



## TC 6.8 Geothermal Heat Pump and Energy Recovery Applications

Virtual 2020 Annual Meeting

Location: Teleconference

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

Thursday, June 18, 2020

10:00 AM EDT

#### 1. Call to Order

- Welcome, Introductions, and Sign-In
  - Each Attendee Introduced Themselves – About 29 Participants
- Visitor Welcome: 1<sup>st</sup> timers and YEA
  - Scott welcomed all new 1<sup>st</sup> timers & Yea participants And recommended they go on the ASHRAE website to Signup as a corresponding member.
- Review Voting Members & Determination of Quorum
  - Need 8/14 *without* members non-quorum
    - A show of Hands indicated 12 voting members present.

#### 2. Approval of minutes from Winter 2020 (Orlando)

Motion to approve by Bill Murphy, Steve Hamstra 2<sup>nd</sup>

Minutes Approved with no corrections or comments.

**(Approved 10-0-0-CNV)**

#### 3. 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

- **Roll On – Roll off List was read by Scott**
- **Topics from Chair's Breakfast**
  - Changes in calendar (post July rollover)
  - There was a discussion on ASHRAE funding with no impact to TC6.8 for the foreseeable future.
  - MTG -
    - CYB
  - Residential Buildings Committee is in need of more activity And partnership. What could we do with them?
  - Any other people for awards? Send me a note.
  - Carl Huber – A newly formed ASHRAE Epidemic Task Force Committee on Covid 19 to be Chaired by Jay Kohler.

#### CURRENT VOTING MEMBERS

- 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)

#### Rolling off

- Scott Hackel (20)
- Bruce Bacceti (20) - MNQ
- Ed Lohrenz (20) - MNQ
- Kay Thrasher (20)
- Dr. Bill Murphy (20)
- Dr. Saojie Wang (20)

#### Rolling on

- Howard Newton (24)
- Dr. Michel Bernier (24)
- Carl Huber (24)
- Brendan Hall (24)
- Xiaobing Liu (24)



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### 5. Subcommittee Reports: daily

- Research - Harrison Skye – See attached Subcommittee Report.
  - Work statements and RTARs
    - 1817-RP: Starts in September 2020
    - 1890-WS: Submitted to RAC; to be reviewed at virtual meeting
    - 1812-WS: We've agreed to co-sponsor, but no progress has been made
  - Discuss research topics
- KTM Award – Lisa Meline - updated the TC with nominations to be submitted by November 16
- Geothermal Handbook - Matt Mitchell
  - (Michel Bernier) There was a discussion on: Low flow rates, deep boreholes, and the effects of borehole thermal capacity on sizing. Examples need to be added to add clarity for these effects of each. Need to add data on high-temperature borehole thermal energy storage design & piping systems.
  - (Lance MacNevin) – Suggested PEX-A pipe for high temperature piping for thermal storage.
  - (Michel Bernier) – Design, material, and borehole grout for thermal storage need to be researched.
  - (Steve Kavanaugh) – Handbook codes and standards section is quite short – should be expanded to include code updates, etc.
  - (Michel Bernier) – Add a brief Example of thermal storage to include thermal response and how to derive borehole resistance.
  - (Howard Newton) – How would high temperature storage affect borehole grout performance. Will research be needed to confirm stability of the grout (will it dry out).
  - (Ted Reinhart) – Renewability section needs to be revised in the handbook.
    - Authors/Revisors/Editors
      - Steve Kavanaugh – Borehole resistance updates
      - Matt Mitchell – SWHP design procedures & examples
      - Lance MacNevin – Pipe & Codes updates
      - Michel Bernier – BTES – effects of low flow rates deep borehole resistance
      - Craig Buschur. – Direct Expansion Loops updates
      - Ted Reinhart – Revise Renewability section of handbook
- Applied Heat Recovery – Mike Filler
  - Steve Carlson – To Chair a session in Chicago - **Energy Conservation with Heat Recovery Heat Pumps in New Applications or Old Applications with New Refrigerants**
  - Proposed Topics & Presenters:
    - Applying HRHP's to Commercial Chiller Plants  
Mike Filler, Johnson Controls, Inc.
    - Applying HRHP's to Waste Water Treatment Plants  
Steve Hamstra,
    - Applying HRHP's to Geothermal Water Loop Heat Pumps to Limit Wellfield Degradation  
Howard Newton, Image Engineering Group
    - Applying HRHP's with R410 and other new Refrigerants in Existing (Old) Applications to Save Energy in Industry (Reference Heat Recovery Heat Pump Operating Experiences, 1994)  
Frank Pucciano, FEDITC
- Standards – Cary Smith – No Updates



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- Lisa Meline – ANSI/CSA/IGSHPA C448 Series-2016 is being updated starting in September continuing through 2021.
  - Programs - Roshan Revankar: **Austin, Chicago, Phoenix**
  - Membership - Vacant – Need a Chair.
  - Education and Special Publications/Journal - **Vacant**
    - Publication review: **1996 GSHP Design book**
    - New publication tools
  - Webmaster - Craig Buschur; updated the website:
    - Orlando minutes
    - Virtual meeting agenda
- **Industry Liaison Reports:**
  - IGSHPA, NGWA – Cary Smith
  - IAPMO - Lance
  - GEO – Roshan
  - Geothermal Resource Council conference
- **Old Business**
  - TC's reorganization – TC 6.08 is not changed presently by the reorganization.
  - Use of basecamp – ASHRAE has initiated the use of Basecamp for file transfer and collaboration. Basecamp is a project management app that you can access in your browser and on your phone. It gives you the tools you need to set up to-dos, a schedule, create and upload documents and files, message and chat with your colleagues, and check in regularly with your group—all in one place!
  - Remote attendance going forward: There is still a question about a virtual meeting for Chicago. Scott Hackel will determine virtual meeting in Chicago.
  - ASHRAE PD on On-site Renewable Energy (Mike Bilderbeck and Steve Hammerling)
  - Electrification/decarbonization: There was discussion on a movement towards electrification and how to implement this: A working group was formed.
    - Frank Pucciano
    - Lisa Meline
    - Xioabing Liu
- **New Business**
  - A discussion on DOE Unified Grid System: Smart Grid as it's commonly called and how Geothermal Heat Pumps would help/support the Grid. The discussion was lead by Carl Orio, Brendon Hall, Jacob Komar, and Steve Carlson.
  - Xioabing Liu started a discussion on the Geothermal Research Council (Hot Rocks). There is a conference in October (date not known). Steve Kavanaugh noted that he had made a presentation in prior conferences that Geothermal Heat Pumps were considered a "Stepchild " the GRC>
  - Cary Smith started a discussion on Methanol Code and its Flash point and the use of Methanol as an antifreeze in colder climates. A subcommittee was formed to research the issues raised from New York Geo about the 50 degree flash point above the maximum design operating temperature. This subcommittee will set up a virtual meeting and report back to the TC.
    - Roshan Revankar – to Lead the Subcommittee
    - Lisa Meline
    - Kay Thrasher
    - Cary Smith



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- Jerry Lewis
- Bill Nowak
  
- **Adjourn:** Lance MacNevin made a motion to adjourn and was seconded by Steve Kavanaugh (**Approved 10-0-0-CNV**)



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

Austin, TX 2020 Summer Meeting

Location: Teleconference

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

Thursday, Jun. 11, 2020

3:00-4:30PM (Eastern)

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

#### 1 Attendance

- Approx. 15 members attended the teleconference

#### 2 Research Chair Breakfast Summary – information from conference in Feb. 2020:

- 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
- 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
- Innovative research grant - \$125K
  - 2-stage review process \$50K, \$25K/yr for 3 years
- Reminder of newly-created “PTAR” Publication Topic Acceptance Request. Similar to RTAR, but for publications relevant to ASHRAE, sold in ASHRAE bookstore.
- 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
  - <https://www.ashrae.org/file%20library/technical%20resources/research/2019-04-24-13.01-pms-training---wed.-apr.-24--2019---1-pm-to-3-pm-edt.mp4>

#### 3 Existing Research Projects

##### 3.1 Project Monitoring

- 1817-RP, “Long term temperature change of ground heat exchangers”
  - Sept. 1, 2020 – Apr. 2022
    - Tentative PMS kickoff meeting date: August 2020
  - PIs: Bing Dong, Edward A Bogucz (Syracuse University), Zheng O’Neill (Texas A&M), Hugh Henderson and (Frontier Energy)
  - Tasks Overview
    - Literature review
    - Identify GHX data sets
    - Uncertainty analysis of measurements
    - Use data to evaluate GHX design methods
    - Validate measurements for new GSHP installation
  - TC 6.8 solicited to help contractor identify GHX data sets with the following criteria
    - Cary – University of Utah Gardner building (2 years operation), Cashman School district. Cary will connect Scott Hackel with data.

##### 3.2 Tentative Research Projects

- None

### 3.3 Projects Approved for Bidding

- None

### 3.4 Work Statements (WS)

- 1890-WS, working title: “Minimum flow velocities for purging air and debris from hydronic piping systems.”
  - TCs voted to approve: TC 6.8 (Co-sponsors TC 6.1 & 6.2)
  - Submitted to RAC Apr. 17, 2020. Will be reviewed at the RAC 2020 Virtual Annual Meeting #2 - Tues. 7/7/2020.
  - 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
- 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. No progress. Got co-sponsorship needed. Plan to submit in December. Need vote for revision.

### 3.5 Research Topic Acceptance Requests (RTAR)

- None

## 4 Research Results & Publications

- None

## 5 Research Topic Idea Discussion

- National database for soil thermal properties (thermal conductivity, diffusivity, ground temperature)
  - Possible PTAR - Publication Topic Acceptance Request funded by ASHRAE. Might also be an RTAR.
  - Increase technology and tool transfer from the oil and gas industry
  - Steve Kavanaugh – Tennessee Valley Authority (TVA) had a database and website, which is now posted on the [www.geokiss.com](http://www.geokiss.com) website.
  - GRTI has many thermal conductivity tests and borehole resistance tests. Perhaps they would be willing to share the data set, though GTRI may want to keep the data proprietary. We can ask them if they’d share.
    - Cary – There are 3 or 4 main ground property testing companies. They may be willing to share data if TC 6.8 produced a customer release form.
    - Roshan –how granular does the data need to be? By zip code or smaller regions? Have to be careful that data is not used inappropriately to extrapolate data to locations not well covered by data. Also, database should be used at preliminary stages of design, but a soil thermal property test still needs to be conducted on site, especially for commercial installations.
    - Xiaobing – There may not be enough TC data to make fine contour map, but even coarse data would be useful at the planning stages. Has potential to stimulate more TC tests since better data would stimulate consideration of GSHPs, and these installations would still need TC measurements at the site.
    - Cary – Oil & gas industry has very detailed data in top several hundred ft of ground, would include information about formation properties.
    - Lisa – Data should include thermal conductivity, diffusivity, ground temperature

- Howard – with GPS coordinates, companies can give range of soil properties based on existing data. Who is going to use the tool and how? If a designer used the data and it was wrong, who is responsible for the error? The data would be best used in the initial assessment phase, but the site still needs a soil thermal property test on the building site. This disclaimer is important to include with data.
- Steve – Include these maps in the Handbook with statement about how the data should be used at initial design phase, but that test needs to be done on sight before construction.
- Lisa – we should do some preliminary work to find out more information. As a practicing engineer, this data would be useful.
- Steve – We should reach out to Bill Murphy about whether this would be better as an RTAR or PTAR
- Xiaobing – DOE could potentially co-fund this project with ASHRAE
- Xiaobing, Lisa, Steve, Cary, Howard will do some preliminary work to better understand the issue and how the TC can propose as a research project.
- Xiaobing – ideas for research
  - Thermal energy storage
    - How to use more actively as a thermal storage system (rather than passive source/sink for heat).
      - Steve – Sees potential problems with the technology. Heat doesn't necessarily stay in borefield. Uses extra pumping energy to move heat. How much does the storage system cost to install? We need data to show that these systems are cost effective.
      - Xiaobing – can be a place to store overproduced renewable energy, even if efficiency is relatively low.
      - Cary – has had successful reductions in loop size using thermal storage. Storage of thermal energy, e.g. focused solar thermal, or PV power electrical converted to thermal. TC 6.7 (Solar and Other Renewable Energies) might be interested in co-sponsoring this research. A standard for thermal storage systems is currently being developed for the US.
      - Xiaobing – Canada has more research & installations for thermal storage.
      - Michel – Recommends TC investigate borehole thermal energy storage systems. There is lack of guidance for design of storage systems. Need to distinguish systems based on time-scale of storage (e.g seasonal). Research into design methodology. Michel has tried to organize ASHRAE technical sessions about thermal storage systems. Scandinavian countries are interested in this technology.
      - Lisa - ANSI/CSA/IGSHPA C448 Series 16 Design and Installation of ground source heat pump systems for commercial and residential building. Annex A (informative): Electrical, environmental, and other guidelines for ground source heat pumps and underground thermal energy storage (UTES) systems
      - Xiaobing - IEA Annex 55 for GSHP with storage
        - <https://heatpumpingtechnologies.org/annex55/>
        - <https://uteshub.com/>
      - How to turn this discussion into an research project?
        - Xiaobing – need design tool for thermal storage, need cost data.
        - DOE project with thermal storage, researched by Chuck Hammock in Albany GA. Used TRNSYS as modeling tool. Chuck has a website that information on this and other projects

- Michel volunteered to draft an RTAR. Xiaobing can work with Michel on the RTAR draft. Focus would be to create a design tool or method useful for practicing engineers (rather than as a research tool).
- Building-grid interactions for GSHPs

### 5.1 Ideas from previous TC meetings that we didn't have time to discuss. Can be considered at a future meeting.

- 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

### 6 Other business

- None

### 7 Old business

- Discussion of DOE “Geovision” report from 2019:
  - <https://www.energy.gov/eere/geothermal/geovision>
- Discussion of GeoVision Analysis Supporting Task Force Report: Thermal Applications – Geothermal Heat Pumps (2019):
  - <https://info.ornl.gov/sites/publications/Files/Pub103860.pdf>
  - Related report on a Global GSHP Research review, done for ORNL:
    - [https://www.dropbox.com/s/sk078ehd7n3s3qe/2016\\_GSHP\\_Research\\_Review.pdf?dl=0](https://www.dropbox.com/s/sk078ehd7n3s3qe/2016_GSHP_Research_Review.pdf?dl=0)
- 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](http://www.iapmo.org)
  - Installation, maintenance, operation costs of different types of systems.
  - <https://www.iapmo.org/hiac>

### 8 Adjourn

### 9 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
Bing Dong		
Hugh Henderson		
Scott Hackel		
Xiaobing Liu		
Lisa Meline		
Howard Newton		
Cary Smith		
Steve Kavanaugh		
Michel Bernier		
Craig Buscher		
Roshan Revankar		
Steve Hamstra		


# TC 6.8 Programs Subcommittee

Meeting Notes for 2020 Summer ASHRAE Conference (Virtual)

1:00-2:00 p.m. Tuesday, June. 16, 2020

Zoom meeting:

<https://zoom.us/j/96285403065?pwd=QIMyWnBYT2hyREZESmRMQWhLSnZlQT09>

Prepared by Roshan Revankar, Programs chair

## 1 Attendance

- Meeting Held Tuesday, 16 members attended on June 16, 2020 via teleconference

## 2 Virtual Summer 2020 Conference:

**Track 1: Fundamentals and Applications** (Rupesh Iyengar, [Rupesh\\_iyengar@yahoo.com](mailto:Rupesh_iyengar@yahoo.com))

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

**Track 3: Research Summit** (Kristen Cetin, [kcetin@iastate.edu](mailto:kcetin@iastate.edu))

### 2.1 Presentations (Monday June 22, 2020)

- 10 - Current Research in Long-Term Performance Monitoring and Analysis of Ground-Source Heat Pump Systems

8:00 AM **1.** Ongoing Research into Long-Term Performance Monitoring of GSHP Systems in IEA HPT Annex 52 **Signhild Gehlin, Ph.D., Member, Swedish Centre for Shallow Geothermal Energy, Lund, Sweden**

8:20 AM **2.** GSHP System Performance Research at the University of Stockholm Studenthuset **Jeffrey Spitler, Ph.D., P.E., Fellow ASHRAE, Oklahoma State University, Stillwater, OK**

8:40 AM **3.** Ground Source Heat Pump Systems Thermal Imbalance Research in Residential Buildings in China **Da Yan, Ph.D., Member, Building Energy Research Center, Tsinghua University, Beijing, China**

9:00 AM **4.** Ground Source Heat Pump Systems Serving Ten University Student Housing Buildings: Performance Research **Xiaobing Liu, Ph.D., Member, ORNL, Oak Ridge, TN**

Matt Mitchell ([Matt.Mitchell@nrel.gov](mailto:Matt.Mitchell@nrel.gov)) will chair.

- 61 - Recent Developments In Thermal Response Tests For GSHP
  - 8:00 AM **1. Multi-Flow Rate Thermal Response Tests** **Matt Mitchell, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO**
  - 8:20 AM **2. Calibration of Thermal Response Test Units** **Michel Bernier, Ph.D., Fellow ASHRAE, Polytechnique Montréal, Montréal, QC, Canada**
  - 8:40 AM **3. How to Collect High-Quality TRT Data** **Chad Martin, P.E., Member, Geothermal Resource Technologies Inc., Asheville, NC**

- Chair Kristen Cetin Northwest Energy Efficiency Alliance

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

- Not accepted for Summer 2020
- “Insights & best practices for community- and campus-scale GSHPs”
  - Mike Kuk ([mkuk@cerxsolutions.com](mailto: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](mailto: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](mailto:dcsmith@soundgt.com)) – college with master plan
  - Robert Mancini ([rmancini@geothermax.com](mailto: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](mailto: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](mailto:liux2@ornl.gov)). Xiaobing said he can chair & resubmit this seminar.

### 3 Chicago Winter 2021 Conference:

- Brenden Hall ([bhall@chacompanies.com](mailto: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](mailto:hugh.henderson@owahgenaconsulting.com)) has a small-scale district system that he’d like to present on – **says will not present**

- Dane Christensen ([dane.christensen@nrel.gov](mailto: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.
- Session submission related to Thermal Energy Storage – Chair Roshan Revankar and Presenters, Steve Hamstra, Xiaobing Liu and Michel Bernier
- Sessions on District energy systems – Presenters Cary Smith and Brendan Hall. Combining this session with previously submitted sessions by Xiaobing Liu.
- Session from Heat Recovery group – Chair Steven Carlson, presenters John Filler, Steve Hamstra, Howard Newton and Frank Pucciano
- Drew Turner [drew.turner@danfoss.com](mailto: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.
- 

Martin Forsen: NIBE

So just to initiate some brainstorming the first thing that came to my mind was to set up a session around the benefits brought by our technology. One can address the topic from different perspectives, e.g. end consumer, GSO:s, and society.

One could have different presenters talking about a set of common topics but from the different perspectives. The topics could be;

- Energy efficiency, energy savings and renewable energy (primary energy savings as well as final energy savings)
- Environmental (GHG-reductions and local emissions)

- Peak shaving and load shifting to enhance the efficiency and utilization factor of the electric grid

Another idea could be to form a session entirely on the topic of smart grids. That could encompass both smart electric grids and smart thermal grids.

- Peak shaving and load shifting to enhance the efficiency and utilization factor of the electric grid
  - Smart thermal grids like the Ectogrid concept by EON
  - Geothermal utilities
  - “Smart price adaption” – The NIBE concept to control the operation of residential heat pumps by real time price signals
  - Vehicle to grid/household/heat pumps/solar PV:s and power walls
- 

Important Dates:

**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**  
**Monday, July 27, 2020: Conference Paper Accept/Revise/Reject Notifications**  
**Monday, August 3, 2020: Website Closes for Seminar, Workshop, Forum, Debate, and Panel Proposals**  
**Monday, August 10, 2020: Revised Conference Papers/Final Technical Papers Due**  
**Monday, August 24, 2020: Conference and Technical Paper Final Accept/Reject Notifications**  
**Monday, October 5, 2020: Seminar, Workshop, Forum, Debate, and Panel Accept/Reject Notifications**

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



