



## TC 6.8 Geothermal Heat Pump and Energy Recovery Applications

Virtual 2021 Annual Meeting

Location: Teleconference

### T.C. 6.8 FULL COMMITTEE MEETING MINUTES

Thursday, January 28, 2021

1:00 PM EDT

#### 1. Call to Order

- Welcome, Introductions, and Sign-In  
Howard Newton (Vice Chair) opened the meeting and announced that he will be hosting the meeting on behalf of the chair
- Visitor Welcome: 1<sup>st</sup> timers and YEA
- Review Voting Members & Determination of Quorum  
Roll call

#### CURRENT VOTING MEMBERS

Dr. Piljae Im - Absent  
Derek Birdsall – Absent  
Hugh Henderson – Present  
Steve Hamstra – Absent  
Roshan Revankar – Present  
Steve Kavanaugh – Present  
Steve Carlson – Present  
Howard Newton – Present  
Dr. Michel Bernier – Present  
Carl Huber – Present  
Brendan Hall – Present  
Xiaobing Liu – Present  
Dr. Harrison Skye – Present  
Cary Smith – Present

Quorum present.

**2. Approval of minutes from Summer 2020 (Virtual)** – No changes or corrections. Motion to approve moved by Cary Smith and second by Harrison Skye. All in favor – none opposed. Motion carried.

#### 3. Announcements from ASHRAE

- Section Head – Dawen Lu – Not present.
- Liaisons
  - Staff – Any Not present.
  - Standards – Erick Phelps Not present.
  - Research – Dr. Omar Abdelaziz – New section 6 liaison – Stephan Evlen . Announced that all work statements were approved. Expecting the projects to go for bid at/after the Vegas conference if approved by ASHRAE. Work statement from this TC relating to the flushing and purging.
  - Handbook – Dhamshala (S)/Werman (A) Not present.
  - TAC – Kelley Cramm Not present.
  - ALI/PDC – Bochat Not present.
  - Codes: Steve Ferguson Not present.

#### 4. Announcements from the Chair

- **Officers**



## TC 6.8 Geothermal Heat Pump and Energy Recovery Applications

Virtual 2021 Annual Meeting

Location: Teleconference

- Chair: Stephen Hamstra – Absent
- Vice Chair: Howard Newton – Wished the chair a speedy recovery. No other announcements. Announced that Roshan will be taking notes. Requested candidates for Secretary – currently vacant.
- Secretary: **Vacant – candidates needed**
- **Subcommittee chairs**
  - Research: Harrison Skye – Flushing and purging is ready to bid. Announced that research funding has been low. Current research on long term temperature changes is in progress and are seeking data sets. Harrison shared his email address and requested that the committee members and everybody present on the call reach out. Hugh Henderson also made the same request.

Antash asked about TC test data set. Harrison announced that an abbreviated RTAR be written for such a set and seek committee approval to move forward. Hessham has drafted an RTAR for this proposal.

Bernier asked for moving forward with RTAR that Liu and him are working on it. Description is listed in Research committee meetings. Liu is asking for inputs/feedback on the description. He suggested that the scope be narrowed for this study. In the meantime, Dr. Liu and Dr. Bernier will work together and narrow the scope.
  - Geothermal handbook: Matt Mitchell – March 15, 2022 is the deadline for final comments and review. Working groups include Ambient temperature loops section. Updates include Pipe and code and Expanding DX section. Adding a section for BTES, updates for borehole resistance calculation, surface water design, direct use geothermal and renewability section. There was a suggestion to consider being more explicit about electrification in the handbook.
  - Applied heat recovery: Mike Filler – Discussed interest in waste water heat recovery and asked for interested members to participate. Handbook chapter question – two chairs – one for applied heat recovery. Suggestion was made to consider having two handbook chairs and a call was made for volunteers. Other discussions were around setting up a seminar for applied heat recovery and using phase change materials and recent research in that area. Steve Kavanaugh suggesting expansion of district energy systems and Brendan Hall mentioned that the TC 6.2 was interested in coordinating efforts with this committee. He is going to facilitate this discussion with the chair of that TC.
  - Standards: Cary Smith announced that standards are being developed and acknowledged Kortney Lull from IGSHPA and Lance McNevin from PPI. Announced that UMC and IMC are being updated for the 2021 cycle. Mark Metzner mentioned that New edition subcommittees will convene in February. Expansion of the standard to include energy piles and sewer wasted heat recovery, District energy loops and community loops. He also mentioned that IGSHPA was going to adopt the CSA standard and sunset the IGSHPA standard. Howard asked how were updates going to be applied? Lisa Meline answered that IGSHPA did a review of CSA 448 and made many recommendations to the committee.



## TC 6.8 Geothermal Heat Pump and Energy Recovery Applications

Virtual 2021 Annual Meeting

Location: Teleconference

Roshan updated the committee that there were several discussions regarding Methanol and that it was deferred to CSA to make the updates first. Mark Metzner updated the group that updates to CSA 448 are expected to be completed and published in 2022.

- Programs: Roshan Revankar informed that the committee submitted 4 sessions of which 3 were approved. 2 will be recorded (on demand) and one will be a live session. Deadlines to submit sessions is February 18. Suggestions include controls, general geo session and equipment updates.
- Education: Vacant – no updates.
- Webmaster: Craig Buschur requested that meeting agendas be submitted on the website before the meeting.

### 5. Subcommittee Reports: All reports were presented during subcommittee chair reports.

- Research - Harrison Skye
  - Work statements and RTARs
  - Discuss research topics
- Kirk T. Mescher Award – Lisa Meline announced that Allison Hall was presented the 4<sup>th</sup> award. She is an active ASHRAE member. The award is bumped up to \$2000 from \$1500. It is an award for practicing engineers doing innovative things.
- Geothermal Handbook - Matt Mitchell
- Applied Heat Recovery – Mike Filler
- Standards – Cary Smith
- Programs - Roshan Revankar: **Phoenix**
- Membership - Cary Smith
- Education and Special Publications/Journal - **Vacant**
  - New publication tools
- Webmaster - Craig Buschur
  - Minutes
  - Virtual meeting agenda
- **Industry Liaison Reports:**
  - IGSHPA.
    - Steve Hamstra was asked by Kortney Lull, the new IGSHPA Chair to either speak at or supply an ASHRAE TC 6.8 member for their meeting coming up on 3/8/2021 (virtual). Steve and Scott Hackle are going to present.
  - IAPMO – Lance announced that the USHGC will be published in March – 2021 edition. Cary Smith and Roshan Revankar recognized the effort put in by Lance and the IAPMO group.
  - GEO – No updates.
  - Geothermal Resource Council conference – Xiaobing Liu attended the conference and informed that a few papers were presented. The council is now called Geothermal Rising.
- **Old Business**
  - Announced by the chair - Use of TC 6.8 Base Camp – If you would like to be added to the list to access our TC 6.8 Base Camp, please email Stephen Hamstra at [stephen.hamstra@gmail.com](mailto:stephen.hamstra@gmail.com) and in the Subject Line enter **TC 6.8 Base Camp – Add Me**



## TC 6.8 Geothermal Heat Pump and Energy Recovery Applications

Virtual 2021 Annual Meeting

Location: Teleconference

- Electrification/decarbonization – Scott Hackle informed that there was a special sub-committee that met to talk about this topic. Minutes of this meeting are added to basecamp. The goal of this group is to work on collecting more data, talk to government stakeholders. Action item included creating an MTG. Mike Filler commented that some states are taking it on themselves and encouraged the committee to work. Lisa Meline encouraged that this topic become part of the groups mission statement and promote it. Hugh Henderson and Cary Smith also supported the effort. Antash volunteered to liaison between EPRI and TC 6.8. The chair of GAC announced that many states and countries brought forward their decarbonization goals. ASHRAE sees this as a long-term activity and impact North America and globally. Steve raised a concern that he had heard in NY that heat pumps don't work in cold climates and that ground source might be dragged in that discussion. Erika from NYSERDA clarified that such a scenario might not occur. Scott clarified the MTG approach is meant for interdisciplinary tasks for electrification and not specific to a particular TC.
- **New Business**
  - No new business or open discussions.
- **Adjourn** – Roshan Revankar made a motion to adjourn the meeting. Seconded by Steve Kavanaugh.



## TC 6.8 (Research) Geothermal Heat Pump and Energy Recovery Applications

2021 Winter Meeting in Chicago IL

Conference Room: Teleconference

### T.C. 6.8 RESEARCH SUBCOMMITTEE MEETING MINUTES

Monday, Jan. 11, 2021

3:00-4:30PM (Eastern)

Minutes prepared by chair, Harrison Skye (harrison.skye@nist.gov)

#### 1 Attendance

- 20 members attended the teleconference.

#### 2 Research Chair Breakfast – Winter 2021

- Section 6 new Research Liaison: Stefan Ebel ([StefanEbel@gmail.com](mailto:StefanEbel@gmail.com))
- RAC “Research Breakfast” Feb. 10, 2021, 8:00-10:00 AM

#### 3 Research Chair Breakfast Summary – information from Virtual meeting for Winter 2021:

- ASHRAE Research budget is normally \$2.6M-\$2.7M per year. In SY20-21 it is \$1.8M and covers current contract commitments only
- New Research Strategic Plan – 7 Initiatives
  1. Understanding IEQ and Impact on Productivity, HVAC airborne pathogen transmission and control
  2. Education and Outreach
  3. Sustainability – Energy and Resources
  4. Resilience for buildings and communities
  5. Tools and Standards
  6. HVAC components including new refrigerants
  7. Leveraging ASHRAE Research
- Training complete for Project Monitoring (PMS) and Project Evaluation (PES) Subcommittees
  - <https://www.ashrae.org/technical-resources/research>
- Publications funding process (PTAR)
  - RAC and PubCom will launch PTAR process in February. Research Manual includes the new process.

#### 4 Existing Research Projects

##### 4.1 Project Monitoring

- 1817-RP, “Long term temperature change of ground heat exchangers”
  - Sept. 1, 2020 – Apr. 2022
  - PIs: Bing Dong, Edward A Bogucz (Syracuse University), Zheng O’Neill (Texas A&M), Carina Paton (Frontier Energy), Hugh Henderson (Owahgena Consulting).
  - Tasks Overview
    1. Literature review – complete, report submitted to PMS
    2. Identify GHX data sets – in progress. Having difficulty finding locations to meet all criteria of: cooling dominated, GHX  $\Delta T > 5$  °F for >75% of operation, flow & temperature measurements with acceptable uncertainty, 7 years’ worth of data.
      - Identified 52 sites, 27 have data
      - 3 promising sights, but none meet all criteria
        - Furman University – only 2 years of data
        - McDonalds – only 5 years of data, GHX  $\Delta T$  is low, missing data for some years

- University at Albany – low  $\Delta T$
- 3. Uncertainty analysis of measurements – in progress. Calculating uncertainty in annual heat imbalance, and impact on GHX design length
- 4. Use data to evaluate GHX design methods
- 5. Validate measurements for new GSHP installation
- Scott – Jeff Spitler may know of data sets in Europe and other places where more data is available.
- TC 6.8 solicited to help contractor identify GHX data sets

#### 4.2 Tentative Research Projects

- None

#### 4.3 Projects Approved for Bidding

- 1890-WS, working title: “Minimum flow velocities for purging air and debris from hydronic piping systems.”
  - Co-sponsors TC 6.1 & 6.2
  - Status: Ready to Bid
    - But.....ASHRAE not bidding projects due to budget constraints this SY. If the 2022 Las Vegas Expo can take place then the research budget could go back to normal next year.
  - Project Evaluation Subcommittee: Lisa Meline (Chair), Gary Phetteplace, Jessica Mangler, Howard Newton, William Murphy, Harrison Skye
  - Project Monitoring Subcommittee: Harrison Skye (Chair), Lisa Meline, William Murphy, Steve Tredinnick, Mike Trantham

#### 4.4 Work Statements (WS)

- 1812-WS “Detection and Diagnosis of Leakage for Ground Source Heat Pump Systems (GSHP)”
  - Developed by TC 7.5 and which TC6.8 agreed to co-sponsor has been returned for revisions; we don’t need to take any action now.
    - From Zheng O’Neill.

#### 4.5 Research Topic Acceptance Requests (RTAR)

- “GSHP with active seasonal and diurnal thermal energy storage”, aka Borehole Thermal Energy Storage (BTES) systems.
- Draft prepared by Xiaobing Liu and Michel Bernier
  - Background
    - “Borehole thermal energy storage (BTES) systems use the ground to store thermal energy [4]. The design of BTES systems is different from regular borehole fields used with GSHP systems. First, boreholes are closely packed and borehole-to-borehole thermal interaction is much greater and most often beneficial. Secondly, boreholes are typically piped in series (they are piped in parallel in GSHP systems) to create a radial thermal stratification with a hot core. BTES systems can be used seasonally to store solar energy [5] or free intermittent cooling [6] or in the short-term [7]. Electric heat pumps, operating during off-peak periods, could also be used to charge the BTES. It is also possible to create a dual temperature bore field with the evaporator side of the heat pump linked to cold boreholes and the condenser side linked to warm boreholes.”
  - Project Objectives
    - Evaluate new designs of BHE that can provide short-term TES
    - Develop modeling and design tool for both short- and long-term TES with BHE
    - Compare cost and performance of various designs of GSHP + TES system
    - Value proposition of the GSHP + BTES system through a techno-economic analysis between GSHP + TES, Dual temperature BTES, conventional GSHP, and other HVAC with/without TES

- Committee solicited for feedback and interested volunteers

## 5 Research Results & Publications

- None

## 6 Research Topic Idea Discussion

- Matt Mitchell – Discussion of “Ambient temperature loops”. Shared ground heat exchanger / shared loop where multiple systems are connected and can be used to recover waste energy. Typically operate with loop temperatures around 45-85 F.
  - Steve Hamstra - This is a new & popular topic in ASHRAE.
  - Xiaobing – These systems are popular in China, there is a very large system in Beijing that has a 40 km loop, includes GSHXs. Called multi-storage supplementary systems. For district heating/cooling applications. Need information about pumping strategies. Methods to incorporate Borehole Thermal Energy Storage, seasonal storage. Information about how to do retrofits (i.e. turning steam system into “ambient temperature loop”).
  - Garen Ewbank – Need unified terminology. Grey Edge group – doing case study for campus with many buildings, has 1-pipe circulation system with 4 geo-micro districts. Seeing EUI from 50 down to low 20s. IAPMO may be coming out with codes and standards around these systems. Research BIN data – how many hours are the buildings in each temperature BIN, and how to manage the system control with buildings in different operating modes (e.g. heating or cooling) depending on the BIN. City-level systems seem to have similar operation as campus-level systems. He is finding that for 1-pipe systems the pumping power can be minimal if done correctly.
  - Cary – Use existing methods for sizing GHX as a baseline and then evaluate the Net load of the system. Add more thermal storage to compensate, preferably with addition vertical or perched aquifer. NREL and Rocky Mountain Institute working on adding modules that can model district system with “thermal sharing”. We have seen a REDUCTION in net loop as a general case and it appears that this is directly related to the amount of wasted energy recovered and stored. Storage calculations can be daily or any other advantageous period (seasonally). Short term used to shift demand. Longer term to control system central loop temperature to “most advantageous”.
  - Scott Hackel – Tool called “Urban Opt” could benefit from data collection, modeling & optimizations
  - Xiaobing – how to implement large-scale connected mixed systems – what are options, design guidelines
  - Scott – what are practical tools needed for these systems – data collection, what assumptions can we use, optimization, software modules. Should reach out to Rocky Mountain Institute and NREL to see what they think the highest priority research topics are.
  - Garen – Grid interactive electrically smart buildings – how will they integrate with thermal smart buildings. Goal to eliminate natural gas energy use.
  - Xiaobing – May be a good way to create “clean buildings” as part of stimulus investment
  - Action plan
    - Compile list of issues around these systems that needs more information.
    - Circulate the list to stakeholders in TC 6.8, National Renewable Energy Lab (NREL), and Rocky Mountain Institute (RMI) to get sense of priorities and topics that ASHRAE could best address.
    - Draft RTAR to address these issues.
- National database for soil thermal properties (thermal conductivity, diffusivity, ground temperature)

- Another discussion about this topic – it has been extensively discussed at 2 previous TC 6.8 Research Meetings, and via email (if you’d like a copy of emails, please contact harrison.skye@nist.gov).
- Proposed methods:
  - Develop/validate ways to estimate a “bracket range” of GTP of a given location based on relevant existing data available to the public – would still need to do in-situ test for large projects.
  - Develop liability release for soil property data that would permit the information to go into an open database
- Email comments in support:
  - “Would be very helpful for investors, engineers, and building owners to evaluate the potential and economic viability of developing a GSHP system.”
- Email comments opposed:
  - “Not prudent to give away information that someone else has paid for or to compete in an industry where companies have invested their time and money to develop a market.”
  - “It seems like a lot of money to spend on something that supports a small percentage of the HVAC market. While we all would like the market to grow – this information would only give you an “estimate” of what the ground properties are and that is all. You can’t use it for design; it only gets you in the ballpark. I’m not sure if it’s the best ‘bang’ for the ASHRAE buck.”
- Other comments added at meeting
  - Garen – As we go into greater electrification, GSHP market are likely to capture increased share of market
  - Cary – There is an implied liability issue here. The customer paid \$5-100K for ground thermal property, so they would have to release the data. Also, the TC test data are managed and distributed by TC companies who are responsible for the data. They are familiar with the equipment, data processing, and reasonable results. And they are responsible if something isn’t correct. If ASHRAE publishes the data, then failures could be blamed on ASHRAE.
  - Howard – On-site testing is critical, especially for large systems. As an example, he did a recent job with 2 conductivity tests for \$24k. Results for first 200’ showed ground temperature at 70 F, next 400’ at 78 F. Would have been a large problem if they hadn’t accounted for the higher temperature at lower depths.
  - Xiaobing – The database would be useful to customers who don’t have access to information via working relationship with thermal conductivity test companies. Would be especially useful for smaller installations where the soil thermal property tests are cost prohibitive
- Harrison proposed making an RTAR draft for a voice vote at the TC committee level, to gauge support for this topic. The RTAR draft could be relatively basic and focus on the main idea and deliverables.

### **6.1 Ideas proposed by members via email (didn’t have time to discuss)**

- A ground temperature vs. depth and thermal properties map for Middle Eastern and African countries. (Hesham Safwat)
  - Garen – information exists for rock and soil types that could be used for basic estimates of ground properties
- Decentralized GSHP with horizontal loop under a green area with periodic irrigation. (Hesham Safwat)

### **6.2 Ideas from previous TC meetings.**

- Building-grid interactions for GSHPs
- Publication with survey of successful system installation characteristics across the country (PTAR).

- Brief description of primary features of installation: Building type, Heat pump type, loop length/ton, GSHP type, delivery method inside building [VAV, hydronic, etc.], pipe types installation & operating costs, GHX type, Pump type. Could also characteristics of “belly-flops”, i.e. badly failed GSHP installations. This would be a broader, and updated effort somewhat like a previous project done by Steve Kavanaugh, and reported in the ASHRAE Journal in 2012.
  - How to frame as a research project?
  - How to measure? How to distinguish between “good” and “bad” installations? Are some configurations inherently bad or just not done correctly?
- Design guidelines for GSHPs in hot climates (PTAR)
- Use of dual-source (air & ground) heat pumps to reduce GHX size
  - Steve Hamstra – There has been work & prototypes for these systems, though it hasn’t been commercialized
- Methods to predict ground temperature in urban areas
- This is a hot topic in European research communities

**7 Other business**

- None

**8 Old business**

- None

**9 Adjourn**

**10 Useful links**

- ASHRAE Research website: <https://www.ashrae.org/technical-resources/research>

### TC 6.8 Research Attendance

| Name                           | Affiliation | Email                  |
|--------------------------------|-------------|------------------------|
| Harrison Skye (Research Chair) | NIST        | harrison.skye@nist.gov |
| Steve Hamstra                  |             |                        |
| Ted Reinhart                   |             |                        |
| Massimo Cimmino                |             |                        |
| Howard Newton                  |             |                        |
| Greg Tinkler                   |             |                        |
| Lisa Meline                    |             |                        |
| Carl Huber                     |             |                        |
| Michel Bernier                 |             |                        |
| Yuewei Li                      |             |                        |
| Lance MacNevin                 |             |                        |
| Craig Buschur                  |             |                        |
| Michael J. Vanden Berg         |             |                        |
| Xiaobing Liu                   |             |                        |
| Jim Paschal                    |             |                        |
| Cary Smith                     |             |                        |
| Garen Ewbank                   |             |                        |
| Jin Jin Huang                  |             |                        |
| Matt Mitchell                  |             |                        |

|              |  |  |
|--------------|--|--|
| Scott Hackel |  |  |
|              |  |  |
|              |  |  |
|              |  |  |

## ASHRAE Geothermal Energy Handbook Subcommittee Meeting Jan 14, 2021

1. Introductions
2. Work Schedule

### 2023 Applications

|                |   | 2019 |        |     | 2020  |       |       | 2021 |     |     | 2022  |     |        | 2023 |        |  |
|----------------|---|------|--------|-----|-------|-------|-------|------|-----|-----|-------|-----|--------|------|--------|--|
|                |   | Apr  | Jul    | Oct | Jan   | Apr   | Jul   | Oct  | Jan | Apr | Jul   | Oct | Jan    | Apr  | Jul    |  |
| Review         | Current HB received (June 1)                                    |      | June 1 |     |       |       |       |      |     |     |       |     |        |      |        |  |
|                | TC selects HB subcom and chair<br>Review current HB for changes |      |        |     | Feb 1 | Jul 1 |       |      |     |     |       |     |        |      |        |  |
| Revise         | Decide extent of and outline revisions                          |      |        |     |       | Jul 1 |       |      |     |     |       |     |        |      |        |  |
|                | Seek and appoint reviser(s)<br>Revise chapter(s)                |      |        |     |       |       | Feb 1 |      |     |     | Feb 1 |     |        |      |        |  |
| Approve        | Send revised chapter to TC for review                           |      |        |     |       |       |       |      |     |     |       |     | Jul 31 |      |        |  |
|                | TC approves chapter   |      |        |     |       |       |       |      |     |     |       |     | Jul 31 |      |        |  |
|                | Send chapter to HBC liaison                                     |      |        |     |       |       |       |      |     |     |       |     | Jul 31 |      |        |  |
| Edit & Produce | HQ sends chpt. proof to TC contact                              |      |        |     |       |       |       |      |     |     |       |     |        |      | Mar 15 |  |
|                | HB sent to printer (April 1)                                    |      |        |     |       |       |       |      |     |     |       |     |        |      | Apr 1  |  |
|                | HB mailed (May 15)  |      |        |     |       |       |       |      |     |     |       |     |        |      | M 15   |  |

HBC = Society Handbook Committee  
 HB = Handbook volume  
 HQ = ASHRAE Headquarters editorial staff

Final due date: March 15, 2022  
 Drop dead date: July 31, 2022

3. Previous Cycle
  - a. Chapter rearranged to put the “Direct Use” Material after the GSHP content.
  - b. New section describing direct exchange system.
  - c. New section discussing pressure considerations for deep boreholes.
  - d. Primary design method updated to include calculation of Long-Term Temperature Penalty
  - e. Updates: Standing Column Wells, Hybrid Systems, Grout, Water Wells and Cost Data sections.
  - f. Code listings updated, including reference to ANSI/CSA/IGSHPA Standard C448-16 (2016) and IMC 2015.

#### 4. Proposed Work

- Ambient temperature loop, geo microgrid, etc.
  - o Common shared loop and ground heat exchanger connecting multiple buildings
  - o Two- and single-pipe system designs
  - o Need to consensus on terminology/vernacular

- Wastewater energy recovery material in Ch. 9 potentially similar/duplicative
- Authoring committee: Steve Hamstra, Cary Smith, Xiaobing Liu, Frank Pucciano, Jacob Komar, Brendan Hall, Hugh Henderson, Ed Lohrenz, Carl Orio, *Garen Ewbank*
  
- Piping and code updates
  - Updates based on IGSPHA CSA 448 guidelines
  - Add material for pipe bedding
  - Authoring committee: *Lance MacNevin*, Howard Newton
  
- Expand DXGCHP section - Currently pp. 35.28
  - Add loop design information
  - Add physics information: evaporation, buoyancy, etc.
  - Authoring committee: Craig Buscher, Chuck High, Parham Eslami-Nejad
  
- New section for borehole thermal energy storage (BTES)
  - Add introduction, basic explanation of the systems
  - No design guidelines currently
  - Authoring committee: Michel Bernier, possibly help from other designers (Drake's Landing, Chuck Hammond - GA system)
  
- Updated borehole resistance calculation information
  - Info related to effects of low flow rates and/or deep boreholes
  - Add succinct BH resistance calculation example(s)
  - Examples on how to compute from TRT data ??
  - Authoring committee: Michel Bernier, Steve Kavanaugh, Garen Ewbank
  
- Surface water heat pump design information
  - Add design diagrams for designing SWHE
  - Authoring committee: Matt Mitchell
  
- Renewability section revisions
  - Harmonize with relevant Fundamentals chapter. Energy Resources.
  - Refer to “geothermal” as heat which comes directly from heat generated within the earth's core/crust.
  - Authoring committee: Ted Reinhart
  
- Direct use geothermal
  - District, hot water, non-steam geothermal systems
  - Example: Boise, ID

- Authoring committee: Cary Smith, with help of others. Matt Mitchell
- Add or update costing information
  - Authoring committee: Steve Kavanaugh
- 5. Proposed work schedule:
  - Handbook Chair check in with authors every 4-6 weeks.
  - Jan XX, 2022 (directly before main TC meeting in Jan 2022 - Final draft ready for TC review.
  - Feb 15, 2022 - Review comments from main TC due.
  - March 1, 2022 - Authors finalize chapter revisions.
  - March 7, 2022 - Final review of draft chapter.
  - March 7-15, 2022 - TC voting members meet for final vote.

## TC 6.8 Energy Recovery Subcommittee

### 2021 Winter Meeting Minutes

Thursday, January 21, 2020 at 4 pm EDT over Zoom

#### Attendee list:

Mike Filler

Steve Hamstra

Antash Najib

Brendan Hall

Carl Jones

Craig Buschur

Hesham Safwat

Howard Newton

John Trouba

Steven Carlson

Ted Reinhart

#### Call to order & introductions

Wastewater energy recovery was discussed by several members:

- Could be a good topic for research, but no one had a specific RTAR to suggest
- The handbook information is likely dated, and could use references and design guidance relative to newer systems available on the market today
- Wastewater authorities have no incentive to consider assisting with this in most markets, but there are paths to provide them an income stream for taking BTU's from the wastewater – budgets are always tight. This may be a great opportunity to get the ASHRAE Government Affairs Committee (GAC) and local ASHRAE chapter GAC's involved.
- More case studies with heavy lifting to be done by the manufacturers and MEP consultants for the specific project(s) would be a good starting point, followed by ASHRAE Journal articles (peer reviewed), and ideally seminars or other learning will be shared.
- After the meeting I found the ASHRAE Journal articles for a couple of technology awards involving heat recovery – one of which was the wastewater heat recovery for the 2010 olympic village. I'll email these articles to Craig Buschur (webmaster) & Steve Hamstra to include on the TC webpage.
- A point was made to ask when the last time introductory training on energy recovery was offered. For commercial buildings, a small part of central chiller plant training

courses/books touch briefly on heat recovery. As for industrial and wastewater heat recovery, it may be time for a basic or beginner level PROGRAM to submit in one of the upcoming ASHRAE meetings. An ALI course on energy recovery would likely be a stretch.

- Another point was that the district heating guide purportedly has no information on waste water heat recovery

Recent research has been completed by ORNL using phase change materials (PCM) in energy storage applications. This might be more relevant to the energy storage TC6.9 or the GSHP portion of this committee TC6.8; however, there is a brief section in the applied heat pump and heat recovery systems handbook on heat sources and heat sinks. After the meeting, my review of ORNL's site showed several PCM studies...published only in systems with a pay-wall. I can try to reach out to the authors soon to gauge interest in joining the committee or at least reviewing the handbook chapter for ideas on revisions and if their research would be pertinent as references.

We also discussed "slingers" within room air conditioners (where condensate is used to reduce the condenser coil temperature), but this likely has no relevance to this committee.

# TC 6.8 Programs Subcommittee

Minutes for 2021 Winter ASHRAE Conference (Virtual)

1:00-2:00 p.m. Monday, January 18, 2021

Zoom meeting: <https://ashrae-org.zoom.us/j/94055435153?pwd=UDhXY3RHSIM4OUxTQXovVno0UGdudz09#success>

Prepared by Roshan Revankar, Programs chair

## 1 Attendance/Introductions

Attached

## 2 Virtual Winter 2021 Conference:

Four sessions were submitted for this years conference. Three were selected of which one was a live conference. The live conference was attended by over 90 participants.

| Session Type | Session Title   | Speakers  | CoSponsoring Committees | Program Chair/Moderator |
|--------------|---|---|-------------------------|-------------------------|
| Recorded     | Energy Conservation with Heat Recovery Heat Pumps in New Applications or Old Applications with New Refrigerants | John Michael (Mike) Filler Jr.,<br>Steve Hamstra,<br>Howard Newton,<br>Frank Pucciano |                         | Steven Carlson          |
| Live         | Ground Source Heat Pump Systems: GeoMicroDistricts to the Thermal Highway (and beyond).                         | Cary Smith<br>Garen Ewbank  |                         | Roshan Revankar         |
| Recorded     | Thermal Energy Storage in Geothermal Systems  | Xiaobing Liu,<br>Michel Bernier,<br>Stephen Hamstra                                   |                         | Roshan Revankar         |

|          |  |  |                     |              |
|----------|--|--|---------------------|--------------|
| Rejected | Accelerating Building Electrification Through District Condenser Loop Systems. |  | 6.2 District Energy | Brendan Hall |
|----------|--|--|---------------------|--------------|

### 3 2021 Annual Conference, Phoenix:

<https://www.ashrae.org/conferences/2021-annual-conference-phoenix>

There were multiple discussions around topics for the next conference. Proposed sessions included topics such as basics of geothermal, district heating and cooling, heat pump controls. Most members suggested that the topics be discussed in the full meeting and seek speakers from outside the committee as well.

#### Phoenix Deadlines 2021 – June 26 - 30, 2021

**Wednesday January 13, 2021:** Revised Conference Papers/Final Technical Papers Due

**Monday February 15, 2021:** Extended Abstracts Due

**Thursday February 18, 2021:** Conference and Technical Paper Final Accept/Reject Notifications

**Monday February 22, 2021: Program Submissions Due**

**Friday March 19, 2021:** Extended Abstract Accept/Reject Notifications

**Friday April 2, 2021:** Program Submissions Accept/Reject Notifications

| Track | Description   | Track Chair  |
|-------|---|--|
| 1     | <b>Fundamentals and Applications:</b> Fundamentals are the foundation for understanding applications in engineering. Key components of ASHRAE fundamentals include thermodynamics, psychometrics, 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. | Sonya Pouncy<br><a href="mailto:sonyapouncy@gmail.com">sonyapouncy@gmail.com</a> |

|   |  |  |
|---|--|--|
| 2 | <p><b>HVAC&amp;R Systems and Equipment:</b> HVAC&amp;R Systems and Equipment are constantly evolving to address the changing requirements of the built environment. Papers and programs in this track will focus on the development of new systems and equipment, improvements to existing systems and equipment and the proper application and operation of systems and equipment.</p>  | <p>Rupesh Iyengar<br/> <a href="mailto:rupesh_iyengar@yahoo.com">rupesh_iyengar@yahoo.com</a></p>        |
| 3 | <p><b>Research Summit:</b> Active research, and the exchange of those research findings, are critical to the development of our HVAC&amp;R industry and built environment. The 8th 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, extended abstracts, 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.</p>  | <p>Kristen Cetin<br/> <a href="mailto:cetinkri@msu.edu">cetinkri@msu.edu</a></p>                         |
| 4 | <p><b>Professional Development:</b> 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.</p> | <p>Marites Calad<br/> <a href="mailto:mcalad@norman-wright.com">mcalad@norman-wright.com</a></p>         |
| 5 | <p><b>Design, Control, and Operation of Critical Environments:</b> Critical environments often present design, control, and operation challenges that require innovation, attention to detail, and a thorough understanding of the intended operational parameters. This track includes innovative designs and strategies that adapt to the standards and special requirements presented by healthcare, cleanrooms, data centers, laboratories, isolation rooms, and pharmacies. Papers and presentations will also address how controls systems, smart building technologies, and security systems and other technologies are adapting to the emerging needs of critical environments.</p>                    | <p>Raul Simonetti<br/> <a href="mailto:raul.simonetti@carel.com">raul.simonetti@carel.com</a></p>        |
| 6 | <p><b>HVAC&amp;R for Indoor Plants &amp; Animals:</b> This track addresses HVAC&amp;R systems design for controlled environments that host plants &amp; animals. Papers and programs in this track will present the challenges and opportunities associated with energy and water utilization for indoor growing spaces, including standards and regulations that guide the design of plant &amp; animal habitats. Environmental parameters for indoor agriculture, including controlling temperature, humidity, air movement, air quality will be covered. This track will also address</p>   | <p>Ryan MacGillivray<br/> <a href="mailto:ryan.macgillivray@dwel.com">ryan.macgillivray@dwel.com</a></p> |

|   |  |   |
|---|--|---|
|   | reducing consumption of energy & water and compare how crop types and animal species impact HVAC analysis and design.  |   |
| 7 | <b>Future Proofing - Renewable, Regenerative, and Resilient:</b> The HVAC&R industry faces many challenges including climate change, pandemics, natural disasters, catastrophic accidents, and terrorism. Rising to meet these challenges are a host of technologies and strategies, including grid-enabled buildings, demand response, decarbonization, resiliency, zero energy design, energy-efficiency and renewable energy systems. This track invites papers, abstracts, seminars and forums that highlight the innovative technologies and strategies that are reimagining our relationship with the built environment now and into the future. | Andy Cochrane<br><a href="mailto:acochrane@industrialairinc.com">acochrane@industrialairinc.com</a> |
| 8 | <b>Hot, Hot, Hot</b> The world is warming. The built environment faces increased challenges to meet the demand for comfortable Indoor and outdoor environments in warmer climates. This track is for papers and presentations that address humidity control, outdoor cooling, passive cooling, water scarcity considerations, other design opportunities, and innovative technologies that help HVAC&R professionals adapt to the hottest climate trends.  | Nohad Boudani<br>nohadb@inco.com.lb   |

Meeting ended at 2:00 PM. Minutes will be forward to the TC chair and committee members.

| TC 6.8 Programs Attendance |             |       |                  |
|----------------------------|-------------|-------|------------------|
| Name                       | Affiliation | Email | Phone (optional) |

