION – John Groenewold
- Welcome
    - Main meeting for the first hour
    - Publications breakout sessions for the second hour
- Meeting Housekeeping
    - Hybrid meetings
    - Teams for Sunday & Monday meetings
    - Virtual Host: Vice Chair – Matt Koukl
    - Virtual Co-Host: Secretary Mark Steinke
    - Projector is sharing content in the room
- Attendance Form
    - Link: https://forms.gle/TnV1uhvR2NLH2RxS7
    - Both in person and virtual attendees to click and fill out the attendance form
    - Must fill out for each meeting (Sunday/Monday)

PROGRAMS – Eric Yang
- New Program Chair taking over for Nick Gangemi
- Upcoming Conferences
  - May 2023 – Developing Economies Conference 2023
    - May 11-12, 2023 | Mumbai, India
  - Sept 2023 – Building Performance Analysis Conference
    - September 11-13, 2023 | Austin, TX
  - Oct 2023 – 2023 Decarbonization Conference for the Built Environment
    - October 25-27, 2023 | Washington, DC
- 2023 ASHRAE Summer Program – Tampa
  - Sponsored by TC 9.9
    - *Panel 1:* Future Data Center: Road Map to Liquid Cooling Facility Design and Implementation and Operation   - Chair: John Groenewold
      - Time: June 25 11:00 AM – 12:30 PM EDT Sunday
    - *Seminar 34:* The Impact of Hot and Humid and Corrosive Environment on Data Center Equipment: Recent Research Activities on Data Centers – Chair: Eric Yang
      - Time: June 26 11:00 AM – 12:00 PM EDT Monday
    - *Seminar 62:* Coupling Simulation Tools for Fast and Accurate Indoor Environmental Models for Assessing Potential Energy Impacts of System Design and Operation
      - Time: June 28 9:45 AM – 10:45 AM EDT Wednesday - Chair: Liang Chung Lo (TC4.10, TC9.9)
    - *Seminar 67:* Blockchain and the HVAC Industry: It's Not All About Cryptocurrencies
      - Time: June 28 11:00 AM – 12:30 PM EDT Wednesday – Chair: Stephen Roth (TC9.9, TC1.5)
- For any future Panels or Seminars. Contact both the TC9.9 Program Chair and the TC9.9 Chair
  - This allows for TC9.9 to be aware, assist, and publicize the events
- 2024 ASHRAE Winter Program – Chicago
  - TC9.9 Focused Tracks
  - Suggested ideas to fit into Tracks
    - Refrigerant management & best practices – Refrigerants track
    - Decarbonization strategies in data centers – Decarbonization track
    - Liquid cooling technologies – workshop sessions – Hydronic Systems track
    - Design Build vs Design bid build approach – Project Delivery Methods track
    - MER Option – System & Equipment track
  - Important Dates
    - Wednesday, August 2, 2023 | Debate, Panel, Seminar, Forum, Workshop, and Debate Proposals Due
- Program types
  - Require Learning Objectives, Q&A
    - Seminars:
      - Feature presentations on subjects of current interest.
      - No papers attached to seminars.
    - Workshops:
      - Provide a series of short presentations on a topic requiring specific expertise.
      - Have an increased emphasis on audience participation and training in a specific set of skills.
  - Do not require Learning Objectives, Q&A
    - Panel Discussion
      - Feature a broad range of subjects and explore different perspectives on industry related topics.
      - This session format includes a panel of 3-6 speakers each addressing a facet of the session topic, followed by an interactive discussion lead by the session chair.
    - Debates

- Highlight hot-button issues commonly faced by ASHRAE members. Industry experts, either on teams or as individuals, argue opposing sides of an issue, concluding with position summaries and audience feedback.
  - Forums
    - "Off-the-record" discussed held to promote a free exchange of ideas.
    - Allow individuals to speak confidentially without concern of criticism.
    - There are no papers attached to forums.
- Maintain a current program idea list
  - https://docs.google.com/document/d/1trRC9wgVLDt4kbZC35uY6rikrVY3kAjK8DkeldB9McY/edit?usp=sharing
- Contact Eric Yang for
  - Program ideas
  - Co-sponsorship from other TCs
  - Other submission help
  - Email: ericyangcem@gmail.com
- Q: What is the difference between Panel discussion and Workshop?
  - A: Workshop is a series of talks vs Panel is one presentation with one topic. Key difference is more audience inputs with a workshop
- Q: Can we get an online location to share ideas?
  - A: Yes. We will use a google form link to keep an updated list of ideas and participation
  - A: Can use Basecamp. Most found this difficult to use

HANDBOOK UPDATE – Bob McFarlane
- HVAC Applications – 2023 Update - Chapter 20
  - 2023 update now published!
  - Revision due date: June 2022 Summer meeting
  - Approved by TC board: June 17, 2022 (drafts April 1, 2022)
  - SI version has several more pages
  - Each Chapter Section reviewed
    - 33 Authors & Reviewers volunteered
    - All Drafts and Edits completed on time
    - Don Beaty did "Final" edit review
  - What did we change?
    - "Air Distribution" Presently Divided Into:
      - Underfloor Air Delivery
      - Overhead Air Delivery
      - Changed To:
        - Underfloor Air Delivery
        - Non-Raised Floor Air Delivery to Incorporate:
          - Overhead Air Systems
          - In-Row Cooling
          - Side Wall Air Delivery
    - Expanded "Data Center Economizer" Section
      - Excellent New Illustrations by Mark Fisher
      - Discovered Economizers Not Really Covered in Any Handbooks!!
    - Added "Data Center Commissioning"
    - Updated "Thermal Envelope" to 5th Edition Numbers
      - Discovered Omission in 5th Edition – Now Corrected by Addendum
    - Massive Re-Wording & Syntax Improvements
    - Moved All "Datacom Book Series" Descriptions to "References"
  - One "Errata" in SI Edition
    - Mixed units used. K vs °C
  - Thank you to everyone who worked on the updates!

PUBLICATIONS – Don Beaty
- Transition from Physical Books to Online Wiki
  - Mission: Time to market & consumable
  - Current library of books is too massive to convert all at once
  - Will focus on a few books to convert right away: Thermal Guidelines, Liquid Cooling, Power Trends
  - Move to a format and structure to allow for rapid navigation
- Replace book titles with general book topics
  - Design Considerations
  - Liquid Cooling
  - Air Cooling
  - Energy
  - Environmental
  - Everything Else
- Demonstrated a "mockup" of the interface
- Structure subjects, topics, and keywords to make a 2-4 click navigation structure
  - First Click - Categories
    - Second Click - Topics
      - Third Click - Subject
  - First Click - Categories
    - 7 Topics: Design Considerations, Liquid Cooling, Air Cooling, Energy, Environmental, IT Equipment, Everything Else, Book List
    - Main topic in bold, examples shown parenthetically
  - Second Click – Topics
    - Overview, Design Criteria & Loads, Distribution & Economizers, Air Cooling, Liquid Cooling, Environmental, Everything Else
  - Third Click – Subject
    - Now content is shown
- The intent is to convert current content
- Subscription service still WIP. Intent would be that the annual cost is less than the book cost
- Q: link structure will be key to success. How do we get that structure
  - A: In the following workshop
    - we will break down each section of the book 3
    - read each section
    - come up with the keywords for that section
- Q: what is the platform being used
  - A: wiki. The workshop will review the book chapters and look at website content updates
- Q: From training perspective. Is this new format suitable for end user/ operator OR more design community
  - A: spirit and focus of books is for technical and non-tech readers
    - Design considerations has the best overview of the multiple
    - Goal by fall
      - Thermal guidelines
      - Liquid cooling
      - Power Trends book
- Q: for subscription. Move to a tiered version. Like NFPA, IEEE, or others
  - A: No tiers, full access
  - Content editing with be controlled
- Q: Consider other languages
  - A: Yes. We should provide other language content

MEETING ADJOURNED: 06/25/23 7:03 pm EST - John Groenewold

PUBLICATIONS WORKSHOP – Don Beaty

- Room: Tampa Marriott Waterside, Grand Salon ABC (2)
- Breakdown of Book 3 Chapters
    - Identify section keywords
    - Identify main keywords

CALL TO CLOSE: 06/25/23 7:43 pm EDT - John Groenewold

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.___TC 9.9_____DATE__June 26, 2023____

TC/TG/MTG/TRG TITLE Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment_____

DATE OF MEETING__June 26, 2023_____LOCATION__Marriot Waterside Tampa, FL_____

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

VOTING MEMBERS PRESENT	VOTING MEMBERS ABSENT
Paul Fitch	Mark Monroe
John Groenewold	Lixia Wu
John Gross	
David Kelley	
Matt Koukl	
Jason Matteson	
Bob McFarlane	
David Moss	
Rick Pavlak	
Joe Prisco	
David Quirk	
Mark Seymour	
Mark Steinke	

CORRESPONDING MEMBERS PRESENT	PROVISIONAL MEMBERS PRESENT
Gerardo Alfonso	Liz Balke
Henry Amistadi	Ray Beezley
Mukul Anand	Nan Chen
John Bean	Elai Dankner
Donald Beaty	Brian DeLeon
Norman Bourassa	Joe Furman
Chris Campbell	Steve Harrington
Brad Cochran	Mark MacDonald
Thomas Davidson	Vinod Narayanan
Dustin Demetriou	Marelle Paas-O'Brock
Ben Dolcich	Nachiket Patwardhan
Ecton English	Erfan Rasouli
Hamza Salih Erden	Muhammad Farooq Saeed
Mark Fisher	Duane Warren
Art Giesler	Nick Yunshu Xu
Steve Greenberg	
Gwenn Ivester	
Roger Jones	
Rajendera Kapoor PE	

CORRESPONDING MEMBERS PRESENT	PROVISIONAL MEMBERS PRESENT
Girish Kini	
Sang Lee	
David McGlocklin	
Michael McKenna	
Dave Meadows	
Chris Muller	
Shlomo Novotny	
Mark Pavol	
John Peterson	
Benjamin Petschke	
Long Phan	
Terry Rodgers	
Jeff Rutt	
Tim Shedd	
Ashwin Siddarth	
Micah Sweeney	
Russell Tipton	
Jeff Trower	
William Truong	
Edward Tsui	
Jonell Watson	
Eric Yang	
Philip Yu	

GUESTS PRESENT	
Michael Boucher	John Sasser
Ryan Enright	Oumou Sidibe
Galen Gerig	Jerry Yeh
Ichinori Kamiji	

PUBLISHED AGENDA

Monday, June 26, 2023
TC 9.9 Main Meeting
2:30 PM – 7:00 PM EDT
Location: Tampa Marriott Waterside, Grand Salon GH (2)

Microsoft Teams Meeting
Meeting ID: 277 656 060 182
Passcode: ejXvUU

Attendance
https://forms.gle/TnV1uhvR2NLH2RxS7

Topic		Time	Presenter(s)	In-Person or Virtual
Welcome	Welcome, Agenda Review, Hybrid Meeting Etiquette	5	John Groenewold	IP
Introductions	Introductions of All In-Person Attendees, Officers, Voting Members and Subcommittee Chairs	10	John Groenewold	IP
Membership	Details of TC 9.9 Membership	5	John Groenewold	IP
Liaison Reports				
	Standard 90.1	5	Rick Pavlak	V
	Standard 90.4	5	Terry Rodgers	IP
	SPC-127	5	David McGlocklin	IP
	AHRI 1360	5	David McGlocklin	IP
	SSPC 300, Guideline 1.6	5	Terry Rodgers	IP
	Decarbonization Task Force	5	Lixia Wu	V
Break		20		
Special Topic	Liquid Cooling Performance Benchmarks	10	Steve Greenberg	V
Special Topic	Airflow & Energy Flow Metrics	10	Jim VanGilder	IP
Research	Research Committee Update	20	Mark Seymour	IP
IT Subcommittee & Publications	IT Subcommittee Update		Roger Schmidt	V
	Liquid Cooling Book	10	Dustin Demetriou	IP
	New TCS/FWS Class Proposed	5		
	Liquid Cooling Technical Brief	5		
	Marine Corrosion Work Study Proposal	10		
	Design Considerations Book	10		
	Power Trend Update	5		
	Thermal Guideline Technical Brief	5		
Work Session	Work Session on Publications	60	Don Beaty	IP
	Total Time:	220	Minutes	

In Person	56
Online	32

CALL TO ORDER: 06/26/23 2:47 pm EDT - John Groenewold

INTRODUCTION – John Groenewold
- Welcome
  - o Attendees are both in person and joining virtually
  - o Published Agenda
- Virtual meetings
  - o Virtual Host: Vice Chair – Matt Koukl
  - o Virtual Co-Host: Secretary Mark Steinke
  - o Virtual attendees to stay muted. Unmute to ask a question
  - o In person attendees to unmute table microphones to be heard by virtual attendees
  - o Projector is sharing content in the room
- Attendance form
  - o Link: https://forms.gle/TnV1uhvR2NLH2RxS7
  - o Both in person and virtual attendees to click and fill out the attendance form
  - o Must fill out for each meeting (Sunday/Monday)
- Introduction to the TC 9.9 website
  - o https://tc0909.ashraetcs.org
- ASHRAE TC 9.9 Overview
  - o Title
    - ▪ Mission Critical Facilities, Data Centers, Technology Spaces, and Electronic Equipment
  - o Purpose
    - ▪ To be recognized by ALL areas of the datacom industry as the UNBIASED engineering leader in HVAC and an effective provider of technical datacom information.
  - o Scope
    - ▪ All things datacom facilities: datacom refers to data processing and communication facilities. It includes rooms or closets used for communication, computers, or electronic equipment
- Introductions – In Room Only
  - o Name
  - o Business Title
  - o TC Membership Status:
    - ▪ Voting Member
    - ▪ Corresponding Member
    - ▪ Provisional Corresponding Member
    - ▪ Guest
  - o TC Leadership & Subcommittee Membership
    - ▪ Subcommittee Chair
    - ▪ Liaison
    - ▪ Subcommittee membership
- Membership
  - o Member roster on TC 9.9 website
  - o Join on TC 9.9 website
  - o Keep emails up to date. Used to fill out roster updates.
  - o Provisional Corresponding Members
    - ▪ Additions to Roster between roster update cycles.
    - ▪ Roster update always due Tuesday following main meeting during Winter Conference.
    - ▪ Usually at the request of someone wanting to participate.
    - ▪ If no action by TC leadership dropped from Roster after 2 years
  - o Corresponding Members
    - ▪ Expected to participate in TC activities
    - ▪ Attend Meetings when possible
    - ▪ May serve as Vice-Chair or Secretary of TC if they attend meetings regularly
    - ▪ Can be Voting Members
    - ▪ Can serve as a subcommittee chair

- o Guest
  - ▪ Attending TC meetings as a guest participant
- TC9.9 Officers – After July 1, 2023
  - o TC 9.9 Chair - Matt Koukl, Affiliated Engineers
  - o TC 9.9 Vice - Chair - Mark Steinke, Advanced Micro Devices
  - o TC 9.9 Secretary - John Gross, J.M. Gross Engineering
  - o Publications Chair - Don Beaty, Retired Founder/CEO of DLB Associates
  - o Research Subcommittee Chair - Mark Seymour, Cadence
  - o ITE Subcommittee Chair - Dr. Roger Schmidt, IBM Fellow Emeritus & Syracuse University
  - o Standards Subcommittee Chair - Rick Pavlak, Heapy Engineering Retired
  - o Program Subcommittee Chair - Eric Yang, Vantage Data Centers
  - o Handbook Subcommittee Chair - Robert McFarlane, Shen Milsom & Wilke, LLC
  - o Webmaster - Ecton English, Department of Defense
  - o Marketing Subcommittee Chair - Paul Finch, KAO Data
  - o Membership Chair - John Groenewold, Vantage Data Centers
- Voting Members
  - o John Groenewold, Vantage Data Centers
  - o Dave Moss, Dell (2023 is last year)
  - o John Gross, J.M. Gross Engineering (2023 is last year)
  - o Matt Koukl, Affiliated Engineers
  - o Dave Kelley, Vertiv (2023 is last year)
  - o Mark Monroe, Microsoft
  - o Rick Pavlak, Heapy
  - o Mark Steinke, AMD
  - o Paul Fitch, KOA Data
  - o Mark Seymour, Cadence Design Systems
  - o Jason Matteson, Iceotope Technologies
  - o David Quirk, DLB Associates
  - o Joe Prisco, IBM
  - o Bob McFarlane. Shen Milsom & Wilke
  - o Lixia Wu, Cushman & Wakefield
- TC 9.9 Liaisons
  - o Standard 90.1: Rick Pavlak
  - o Standard 90.4: Terry Roders
  - o Standard 127: David McGlocklin
  - o AHRI 1360: David McGlocklin
  - o Standard 300, Guideline 1.6: Terry Rodgers
  - o International: Don Beaty
  - o MTG.CYB: Ecton English
  - o Building Decarbonization: Lixia Wu
- TC9.9 2023 Votes
  - o Adoption of 2022 Summer Meeting Minutes – Approved
  - o Move forward with online publications & subscription model – Approved
  - o TC 9.9 co-sponsoring a TC 4.10 RTAR titled "Compact CFD Modeling Guidelines for Flow Resistances" - Approved

LIAISON REPORTS - Various
- Standard 90.1 – Rick Pavlak – John Groenewold covering
  - o Energy Standard for Buildings Except Low-Rise Residential Buildings
  - o Standard 90.1-2022 is published
    - ▪ Incorporates 80+ addenda
    - ▪ Other additions
      - • Min prescriptive requirement for on-site renewable energy
      - • Optional Mechanical System Performance Path
      - • New requirements to address impacts of thermal bridging
    - ▪ Other highlights

- Expanded scope to include sites as well as buildings
- New energy credit requirements for customized approach to improving energy efficiency
- New informative guidance for using carbon emissions, site energy, or source energy as alternative performance metrics to the current energy cost metric
- Significant efficiency increases in IEER for commercial rooftops and a new SEER2/HSPF2 metric for <65kbtu sized air-cooled heat pumps
- Refrigerant Pipe Insulation: Addendum E first proposed in 2020 to Standard 90.1-2019 has not moved forward and as of now is still a pending action.
- SSPC-127 – David McGlocklin
  - Method of Testing for Rating Air Conditioning Units Serving Data Center and Other Information Technology Equipment Spaces
  - TPS has been revised to include liquid cooling
  - Updated work plan created and approved
  - Two new subcommittees have been formed:
    - Air Subcommittee – Chair Dave McGlocklin, Secretary Dave Meadows
    - Liquid Subcommittee - Chair Dr. Tim Shedd, Vice Chair John Gross, Secretary Dustin Demetriou
  - Air Sub is continuing with our work on the overall harmonization of 127 with AHRI 1360 standard & iNSenCOP
  - Liquid Sub is just getting going putting pen to paper after spending the last few meetings going over housekeeping & members thoughts on liquid scope & MoT. New members officially roll on July 1st.
  - Call for members and interested parties.
    - Meeting Tuesday 8-12 (Tampa Marriott Waterside – Meeting room 11 (3rd floor))
- AHRI 1360 – Dave McGlocklin
  - Performance Rating Standard for Datacom Air-Conditioning Units
  - Committee is meeting again after 2022 release
  - Approved a new project charter scope for next 202X revision
  - Work with SSPC 127 to harmonize the two standards and ASHRAE 37
  - Investigate a method of rating for liquid cooling to accompany the 127 Method of Test being developed
  - Q: When did the title change?
    - A: In the April meeting

SPECIAL TOPIC – Benchmarks for Water-Cooled Data Centers - Steve Greenberg
- Typical Metrics for Water-Cooled Data Centers
  - PUE, Power Usage Effectiveness (total data center energy/ITE energy)
  - ITUE, IT Usage Effectiveness (total energy into ITE/total energy into compute components)
  - TUE, Total Usage Effectiveness (PUE x ITUE = total data center energy/total energy into compute components)
  - ERE, Energy Reuse Effectiveness (total data center energy – reuse energy/IT energy)
  - WUE, Water Usage Effectiveness (liters of water usage/total data center energy in kWh)
  - Compute energy efficiency (e.g. flops/watt)
- Typical Metric Values
  - PUE: typical goal 1.1, typical operation 1.05
  - ITUE: little available data
  - TUE: higher than PUE, little available data
  - ERE: highly site specific
  - WUE: 1.6 l/kWh (site) with 100% evaporative rejection and no blowdown; typical goal 1.25 with hybrid rejection and 1.0 operation. Site vs. source complexity.
  - Compute energy efficiency (e.g. flops/watt): holy grail of efficiency; complicated due to different computing functions
  - Common themes:
    - Need appropriate metering
    - Comparisons worthwhile internally, less so across data centers
- Need appropriate metering
- Comparison across multiple data centers very difficult

- Contact Steve with interest in participating
  - Steve Greenberg, Lawrence Berkeley National Laboratory - segreenberg@lbl.gov
- Q: Where would you get data to compute ITUE
  - A: some supercomputer centers track but not publish
  - A: Redfish schema to pull power telemetry, more in theory
  - A: PUE numbers had to do with time domain and location
- C: Terry R. PUE can be miss-leading. Need both ITUE and PUE. Looks at intersection of infrastructure vs ITE
- C: Steve H. Characterize fan speeds wrt power. Pick a CPU temp as a standard
- C: David M. Green grid working on a new liquid cooling metric
- C: Mark S. PUE will undermine case for liquid cooling. Liquid cooling uses less energy vs fans
- C: Bob M. Maybe bring X factor approach into PUE
- C: Terry R. PUE was intended for self-monitoring. Misused as a comparison
- C: Terry R. Perception of ASHRAE 90.4 or TC9.9 are not allowing folks to move to allowable
  - R: Proposed a white paper to clarify
- C: John Groe. Use of the recommended is easy. Into the allowable is harder to know
- C: Hugh H. how do you monetize it. Here are the performance modes and the CAPx & OPx of operating in those other zones
- C: John Gros. Lawyers won't do it. But other industries do add this level of detail

LIAISON REPORTS - Various
- Standard 90.4 – Terry Rodgers
  - Energy Standard for Data Centers
  - John Sasser presented on optimizing on DCs
  - External publicity included a pod cast, which was well attended
  - Working groups
    - Mechanical work group still striving to increase efficiencies
  - Include ESG type parameters into next update
  - Subcommittee setup
  - 4 new members added
  - Addendum G just approved
  - Uptime institute to revisit allowable range
- SSPC 300, Guideline 1.6 – Terry Rodgers
  - Data Center Commissioning
  - Guideline to be used in conjunction with Guideline 0
  - Goal is to get initial pub of guideline of late '23 or early '24
  - Title, purpose, scope maybe revised to include server rooms
  - Looking for participants to help provide comments
  - New chair Jim McGee starting
- Decarbonization Task Force – Lixia Wu
  - Data

BREAK – 4:15 pm EDT; Restart 4:35 pm EDT

SPECIAL TOPIC – Airflow & Energy Flow Metrics - Jim VanGilder
- Recent study on air flow dynamics and metrics used in the data center
- Poster 4: Heat Pump Water Heaters / Data Centers - "Rationalizing Data Center Whitespace Airflow and Energy-Flow Metrics"
  - Managing airflow patterns key to effective and efficient whitespace cooling
  - Several metrics utilized today
    - Airflow based (amounts of cfm)
    - Thermal based (based in temperature or W, aka Energy flow)
  - A few different models
    - SHI & RHI
    - Capture index

- ACU effectiveness
  - o Effectiveness vs Efficiency
    - Effectiveness – related to what we are trying to cool. IT equipment
    - Efficiency – what it costs us to cool
  - o Comparisons over 25 data centers in data set
  - o Airflow metrics better than energy flow metrics for data center CFD
  - o Metrics can be scaled down to rack level details
    - C: Mark Seymour. There is a difference if there is some self-recirculation and are different than the data center leveled details
    - C: Mark Seymour. Earlier work was focused on most popular and not all the metrics
  - o Conclusion
    - Airflow and energy flow metrics provide valuable insights
    - Existing metrics have inconsistent naming, redundancies, and gaps
    - Proposal: Standardize on IT airflow effectiveness and Cooler airflow efficiency
  - o Q: How do you measure the efficiency?
    - A: Get match between actual airflow required to support the server temps. Idealize case is zero Qbypass and zero Qrecirculation

RESEARCH – Mark Seymour
- ASHRAE Research Policy Update
  - o Budget increased from $250k to $350k
  - o Typical funding cost
    - 2 yr $250 - 350k
    - 3 yr $350 - 450k
  - o Suggesting co-funding can come from other orgs like DOE AHRI
  - o Not so much commercial
- Sea Salt Corrosion
  - o Justification from Industry
  - o Review SOW
  - o Co-funding
    - Forms: monetary, equipment, data from DCs
  - o Contact Roger with interest
  - o Q: Could the SOW add a list of needed support
    - A: great suggestion. We should do that
  - o Q: can we get a new link so that new members can get involved
    - A: we should find a way to list these
  - o C: Try and get a statement of involvement from industry folks
- Wetted Materials
  - o Method of test
  - o Looking for a new leader
  - o C: Don't see the reason we are doing this
  - o C: OCP has provided a list of wetted materials
  - o Perhaps we laisse to other orgs OCP, Green Grid
  - o John Bean might be able to bridge
- External Flow
  - o Current RTAR already in progress
  - o Maybe difficult to get a second RTAR
  - o Support statements and commercial funding to justify DC focus
- Other Research Ideas
  - o Refrigerant ignition and flammability applied to DCs - Rick Pavlak
  - o Contact Mark Seymour mseymour@cadence.com
  - o August 15th deadline
  - o Method to estimate of time duration of battery backup systems - Bob M
  - o PTAR. Funding to create a publication for the information

ANNOUNCEMENTS – Brad Cochran – TC Section Head
- New program, first time registration is free
- Electronic rosters
  - New replacement
  - TC9.9 is the pilot
- TAC trying to maintain voting member balance. All leadership and voting members to fill out discipline in your bio
- GTIC: Global Technical Interaction Committee. Drive ASHRAE standards to harmonize or supplant international
  - ISOTC205 – Building environmental design
  - ISOTC163 – Thermal performance and energy use
  - ISOTC86 – Refrigeration and air conditioning
  - ISOTC142 – Cleaning equipment for air
- Handbooks are thick and hard to publish. Review content and see if we can remove content
- Certificate of Appreciation presented to John Groenewold for his work as TC 9.9 Chair

IT SUBCOMMITTEE – Dustin Demetriou
- Liquid Cooling Book Update
  - Planning transition to online
  - WG content closed
  - Small group began editing entire book
    - Redundancy removed
    - Reorg chapters
  - 3rd edition
    - IT power trends
    - S class
    - Fluid quality
    - Conductive cold plate details
    - Air cooling facility upgrade to liquid cooling
  - Overview of Chapters
  - Needs
    - Server OEMS to provide data on the number liquid cooling products past 2017
    - Finalizing TCS water classifications
    - Wet break figures
    - Transitioning air-cooled DC to liquid
    - Review commissioning checklist
  - Timeframe: Complete draft by July 2023
- TCS Water Classes
  - IT Subcommittee discussions on TCS class definition
  - Cover the gap from the server to the facility in the fluid temperature requirements
  - Q: would it helpful to include a DT as well.
    - A: Not considered at this point. Maybe a range or a limit
  - Q: what about the acceptable rate of temperature change
    - A: not considered yet. Should be discussed
  - Q: would existing servers use S50 and what level of DT
    - A: Yes. Mainly targeting heat reuse
- Liquid Cooling brief
  - Quickly release updates while the book completes
  - Interested contact Roger
- Thermal Guideline Brief
  - Clarify the confusion around the application of the Thermal Guidelines
  - Increase access to the information and hence the understanding of the content
  - C: Original intent was to stop the use of ultra-low ambient data centers
    - R: the content is there. It is more that folks do not read the content

PUBLICATIONS WORKSHOP – Don Beaty
- Update on online subscription
  - Displayed online graphic transition versions of
    - "Air to Liquid Transition" chart
    - Psychometric chart
- Passed out Book 3 sections to refine key words
  - Step 1: Draft email to Don with all the keywords
  - Step 2: Read the chapter
  - Step 3: Review keywords
  - Step 4: Select 1 – 3 keywords to represent the chapter
  - Step 5: Email 3 keywords to Don
- Passed out Table of Contents
  - Step 1: Read TOC twice
  - Step 2: Create simple outline
  - Step 3: Type the Book # or Title and email to Don

CALL TO CLOSE: 06/26/23 6:15 pm EDT - John Groenewold