TC 6.8 Geothermal Heat Pump and Energy Recovery Applications

Orlando, FL 2020 Annual Meeting

Location: Hilton Orlando, L, Lake Highland B

T.C. 6.8 FULL COMMITTEE MEETING AGENDA

Tuesday, February 4, 2020

3:30-6:00PM

1. Call to Order (called to order at 3:32 PM)

- Welcome, Introductions, and Sign-In
- Visitor Welcome: 1st timers and YEA
- Review Voting Members & Determination of Quorum
  - Need 8/14 without members non-quorum
  - Have 11 voting members, we have a quorum.
  - Total of 38 people in attendance

2. Approval of minutes from Winter 2019 (Atlanta)

- Moved to approve and seconded
- Motion approved

3. Approval of minutes from Summer 2019 (Kansas City)

- Moved to approve and seconded
- Motion approved

4. Announcements from ASHRAE

- Section Head – Dawen Lu
- Liaisons
  - Staff - Any
  - Standards – Erick Phelps
  - Research – Dr. Omar Abdelaziz
  - Handbook – Dhamshala (S)/Werman (A)
  - TAC – Kelley Cramm
  - ALI/PDC – Bochat
  - Codes: Steve Ferguson

4. Announcements from the Chair (in attendance)

- **Topics from Chair's Breakfast**
  - Carl Huber recognized as award winner of the Distinguished Public Service Award
  - Subcommittee trainings at 11:15am on Tue
  - MTG
    - Carl Huber shared that a new MTG has been established for safety best practices
    - Controlled Env Ag
    - Ref and AC
  - Residential Buildings Committee needs more activity and partnership. What could we do with them?
  - Any other people for awards? Send me a note.
  - ASHRAE has an online team management system called Basecamp for our use. If you have interested in accessing TC6.8 Basecamp contact Scott Hackel via email. This is a repository for all of our TC activities.

5. Subcommittee Reports:

- Research - Harrison Skye (in attendance)
  - An ASHRAE research survey was emailed on January 13 (please check your SPAM folders). It was from RAPstaff@ASHRAE.org – please check your email and respond if you can.

CURRENT VOTING MEMBERS

- Scott Hackel (20)
- Bruce Baccei (20) - MNQ
- Ed Lohrenz (20) - MNQ
- Kay Thrasher (20)
- Dr. Bill Murphy (20)
- Dr. Saojie Wang (20)
- Dr. Harrison Skye (21)
- Cary Smith (21)
- Dr. Piljae Im (22)
- Derek Birdsall (22)
- Hugh Henderson (22)
- Dennis Koop (22)
- Steve Hamstra (22)
- Roshan Revankar (23)
- Steve Kavanaugh (23)
- Steve Carlson (23)

  - PTAR – is a new Technical Assistance Request for publications. If you have ideas for efforts that could get published (journal, etc.) please contact Harrison Skye.
  - The Minimum Flow for Purging research project has passed the RTAR phase but needs additional input to be considered for the next steps. If you have any input or thoughts, please contact Harrison Skye or Lisa Meline. RAC expressed a concern about whether flow rate specification was the Engineer's responsibility or the contractor? We are looking for any supporting document or code that might support this as being the Engineer's responsibility. CSA 2448 2016 Edition Section 9.1.2 calls for 2 FPS notes this or is that solely for air purging? Could we get any cosponsor support from pipe manufacturers or some other body?
  - Work statements and RTARs
    - For 1817, we will have an exec session to consider and potentially award this project
    - Please begin to think about projects where we have flow measurement and data from day 1, that are at least 7 years old. TC 6.8 will send out an email soon requesting our input on potential sites for this study.
  - Discuss research topics
- KTM Award – Scott Hackel / Lisa Meline (Scott in attendance, Lisa not in attendance)
  - Massimo Cimmino (in attendance at meeting)
    - Polytechnique Montreal
    - Graduate work in simulation of GSHPs, including
      A semi-analytical approach for faster g-functions
    - 3 technical papers published in ASHRAE already
    - Seminar 24 this week
    - Use the funding to develop open source geo modeling tools
- Geothermal Handbook Matt Mitchell (in attendance)
  - Will have a handbook cycle meeting at the next meeting (Summer 2020)
  - There were 3-4 people that expressed interest in participating
  - Matt will also request support via email
  - Dr. Kavanaugh noted that there have some PVC piping failures that the handbook should address and requested any information be shared. PPI Technical Note 55 suggests the four type of pipe that are approved for geothermal use and this excludes PVC. This is also in some of the new codes.
  - Cary Smith noted district energy ambient temperature loops are growing in popularity – consider for this chapter of the handbook?
  - RP 1385 Surface Water Heat Pumps – Matt hopes to add info from this research project.
  - Steve K. asked if anyone is using the direct water use portions at the end of this chapter. Cary Smith notes that he has/is doing this, with 20-30 systems operating. This portion should be updated.
- Applied Heat Recovery – Mike Filler (in attendance)
  - Mike explained the history of Applied Heat Recovery as a previous TC that was merged with TC 6.8. Lasts update was in the 2016 version (no changes in the 2020 version)
  - Mike is requesting any interest, feedback, etc. be expressed to him.
  - At the meeting this morning, they had around 6-7 people in attendance. Potential Chicago presentation topic that will be shared with Roshan.
  - Steve Hamstra noted that Seminar 27 Wastewater Heat Recovery might be something to add to this chapter
- Standards – Cary Smith (in attendance)

- Standard 194-2017 Method of Test for Direct-Expansion Ground-Source Heat Pumps update: Cary asked for input, Bill made some suggestions to either keep as is or form another committee to revise it. There are numerous references that are out of date. A motion was made and supported (Bill Murphy) to approve efforts to reaffirm this standard, this requires updating the references. Motion carried. Supporting Cary on this effort is Steve Hamstra, Craig Buschur, and Joe Parsons, Harrison Skye, and Scott Hackel. Craig Buschur expressed that this standard is useful.

- Programs - Roshan Revankar: (Roshan was on phone, Harrison Skye covered this)
  - Orlando – we had Seminar 27 sponsored by TC 6.8, Wastewater Energy Recovery
  - Austin – several programs proposed including:
    - Recent developments in Thermal Response Tests, currently chaired by Michel Bernier. We have three (3) speakers that have agreed to present. Mike Filler agreed to Chair.
    - Insights and Best Practices for Community and Campus – will be resubmitted and Xiaobing will Chair
    - Monitored GSHP Performance – Xiaobing will speak and Dr. Yan from China could also speak. Dr. Spitler discussed Annex 52 and the potential to speak along with one of the researchers on this effort. Matt agreed to chair this session.
    - Deadline for final submission is February 10, 2020.
  - Chicago
    - Brendan Hall proposed a campus-scale heat pump/district energy presentation for Chicago. Potential collaboration with TC 6.2. Hugh has a speaker. Cary Smith expressed interest in speaking. Also interested was Dane Christensen.
    - Consider rewording the Abstract to align with one of the proposed tracks.
    - Harrison asked for any presentation ideas to be emailed to him
- Membership - Cary Smith (in attendance)
  - We have started to reach out to four (4) potential Voting Members and Scott encouraged anyone to reach out if they have an interest in serving as a Voting Member.
  - Corresponding members can simply join at ASHRAE.org and under *MyProfile* add yourself or go to the TC 6.8 website.
- Education and Special Publications/Journal - Vacant
  - Publication review: **1996 GSHP Design book –** Scott can check on what current sales might be. Cary asked about creating a new collection of papers to replace this book. Scott will ask if this is selling. Then we will determine next steps.
  - New publication tools
- Webmaster - Craig Buschur (in attendance)
  - Kansas City minutes
  - Orlando agenda
  - KTM Award – he will post
  - Craig asked for any input from members

- **Industry Liaison Reports:**
  - IGSHPA, IAPMO, NGWA – Lance /PPE? (in attendance)
    - Lance thinks the Public Comment period has closed on the 2021 IAPMO GSHP portion of the Uniform Mechanical Code.

- IGSHPA developments – Cary Smith shared that OSU has placed IGSHPA on hold (has not dropped it). OSU would like to keep providing certifications (which potentially generates revenue) but would like the membership (which potentially generates less revenue) to pass onto a different or new organization. A survey of members indicated dissatisfaction with IGSHPA. Hopefully more information by our summer 2020 meeting in Austin.

- GEO – Roshan (via text, but lost audio) – nothing new to report.
- Call for Papers Geothermal Resource Council conference, due May 27, Reno in October 2020. GSHP's are a topic of interest for them. Refer to their website.
- Brendan Hall mentioned NY GEO Conference, and discussion ensued on current activities in New York and Massachusetts. Steve K emphasized a concern with air-source heat pumps in cold climates not being efficient or keeping up with the load as this may have a negative impact on GSHP. Should ASHRAE take action? Yes – provide more programs and education to promote GSHP and illuminate the potential issues with ASHP in cold climates. Mike Filler proposed a sub-committee meeting to discuss and make a recommendation back to the TC. Cary volunteered to work with Mike and run this as a separate meeting in Austin – Scott will get a meeting room.

- **Old Business**
  - TC reorganization efforts:
    - Per TC Chair Breakfast - Motion made to keep TC 6.8 as is (not merge with another TC) was made and supported. Motion carried.
    - The TC Collaboration space is available and was useful at this conference.
    - Standardizing scheduling is still a topic being considered.
  - Use of basecamp – please try it! Both Voting and Corresponding Members can use – contact Scott if you want access as he can only add one person at a time. Scott will also send out emails for important items.
  - Remote attendance in summer meeting in Austin
- **New Business**
  - ASHRAE Position Document on On-site Renewable Energy (effort by Mike Bilderbeck and Steve Hammerling)
    - Need a volunteer to sit on this – Roshan Revankar and Brendan Hall volunteered.
  - Electrification/decarbonization
  - Open Discussion
- **Executive session**
  a. Non-voting members left the meeting at this point.
  b. 9 voting members in person, 1 on phone
  c. 1817 RP Consideration
     i. Multiple bids were received and the PES evaluated them
     ii. The PES recommended a bidder for award of RP contract
     iii. Motion to award the project carried, with 9 Yes, 0 No and 1 abstention (RAC member)
- **Adjourn** – meeting adjourned at 6:00 PM

Appendices

A. Research subcommittee minutes

B. Program subcommittee minutes

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

Orlando, FL 2020 Winter Meeting

Location: Hilton-Orlando, L, Maitland Boardroom

T.C. 6.8 RESEARCH SUBCOMMITTEE MEETING MINUTES - DRAFT
Monday, Feb. 2, 2020
4:15-5:45PM
Minutes prepared by chair, Harrison Skye (harrison.skye@nist.gov)

1 Attendance

2 New Research Chair

- Harrison Skye has taken over position from Jeff Spitler

3 Research Chair Breakfast Summary

- ASHRAE has 49 active research projects
- Funding limit update
  - RAC - < $150k (previous $100K)
  - TAC - < $250K (previous $200K)
  - BOD - < $ (previous $)
- New investigator award
  - To enhance careers of new (< 5y) faculty members w/ research related to ASHRAE
  - Award up to $125K over 3 years to support research
  - Tough competition – 11 applicants
- Homer Addams award - $5K
  - Graduate students who publish in STBE, do work relevant to ASHRAE
  - Only 2 applicants
- Service to ASHRAE Research Award
  - Recognizes excellence in service to Society Research
  - No applicants!
- Innovative research grant - $125K
  - Very novel research that doesn't fit in TC structure
  - 2-stage review process $50K, $25K/yr for 3 years
- ASHRAE Research Strategic Plan (current is 2010-2018)
  - Needs to be updated and harmonized with ASHRAE 2019-20204 ASHRAE Strategic Plan
  - Research Advisory Kickoff happened November 2019
  - Chair in Reinhard Radermacher
  - Research survey sent to ASHRAE membership & others – this will be large basis for research document. Ask TCs to please participate in survey.
    - Check Spam folders! Email in individual and has a link. Another will likely be sent from RAPstaff@ashrae.org
    - If you don't get one, email Mike Vaughn
    - Survey open until Feb. 10, 2020.
    - Survey can help direct research direction.
  - Reminder of newly-created "PTAR" Publication Topic Acceptance Request. Similar to RTAR, but for publications relevant to ASHRAE, sold in ASHRAE bookstore.
- Kaggle – Great Energy Predictor Shootout
  - Online community of data scientists
  - ASHRAE funded ($25K) competition to create building energy model from data
  - Received over 40,000 entries
- PMS and PES training

- RAC is creating training modules that will be available for PMS and PES members.
- Training will occur before RAC deadlines for research projects

- TC meeting discussing of Bidders for Work Statement
  - Only TC voting members and PES can be in the room for discussion and vote. Do this at the end of the meeting.
  - Meeting minutes can only say that contractor "A" was selected (don't give contractor name), and the vote tally for the contractor selection.

4 Existing Research Projects

4.1 Project Monitoring

- None

4.2 Tentative Research Projects

- 1817-TRP, "Long term temperature change of ground heat exchangers" has received bids from contractors. Project Evaluation Subcommitte will meet Tuesday (2/2/2020) to review the bids and make a bidder recommendation to the voting TC 6.8 members.
  - TC MUST COMPLETE PROPOSAL EVALUATION SUMMARY SHEET AND E-MAIL TO MORTS (morts@ashrae.net) OR PLACE IN MORTS LOCKBOX OUTSIDE HQ ROOM IN ORLANDO (Key Largo A room - Lower Level) BY MIDNIGHT TUESDAY, 2/4/20, IF FUNDING APPROVAL IS TO BE COMPLETED IN ORLANDO. A REQUEST FOR REBID SHOULD BE NOTED ON SUMMARY SHEET IF TC REJECTS ALL BIDS. A REQUEST FOR PROPOSAL CLARIFICATION QUESTIONS CAN ALSO BE SUBMITTED TO MORTS IF TC NEEDS MORE INFORMATION OR WRITTEN ASSURANCES FROM PI BEFORE MAKING A DECISION.

4.3 Projects Approved for Bidding

- None

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.

4.5 Research Topic Acceptance Requests (RTAR)

- 1890-RTAR, working title: "Minimum flow velocities for purging air and debris from hydronic piping systems" has been "accepted with comments" for further development into a work statement (WS) by RAC, provided that key comment(s) and question(s) are addressed to the satisfaction of our Research Liaison (Omar Abdelaziz, omar.abdel.aziz@gmail.com, or RL6@ashrae.net).
- Jessica Mangler (jmangler@aeieng.com), Research chair of TC 6.1, has agreed to review. Mike Trantham (mike.trantham@imi-hydronic.com) has also agree to help review the WS.
  - Jessica Mangler is also the Vice Chair for TC 6.2 and will solicit the chair for a reviewer.
- Comments on 1890:
  - The first draft of the work statement should be submitted to RAC no later than August 15, 2021, or it will be dropped from display on the Society's Research Implementation Plan. The next likely submission deadline for a new work statement on this topic is May 15, 2020 for consideration at RAC's 2019 Annual meeting. The submission deadline after that for work statements is August 15, 2020 for consideration at the RAC's 2020 fall meeting.
  - "Why should RAC take this RTAR seriously, if roughly half of the TC voting members don't even take the time to return their letter ballots!"
  - "This issue is an installation, rather than design issue. The referenced standards are not ASHRAE standards. This issue would best be taken up by applicable trade associations"
    - CSA Code 448.1 Section 9.1.2, specifies the flushing velocity of 2 ft/s "shall" be used. It does not give specification as to who is responsible (design engineer vs. installation contractor).

- "For the Work Statement, the objectives and expected approach should be presented clearly to allow progress tracking and evaluation by the PMS."
- "One or more models, instead of a set of tables, would be desirable."
- "This project seems high given that there should be existing facilities that would have water measurement facilities already existing that could be used. How was the budget established? What is the number of tests envisioned?"

5 Research Results & Publications

The group had a discussion of possible ASHRAE research ideas that would address the needs identified in the recent Department of Energy (DOE) "Geovision" report (2019):

- https://www.energy.gov/eere/geothermal/geovision
- Compile national, high-resolution data on key soil properties for sizing ground heat exchangers and evaluating ground-source heat pump economics (P. 94)
  - Develop drilling data repository (P.97)
  - Bill Murphy – Darren Nutter completed an ASHRAE project with similar scope – trying to compile national database for soil properties
  - Steve Kavanaugh – Tennessee Valley Authority (TVA) had a database and website, but have since taken it down. Steve may have the database on his computer.
  - Other possible sources of well-drilling data:
    - Department of Natural Resources
    - US Geological Survey
  - Jeff Spitler – there is a recent paper in STBE discussing well-log data for GSHPs.
- Develop exploration tools that identify undiscovered geothermal resources (P.95)
- Develop new drilling technologies, methods, and tools specific to geothermal environments (P. 97)
  - Steve Kavanaugh – 75% of cost of GSHP is inside the building for commercial installations, only 25% of cost is in loop. Drilling technology is already quite good.
    - Should focus on bringing down the cost of systems installed in buildings.
    - There is a need to compile installation & operation cost data for GSHP projects. The information would show what are the salient general characteristic of successful GSHP systems (loop length/ton, GSHP type, delivery method inside building [VAV, hydronic, etc.], pipe types, installation and operating costs, etc.] 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. Might not be able to get professors to bid on this type of work. Contractors may do it, but RAC may not approve.
  - Howard Newton – his company has been able to cost-effectively install GSHPs in Texas. He is willing to share his knowledge of best practices.
    - Howard uses HDPE tubing inside the building (rather than steel). Cost savings is high. Reduces chemical treatment needed to preserve inside tubes.
- Methods for testing novel ground heat exchanger tubing, orientation, geometry
  - Steve Kavanaugh – methods exist to take TRT data and back out borehole thermal resistance. Using modeling tools.
- Increase technology and tool transfer from the oil and gas industry (P.98)

The group also discussed possible ASHRAE research ideas that would address the needs identified in the recent GeoVision Analysis Supporting Task Force Report: Thermal Applications – Geothermal Heat Pumps (2019)

- https://info.ornl.gov/sites/publications/Files/Pub103860.pdf
- Jeff Spitler (spitler@okstate.edu) also offered to share a related report on a Global GSHP Research review, done for ORNL:

- https://www.dropbox.com/s/sk078ehd7n3s3qe/2016_GSHP_Research_Review.pdf?dl=0
- Barriers GSHP use: high cost, low returns, poor awareness, inexperienced designers (P. 11)
  - Idea from 2019-01-23 Research meeting: Simplified algorithms for techno-economic analysis to help engineers that are not experts in GSHP system design.
  - Steve Hamstra – there is a program for Hydronic Systems called "Best Efficiency System Tool", available for free download from Hydronics Industry Alliance (IAPMO). www.iapmo.org
    - Installation, maintenance, operation costs of different types of systems.
    - https://www.iapmo.org/hiac
- Technology development to reduce cost
  - Lower-cost, performance-neutral GHX, including installation techniques/equipment (P. 12)
  - More cost-effective GHP equipment and system configurations (P. 11)
  - Automated process for installation and performance evaluation (P. 11)
- Customer adoption rate could have a bigger impact than the technology advancement (P.2)
- Innovative financing (such as third-party-ownership or TPO) and associated business models are needed to overcome the high initial cost barrier by monetizing the energy savings (P.2)
- GHXs
  - Characterization of GHXs in deep boreholes (P. 13)
  - Develop a standard testing method for GHXs that would allow accurate measurements of the borehole thermal resistance and the pressure drop resulting from alternative designs (P. 13)
  - Use of foundation piles for GHXs (P. 13)
    - Jeff Spitler – Work at Virginia tech regarding putting tubes in foundations
- GSHPs: use of dual-source (air & ground) can reduce GHX size (P. 14)
  - Steve Hamstra – There has been work & prototypes for these systems, though it hasn't been commercialized. Sponsored by EPRI? Steve will send the paper to Harrison. The systems used direct expansion of refrigerant (i.e. refrigerant circulated in GHX).
- Methods to predict ground temperature in urban areas (P. 14)
  - This is a hot topic in European research communities

6 Research Topic Idea Discussion

- Discussion of possible research topics
- Steve Kavanaugh – are there other organizations that have research interest that would co-sponsor research projects?
  - DOE
    - Steve Hamstra has a Phase 2 research project. 30000 ft2 and 2800 ft2 facility, has GSHP technology. Xiaobing is doing measurement. Project has TRNSYS modeling. Final report due September 2020. Steve would like to present the information to TC 6.8 and ASHRAE, if technology has market potential.
  - Comment - TC 2.8 Environmental impact committee – GSHP in hot climates, how to properly de-rate GSHPs operating in hot climates (i.e. Florida). Interest in knowing how far south GSHPs can be applied.
    - Comment – hybrid systems may be good applications for hot climates
    - Steve Kavanaugh – systems in hot climates, Austin TX, get Energy Star rating using simple systems (single speed, on/off control). Successful systems use long GHXs.
    - Steve Kavanaugh – Information dissemination is lacking, need to transfer knowledge from successful designers to other parts of the country.
- Idea to use PTAR (Publication Topic Acceptance Request funded by ASHRAE).
  - Steve Kavanaugh did a research project to update the Geothermal Blue Book.
  - Could be a place to publish the national soil property database.
  - Could be a place to publish design guideline for GSHPs in in hot climates.
  - Steve Kavanaugh – publication with survey of successful system installation characteristics across the country. Brief description of primary features of installation.
    - Building type

        - Heat pump type
        - System cost
        - GHX type
        - Pump type
        - Could also characteristics of “belly-flops”, i.e. badly failed GSHP installations

7 Other business

- None

8 Old business

- Research ideas from previous meeting
    - Simplified algorithms for techno-economic analysis.
    - Integration of load-side storage to enable grid-responsive operation of GSHP systems.
    - Integration of GSHP systems with photovoltaic arrays.
    - Dennis Koop discussed pipe manufacturers’ reporting of stagnation of pipe sales.
    - More accurate and easier-to-use engineering design tools for GSHP system design.
    - Thermal energy storage systems.
    - Borehole thermal energy storage systems.
    - Lower-cost GSHP & GHX.
    - GSHP design courses for ASHRAE.
    - Distributed temperature sensing (DTS) fiber optic measurements for TRT and continuous monitoring
    - TRT testing that gives measure of borehole resistance
    - Thermally enhanced grout

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	NIST	harrison.skye@nist.gov
Craig Buschur	Total Green Mfg	craig@totalgreenmfg.com
Howard Newton	Image Engineering Group	hnewton@iegltd.com
Steve Kavanaugh	University of Alabama	skavanaugh@eng.ua.edu
Bill Murphy	Retired Univ of KY	william.murphy@uky.edu
Mike Filler	JCI	john.m.filler@jci.com
Derek Birdsall	Carrier	Derek.birdsall@carrier.com
Richard Weekley	FHP Manufacturing	Richard.weekley@us.bosch.com
Matt Mitchell	NREL	matt.mitchell@nrel.gov
Stephen Hamstra	Melink Solar & Geo	Stephen.hamstra@gmail.com
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Michel Bernier	Polytechnique Montreal	michel.bernier@polymtl.ca
Steven Carlson	XRG Analytics	carlson@xrganalytics.com
Xinlei Wang	University of Illinois at Urbana-Champaign	xwang2@illinois.edu
Laura Carnieletto	LBNL-University of Padova (Guest)	laura.carnieletto@phd.unipd.it

TC 6.8 Programs Subcommittee

Meeting Notes for 2020 Winter ASHRAE Conference in Orlando FL

5:00-6:00 p.m. Sunday, Feb. 2, 2020

Marriot-West, 3rd floor, Mary Lou Williams A

Prepared by Roshan Revankar, Programs chair

1 Attendance

- Meeting Held Sunday Feb. 2, 18 in attendance, +1 via teleconference (Roshan Revankar)

2 Austin, TX, June 27-July 1 2020 Conference:

2.1 Important Dates:

August 12, 2019:	Conference Paper Abstracts, Technical Papers and Paper Session Requests Due
August 30, 2019:	Conference Paper Abstract Accept/Reject Notifications
January 13, 2020:	Final Conference Papers Due - Submitted for Review (Includes Bio, Learning Objectives and Methods of Assessment); Request for Conference Paper Sessions Due
February 10, 2020:	Program (Seminar, Forum, Workshop, Debate and Panel) and Extended Abstract Paper Due

- **General comment from Mike Filler:** for sessions being re-submitted, the chair should contact the track chair directly to make them aware of the seminar, and to solicit feedback.

Track 1: Fundamentals and Applications (Rupesh Iyengar, Rupesh_iyengar@yahoo.com)

Track 2: HVAC&R Systems and Equipment (Ashu Gupta, ashu.energy@gmail.com)

Track 3: Research Summit (Kristen Cetin, kcetin@iastate.edu)

- Monitored GSHP performance
    - Xiaobing Liu (liux2@ornl.gov) – has a project from Oakland University, has agreed to present.
    - Da Yan (yanda@tsinghua.edu.cn) - Evaluation of thermal imbalance of Ground Source Heat Pump systems in residential buildings in China.
    - "Signhild Gehlin (signhild.gehlin@geoenergicentrum.se) – "What would make the most sense for me, if possible, would be to give a talk in conjunction with another talk by Dr. Spitler (spitler@okstate.edu)., if you can fit both of us into the seminar. I would give a talk that focuses on the work on long-term performance monitoring of GSHP systems for commercial, institutional and multi-family buildings that is currently being carried

out within the international collaboration project IEA HPT Annex 52 that I am chairing. I would introduce the Annex, the new system boundary schema that has been developed, and give an overview of the 40 international GSHP system case studies that are included in the annex. I would then introduce the case study of the university building (Studenthuset) in Stockholm that Dr. Spitler and I have analyzed. Then, Dr. Spitler would present the results from our evaluation of 45 months of performance data from Studenthuset. He could also draw some interesting comparisons to measurements of the ASHRAE Headquarters building. If that's not possible, you could ask Dr. Spitler to present on the Studenthuset building . It's a long way to come and easier for me to justify if I'm helping to spread the word on the Annex results. I've talked to Dr. Spitler about this, and you could talk to him further this afternoon."

        - Signhild and Jeff have both agreed to speak.

    - Matt Mitchell (Matt.Mitchell@nrel.gov) will chair. Harrison Skye will forward relevant communications to Matt.

- "Recent developments in thermal response tests for GSHXs"
    - Speaker #1 : (Jeff Spitler, spitler@okstate.edu or Matt Mitchell, Matt.Mitchell@nrel.gov). Potential title #1: Multi-flow rate thermal response tests
    - Speaker#2: (Michel Bernier, Michel.Bernier@polymtl.ca) or Parham Eslami-nejad, parham.eslaminejad@canada.ca). Title #2: Calibration of thermal response test units (Confirmed)
    - Michel Bernier has other potential speakers that could present on TRT.
    - Allan Skouby, from GTRI - presentation about all the tests they've done. For example, how many have they run? Show map? What insights do they have from all that data? Steve Kavanaugh (Skavanaugh@eng.ua.edu) contacted them and asked for a speaker. (confirmed)
    - Jeff Spitler (spitler@okstate.edu) & Xiaobing Liu (liux2@ornl.gov)– can we find someone who is doing work to get a more resolved data map for ground thermal conductivity data?
        - Oil companies have a lot of data about rocks and ground type. How does this data compare with TRT tests? Is it useful to estimate ground thermal conductivity? Gives rough estimates w/ 10-20% accuracy. Can we do more with this data? Could be a research project. Those data could be used for initial feasibility study.
    - Chair: Mike Filler (fillerjr@yahoo.com). Michel will coordinate with Mike Filler. Michel confirmed the speakers.

Track 4: Professional Development (Devin Abellon, devin.abellon@yahoo.com)

Track 5: Grid-Interactive Efficient Built Environment (Vikrant C Aute, vikrant@umd.edu)

Track 6: Multifamily and Residential Buildings (Sonya Pouncy, sonyapouncy@gmail.com)

Track 7: Resilient Buildings and Communities (Christine Reinders-Caron, christinereinders@gmail.com)

Track 8: Zero Energy Buildings and Communities: Opportunities and Challenges (Raul Simonetti, raul.simonetti@carel.com

- "Insights & best practices for community- and campus-scale GSHPs"
    - Mike Kuk (mkuk@cerxsolutions.com) – Has a contact who built a school facility with track, dormitory, GSHP. He commissioned the job. He could reach out to the contact.
    - Jay Egg (Jayegg.geo@gmail.com) would be willing to speak about the Water-Energy Nexus and Geothermal Systems-Master designed buildings, campuses & communities are using existing infrastructure & water-conserving technologies. He recently wrote about this in Professional Engineer (online): http://bit.ly/2ATFM4y ...and here in print: http://bit.ly/2JVkw1z (Confirmed)
    - Cary Smith (dcsmith@soundgt.com) – college with master plan
    - Robert Mancini (rmancini@geothermax.com) - application of geo in Net Zero Energy and Net Zero Carbon buildings, again we have some experience in these. I have been designing commercial / institutional / residential projects since 1984, including the largest ground water geo system in Canada, serving 8 buildings 5 hi-rise and three mid-rise, commissioned in 2017.
    - Robert Mancini (rmancini@geothermax.com) - application of geoexchange to urban hi-rise condo buildings. We have designed a few in Downtown Toronto.
    - Chair: Xiaobing Liu (liux2@ornl.gov). Xiaobing said he can chair & resubmit this seminar.

3 Chicago Winter 2021 Conference:

- Brenden Hall (bhall@chacompanies.com) submitted an idea for Chicago 2021 winter conference: District condenser loops as an avenue to help cities and campuses do net zero/carbon neutral districts.

    Brendan's email to TC 6.2 "I am a member of TC6.8 (Geothermal Heat Pumps and Energy Recovery) and we have one seminar on sewer heat recovery in Orlando (Seminar 27). I was interested in expanding that to a program for the summer meeting in Austin to cover district condenser loops as an avenue to help cities and campuses do net zero/carbon neutral districts. I would submit it to track 8 : Zero Energy Buildings and Communities: Opportunities and Challenges. It is a topic that has come up a lot for us in NY as people are trying to figure out how to hit the deep decarbonization goals that have been set. I would like to include info on wastewater heat recovery and district geothermal as well as how it allows for flexibility at the building level (WSHPs, water to water HPs, water cooled vrf, etc.). I would be interested in what ideas your members would have in this area. I know of a couple systems in existence now with a few more being explored currently. Would your TC be interested in co-sponsoring a proposed program with 6.8?"

    - Hugh Henderson (hugh.henderson@owahgenaconsulting.com) has a small-scale district system that he'd like to present on
    - Dane Christensen (dane.christensen@nrel.gov) had a presentation they'd like to discuss in this session-Dane has sent a ppt to Roshan.

- At the TC meeting, there was discussion about the need for a program presenting **comparisons of GSHP and ASHP for cold-climate applications**. ASHPs are being aggressively promoted for cold climates to increase electrification, we should show how GSHPs compare.

- Drew Turner drew.turner@danfoss.com –"New Vapor Compression Technology to Reduce Heating Operating Costs & CO2 Emissions"

  Heating consumes a significant portion of the average United States commercial building energy use and resulting operating costs. Because this heating has historically primarily been provided by onsite burning of fossil fuels, it has comprised an even higher average portion of resulting CO2 emissions. Now that renewables are an increasing percentage of electricity, there is a corresponding opportunity to significantly decrease CO2 emissions through switching fossil fuel heating to heat pumps. But, to ensure rapid adoption and emissions reduction, this switch has to come with a corresponding decrease in operating costs, which is a challenge with the higher equivalent base cost of electricity vs onsite fossil fuels. This paper and presentation will describe a new heat pump compressor technology, which borrows technology from what has become the high efficiency standard in commercial air-conditioning, with expanded technology-enabled capability for the more challenging heating conditions. It will describe in detail the opportunity that this new technology presents to both decrease operating costs and CO2 emissions, presenting comparisons to both the fossil fuel heating equipment it would replace and alternative heat pump vapor compression technologies. It will also describe in detail the technology components which provide these benefits, the evolution of the technology to enable the new capability, other related technology benefits critical to owners and operators and efficiency / emission reduction opportunity variations for varying source geothermal / heat recovery qualities.

  - Likely target is Track 2 – He sent in a white paper for this topic. Drew Turner submitted the white paper via email.

- Antash Najib - Parametric study of Helical GHE. I will also work control optimization of the GHE based on different design parameter.

Important Dates:

- **Wednesday, March 18, 2020:** Conference Paper Abstracts, Technical Papers and Paper Session Requests Due
- **Wednesday, April 22, 2020:** Conference Paper Abstract Accept/Reject Notifications
- **Monday, June 15, 2020:** Website Opens for Seminar, Workshop, Forum, Debate, and Panel Proposals
- **Wednesday, July 8, 2020:** Final Conference Papers Due - Submitted for Review (Includes Bio, Learning Objectives and Methods of Assessment); Request for Conference Paper Sessions Due

Tracks:

1. **HVAC&R Fundamentals and Applications**
2. **Systems and Equipment**
3. **Refrigeration and Refrigerants**
4. **Environmental Health Through IEQ**
5. **Building Performance and Commissioning for Operation and Management**
6. **Energy Conservation**
7. **International Design**
8. **Standards, Guidelines and Codes**

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TC 6.8 Programs Attendance			
Name	**Affiliation**	**Email**	**Phone (optional)**