NY ASHRAE Climate Crisis Committee
EARTHDAY 2024 Event - April 15, 2024

PDH QUESTIONS/Answers

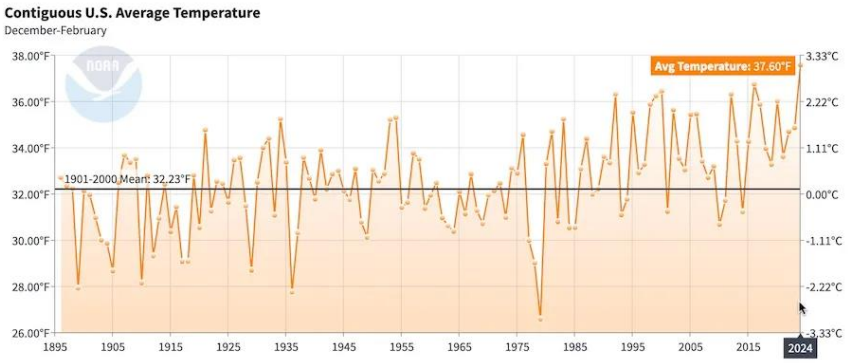
Carrie Brown Questions:

1. CB1 (True/False) According to ASHRAE's Building Decarbonization Position Document, by 2050, at the latest, all new and existing assets must be net zero GHG emissions across the whole life cycle.
   True.

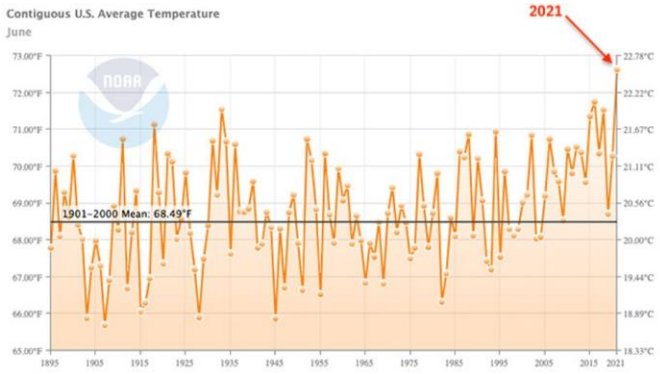
   Scott Sherwood (SS): It is important to note, that buildings across different segments will decarbonize with different paths and different time schedules towards 2030 and then, 2050. These early Decarbonization projects are setting the standard and developing a learning curve that will help our entire Building Industry determine the best paths forward.

2. CB2 (True/False) Climate change is affecting New York State now and is projected to continue to change and affect every region of the state. Even under a lower-emissions scenario, climate change impacts across New York State will be substantial. Every community and every sector in New York State has the potential to contribute to innovative climate solutions that reduce vulnerabilities, foster resilience, and enhance equity.
   True.

   SS: Absolutely every community can and must contribute. I call it The Climate Crisis, not climate change anymore. First, Climate Change has been happening for billions of years and will continue to happen for as long as the earth exists. Emissions are still rising across the globe, and the effects of ALL our "past emissions", will continue to stress our environment and cause increasingly more damage for decades to come. Last year alone, there were over 23 Climate Events that caused a minimum of $1Billion of damage in the US alone. This trend has increased in recent years. Let us hope we are on a linear curve, and not an exponential curve. Last summer was our hottest on record since records began in 1880. This winter was our hottest winter on record.



HOTTEST WINTER ON RECORD since 1895.



HOTTEST SUMMER ON RECORD since 1895.

SS: **So, I would suggest that all people should be involved in the education, development, and implementation of climate related solutions in their communities.**

Paul Torcellini Questions:

3. Why are zero energy buildings not routine today?

   Many will say that the costs are too high. This cost is more driven by a paradigm shift and often needs a fully integrated design team that is aligned with construction costs. Others will say there is not enough roof area especially in densely populated areas. The concept of a zero-energy building is achievable today across building types at least up to two stories—at a comparable cost. Using this benchmark, an EUI target can be established and applied to all buildings regardless of number of stories. Renewable energy can then be procured from off-site to meet the loads.

4. What are the greatest challenges to making all buildings Net Zero by 2050?

   The ability to substantially reduce energy loads in existing buildings—often by a factor of 2. The cost to make these changes, especially if they are done in the context of only reducing loads and not in a broader context that the building needs to be renovated for other reasons. The workforce knowledge and the amount of construction workforce available to make the changes to buildings. The ability to invest in the building, especially at return on investments greater than 3 years. The ability to create enough renewable energy resources to keep up with the demand of owners wanting renewable energy.

5. What problems are expected of the electric grid as we further implement electrification of buildings?

   Historically, the grid has adapted quickly to market needs for electricity and kept the grid stable in previous periods of unprecedented growth. Expressed concerns include the ability to keep the grid stable with large increases in loads; the cost to build out the infrastructure accounting for adding renewable energy, the cost recovery model for the grid, especially if buildings add substantial renewables on their side of the meter; ability to store vast amounts of electricity such that the renewables and storage can provide all the grid power; and the issue of stranded assets and who pays for these assets.

Griffin Teed Questions:

6. What are technical challenges associated with existing building high rise electrification in urban environments?

   There are many technical challenges, but they can be overcome with holistic planning using solutions available today. The challenges can include the following: limited rooftop space available, limited excess power available at the rooftop, limited space in existing mechanical rooms for additional equipment, a large amount of perimeter heating loads relative to the rooftop area that require high temperatures due to poorer performing existing envelopes, the ability for common water-to-water heat pumps to lift to the necessary temperature, and available space adjacent to the building.

7. What are the three steps for high-rise electrification?

   Reduce heating loads, then recover heat generated within the building, and electrify the remaining heating loads.

8. What are viable electrification solutions if air source heat pumps cannot provide a building's full heating load?

   Heat recovery within the building from condenser water or exhaust air can provide an initial base layer of electrification with water-to-water or air-to-water heat pump. Innovative drilling technology in urban environments is making the ability to interlock with the ground more feasible, and ground source heat pumps can provide additional electrification.

Sarah Maclean Questions:

9. How is EV infrastructure being used in NYC for compliance with LL97?

   While there are no requirements within LL97 requiring EV infrastructure, there are requirements on how to report on the energy use if it is installed in your building. EV Charging plays into NYC and NY State's larger decarbonization goals – New York State will require all passenger and light duty vehicles sales within the state to be ZEV (zero emission vehicles) by 2035. Laws such as this are going to drive adoption of EVs within NY State and NYC and the need for accommodating these drivers is going to grow rapidly. While reviewing LL97 building compliance, consider your interest or requirement per LL130 to install EVSE. Early electrical planning considering day-1 and day-n EVSE needs is critical for the success of your EVSE project, and you want to make sure your system is future proofed during any electrical service upgrades your building may require.

10. What is the biggest challenge to EV development?

Challenges regarding the development of EV charging infrastructure can be as unique as the individual projects themselves but the main challenge we see across the board is time. When developing your project's schedule goals, you need to be aware and flexible dealing with the time challenges that can arise with these projects. Successful projects will take the upfront time needed to complete comprehensive feasibility and due diligence efforts before design even begins. Utility coordination to provide service upgrades or new services for EVSE can take a significant amount of time. Project permitting can also take longer than expected – While smaller Level 2 charging projects may go through permitting quickly, larger Level 3 DCFC charging projects are likely to have a more challenging permitting process. If you need significant infrastructure such as new utility transformers or large switchgear equipment – lead times have been an issue and do not look to be improving any time soon. Understanding the various time challenges and building these contingencies into your project schedules is key.

11. What rebates or incentives (USGBC LEED points) does EV introduce to the project?

Depending on the type of EVSE project you are considering there are several incentives that are worth considering:

For LEED projects *– points are available for EV infrastructure under the following credits: Energy & Atmosphere credit if 100% renewable energies are used as source power; Innovation & Design for innovative green strategies; and Location and Transportation – 1pt for 5% of all spaces and 1pt for 10% of all spaces provided with Level 2 charging.*

Incentives and Grants *– There are many sources of funding out there that can help offset capital costs associated with EVSE infrastructure projects.*

Utility Rebates *– Con Edison and National Grid both have EV rebate programs available for various EV project types in the form of advisory services, infrastructure equipment rebates, and rate incentives.*

Federal Incentives *- Alternative Fuel Infrastructure Tax Credits -Fueling station owners can get a tax credit for qualified equipment installed at multiple sites. The credit is 30% of the cost, or 6% for property subject to depreciation, capped at $100,000.*

Randy Topp Questions:

12. What are some of the service providers needed to complete an energy services project?

There are many different service providers needed for an energy efficiency and carbon reduction project. Some of them are: a) Utilities, b) energy consultants – energy analysts, energy engineers, etc. c) Project Managers, d) contracting specialists – budgeting and costing to implementation of the measures, e) subcontractors -specialists in the piece of the project – like geothermal, infra-red technology, etc.,, f) Testing and commissioning agents, g) measurement and verification specialists, h) Financiers, g) Owners/Clients that work with the team for successful outcomes.

13. What are the general differences between an energy conservation measure vs a capital-intensive measure?

Energy conservation measures (ECMs) generally have a simple payback where the energy savings pays for capital costs over a number of years. The payback term is said to be under 8 years and therefore the ECM's can be generally financed through energy savings.

Capital intensive measures (CIMs) are ones that have a much longer payback than the ECM's and may require capital input from the client, to be able to finance the measure. The CIM's are desirable for the client to be able to do deeper energy conservation retrofits and carbon reductions measures leading to a possible net zero carbon operations. In addition, CIM's often include a component of replacing the aging building infrastructure.

14. How do Chilled Beams work?

Active chilled beams have a ducted supply air from a central air handing unit to the ceiling hung "beam". The airflow entering the beam causes air to be induced across the heating/cooling coil and the mixed air stream is then projected into the space for heating and cooling. The beam has a control valve that controls the heating or cooling fluid into the coil. Beams provide local heating and cooling for the space.

Using active chilled beam technology efficiently cools (or heats) spaces while minimizing energy consumption. Additionally, active chilled beams offer a quiet operation, improved indoor air quality, and the ability to integrate with various architectural designs.

15. Why were the perimeter convectors required to be so wide, in the 345 Hudson fit out?
The heating water maximum supply temperature is 104F. In order to get the convective heating effect from the coil at these lower temperatures, there needs to be a lot of surface area to provide the heating effect.

Jeff Urlaub Questions:

16. Is there any difference other than size between a GSHE (Ground Source Heat Exchanger) system serving a single building and a system serving an entire campus?
Yes, the GSHE has to be sized to handle the thermal heating and cooling load on an annual basis and peak.

17. What impact does locating GSHE bores under a building much less integrating them within the pile foundations have on the design process and project schedule?
Installing GSHE under a building needs to be closely coordinated with structural and project schedule. Installing HDPE u bends in a foundation pile also needs to be coordinated with the structural engineer and the contractor constructing the cages for the piles. Also, the Geo contractor needs to work closely with the pile contractor when installing the cage in the bore.

18. What goes into a GSHE feasibility study and is anything other than projecting effective function being verified?
One of the main reasons for the feasibility study is to determine the GSHE and heat pumps sizing which drives the financial ROI.

19. What kind of benefit is a waterfront to this kind of system?
For cooling dominant systems, waterfront is very beneficial if it can be permitted to use the water as an energy sink

Jean-Simon Venne Questions:

20. Describe the AI-driven HVAC optimization process?
The AI-driven HVAC optimization process consists of the following steps:
- Data collection: the process collects data from various sources, such as weather forecasts, occupancy sensors, building automation systems, smart meters, and indoor and outdoor temperature and humidity sensors. The data is transmitted to the cloud via a secure connection.
- Data processing: the process uses advanced machine learning algorithms to analyze the data and learn the thermal behavior and energy consumption patterns of each building. The algorithms take into account factors such as building characteristics, weather conditions, occupancy levels, equipment performance, and energy prices.
- Data prediction: the process uses deep neural networks to predict the optimal HVAC settings for each zone of the building, based on the desired comfort level, energy efficiency, and carbon footprint. The predictions are updated every five minutes to adapt to the changing conditions and user preferences.
- Data action: the process sends the optimal HVAC settings to the building automation system, which adjusts the temperature, airflow, and humidity accordingly. The system also monitors the feedback from the sensors and the user satisfaction ratings to fine-tune the settings and improve the performance over time.
The process can reduce the energy consumption and greenhouse gas emissions of commercial buildings by up to 25%, while improving the comfort and indoor air quality for the occupants. The process is fully autonomous and does not require any human intervention or capital investment. The process is also scalable and adaptable to various types of buildings and HVAC systems.

21. What inputs are needed to optimize the learning models used in AI-driven optimization of HVAC?
To optimize the learning models, the following inputs are needed:
- Data from sensors installed in the building, such as temperature, humidity, CO2 levels, occupancy, and energy consumption. This data provides the real-time feedback on the state of the building and the HVAC system.
- Data from weather forecasts, which provide the external conditions that affect the indoor environment. These data help the system anticipate the future demand and adjust the settings accordingly.
- Data from historical records, such as energy bills, maintenance logs, and occupancy patterns. These data help the system learn from the past performance and identify the potential savings and improvements.

22. What is the difference between reactive and proactive systems?

- Reactive systems are those that respond to the changes in the indoor environment or user preferences after they occur. For example, a reactive system might turn on the heating when the temperature drops below a certain threshold or adjust the lighting when the user presses a button.
- Proactive systems are those that anticipate the changes in the indoor environment or user preferences before they occur. For example, a proactive system might turn on the heating before the temperature drops, based on AI predictions.

23. Describe the continuous self-optimization cycle?

The continuous self-optimization cycle in AI is a process of improving the performance and efficiency of a system by using data and feedback to learn from its own actions and outcomes. The cycle consists of four steps:

- Sensing: The system collects data from the indoor environment, such as temperature, humidity, light, air quality, etc., as well as user preferences and behaviors, such as comfort levels, schedules, activities, etc.
- Modeling: The system uses AI techniques, such as Deep learning, to analyze the data and build models that capture the relationships between the inputs and outputs of the system, as well as the dynamics and uncertainties of the environment and the users.
- Predicting: The system uses the models to forecast the future states of the environment and the users, as well as the expected effects of different actions or interventions on these states. The system also estimates the costs and benefits of each action in terms of energy consumption, user satisfaction, etc.
- Optimizing: The system uses optimization algorithms to select the best action or intervention that maximizes the desired objectives, such as minimizing energy usage, maximizing user comfort, or balancing multiple goals. The system then executes the action and updates the models with the new data and feedback.

The cycle repeats itself continuously, allowing the system to adapt to the changing conditions and preferences and improve its performance over time. A continuous self-optimization cycle can enable proactive systems that anticipate the needs and wants of the users and the environment, rather than reacting to them. Such systems can enhance the user experience and the sustainability of buildings.

Heat Pump Questions: (Answered by Jeff Urlaub – Salas O'Brien))

24. What heat pump technology is being used on major NYC high-rise buildings?
    Depending on building size, type of building, etc. Scroll Compressor technology is most often used.

25. What are the concerns or issues with using heat pumps in NYC?
    The only concern is the Hp size of the compressor, which can drive the facility to have an operator.

26. Has the demand for heat pumps caused supply chain issues and building delays?
    Yes, and the cost has increased.

27. How do AC plants based on Heat Pump compare in energy usage to chiller plants?
    If a centrifugal heat pump is utilized, this unit is comparable to a water-cooled centrifugal chiller. If modular heat pumps are utilized, the kW/ton is higher in cooling compared to a water-cooled centrifugal chiller.

Heat Pump Questions: (Answered by John Bender – MWSK Equipment)

24. What heat pump technology is being used on major NYC high-rise buildings?
    VRF and WSHPs are both used in NYC high rise. In the future it will be water source and air source, but VRF will most likely lose market share due to A2L refrigerants.

25. What are the concerns or issues with using heat pumps in NYC?
    Space required for geothermal and ASHPs, electrical demand in winter with low COP systems, defrost cycles on ASHPs, maintaining winter loop temps in the winter, the push to eliminate cooling towers, integrating WSHP chiller plants into existing systems, and general lack of knowledge about systems.

26. Has the demand for heat pumps caused supply chain issues and building delays?
    Yes, it has, but business is now slow due to interest rates.

27. How do AC plants based on Heat Pump compare in energy usage to chiller plants?
    Large chiller plants are optimized for cooling, heat pump chiller plants are more modular, and performance is not necessarily optimized for one mode if one machine is multi-use.