HERRICK CONFERENCES 2024
COMPRESSORS | REFRIGERATION | BUILDINGS
JULY 15 - 18, 2024 · WEST LAFAYETTE, INDIANA

Heat Pumps - Technology and Policies Update

Purdue 2024 Refrigeration Short Course
July 14, 2024

Short Course Summary

Heat pumps are being promoted worldwide as an environmentally conscious alternative to combustion heating in buildings and in industrial applications while also satisfying the rapidly growing demand for comfort cooling. This short course will have recognized speakers who will address current and future advances in heat pump technologies as well as policy decisions that will encourage heat pump use around the world.

8:00 am Course Introduction and Schedule (Murphy)

8:10 State-of-the-Art – Unitary and Commercial HVAC Applications (Murphy)
- Highest efficiencies currently available
- Cost effectiveness versus using fossil fuel heating systems
- Government incentives for heat pump purchases
- Global sales and marketing trends

8:55 Emerging Technologies and Their Potential Impacts (Elbel)
- Compressor technologies
- Heat exchanger technologies
- Ejectors, expansion, and control devices
- New refrigerants – challenges and benefits

9:50 Break

10:00 Heat Pump Market Expansion with Cold Climate Technologies (Shen)
- System optimization and control for unbalanced heating/cooling
- Compressor options and performance at low temperatures
- Supplemental heating options for all-electric systems
- Special design considerations for low temperature applications

10:50 De-Carbonization with High Temperature Heat Pumps (Dixit)
- Diversity of technology and refrigerants
- Large campuses
- District heating
- Industrial processes

11:45 Lunch provided

12:30 pm Role of Heat Pumps in Building Decarbonization (Gluesenkamp)

- The transition to all-electric HVAC systems in buildings
- Impact of heat pumps on utility grids and their peak demand
- Water heating and integrated appliance applications
- International and North American marketplace directions
- Combining heat pumps with thermal storage
- Practical limits for heat pumps in select applications: heating with thermal storage, separate cooling of sensible and latent loads, and major household appliances

1:30 Break

1:40 Heat Pump System Modeling and Simulation (Shen)

- Simulation options for new heat pump designs
- Compressor model performance for extreme conditions
- Commercial heat pump/thermal storage performance modeling
- Grid and utility scale models with new electric loads

2:35 Climate Change – The 800 Pound Gorilla (Kircher)

- The impact of heat pumps in response to climate change targets
- Future impacts on energy markets with more heat pumps and EVs
- European versus North American approaches to energy policies

3:20 Break

3:30 Electrification and Decarbonization – What's on the Horizon? (Woods)

- The impact of heat pumps on CO2 emissions and our response to climate change targets
- Are non-vapor compression cycles (zero GWP) always 20 years away?
- Near-term and long-term space conditioning options to mitigate climate change
- How can the grid handle heat pumps, EVs, renewable sources?

4:20 Q&A for all speakers and open discussion

4:50 Final announcements, course satisfaction survey

5:00 Adjournment

Short Course Speakers

Stefan Elbel - Dr. Stefan Elbel is a professor at TU Berlin, Germany and his research is in the area of Heat Transfer and Energy Conversion. For many years he was a faculty member at the University of Illinois at Urbana-Champaign and Co-Director of the Air Conditioning and Refrigeration Center (ACRC). He is also the President & CTO of Creative Thermal Solutions, Inc., an independent research lab focusing on technology development for all sectors of the HVAC&R industry.

Bo Shen - Dr. Shen is a senior research staff in Oak Ridge National Labs. He received his PhD from Purdue University in 2005 where his research topic was thermal system modelling and heat pump development. He worked seven years in industry with Hitachi and Trane before joining ORNL. His work at ORNL has focused on various heat pump applications. His cold climate heat pump work was acknowledged as one of the DOE BTO's success stories, and he also participated in two R&D 100 award winning teams. For the past 15 years he has developed and supported the DOE/ORNL Heat Pump Design Model, which is used by many US heat pump manufacturers.

Kyle Gluesenkamp – Dr. Kyle Gluesenkamp is a senior R&D Scientist, serves as ORNL's Subprogram Manager for Thermal Energy Storage, and as a Graduate Advisor with the University of Tennessee Bredesen Center. He has deep expertise in heat pumps, thermal storage and phase change materials, residential clothes dryers and dishwashers, sorption technologies, heat transfer, psychrometrics, and experimental prototype design and development. He has published two book chapters, over 50 journal articles, over 100 conference articles and reports, and has 7 granted patents.

Rajesh Dixit – Rajesh Dixit is the Global Product Management Leader for Johnson Controls International PLC – Building Technology & Solutions. Rajesh and his global team are responsible for the York, Frick and Sabroe branded industrial chillers and heat pumps of JCI. Rajesh is a Chemical Engineer, an MBA and has been helping customers in their sustainability journey for over 30 years. Rajesh is the ex-chair of ASHRAE TC 8.3 committee, a frequent speaker at the IDEA (International District Energy Association) conferences, ex-board member of the Belmont Theater in York PA, an active community volunteer and a mentor for interns.

Kevin Kircher – Dr. Kevin Kircher is an assistant professor of mechanical engineering at Purdue University where he is part of the Center for High Performance Buildings and the Institute for Control, Optimization and Networks. His research is focused on optimization and control strategies for various distributed energy resources and their interactions with the power grid. He received his PhD in mechanical engineering from Cornell University and was a postdoc scholar at MIT in electrical engineering.

Jason Woods – Dr. Jason Woods is a senior researcher in NREL's Advanced Building Equipment Research Group. His expertise is in heat and mass transfer and phase change processes, with applications to heat pumps, thermal energy storage, dehumidification, and membrane-based HVAC processes. He leads many projects at NREL that connect system and building modeling with technology development and experimental research. He received his BS from Purdue University and his PhD from the University of Colorado, both in mechanical engineering.

William Murphy – Dr. Bill Murphy is a professor emeritus of mechanical engineering after retiring from the University of Kentucky. He received his PhD from Purdue University and helped develop the Energy Management graduate program and the Energy Systems Laboratory at Texas A&M University. He developed a research lab at UK focused on ground source heat pumps and is active in ASHRAE as a Fellow and just completed serving as chair of the Research Administration Committee.