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Comments

Additional submitted attachment is included below.

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To whom it may concern:

Taylor Engineers respectively submits the following in response to RFI 22-DECARB-02 Building Decarbonization and Electric Vehicle Charging Equipment Website.

- **General comment.** The RFI requests recommendations for "building technologies (e.g. devices, appliances, and equipment) that advance or facilitate building decarbonization, electrification, and EV charging" (emphasis added). Please note that while there are some stand-alone heating, ventilating and air-conditioning (HVAC) equipment that directly support building electrification for some applications (e.g. variable refrigerant flow systems (VRF)), many applications require customized HVAC systems that are individually designed, field constructed, and then controlled with customized building automation systems (BAS). These custom HVAC systems are generally comprised of standard HVAC and BAS equipment and components, but appropriate design expertise and installation diligence are needed to achieve successful low carbon implementations.
    - VRF and air-to-air heat pumps are simple and straightforward products for small commercial and residential applications, particularly for single zone HVAC applications. As these product lines are mature and well established, they are an obvious and cost effective solution for certain building types.
    - Built-up HVAC systems are generally required for medium to large commercial buildings with multiple HVAC zones. Designing the HVAC systems for these building types to be 100% electric is more challenging, particularly where there may be space constraints for locating outdoor HVAC equipment (e.g. high-rise buildings with limited roof area). Retrofitting existing buildings that have conventional gas-fired boilers to be 100% electric is even more challenging to do practically and cost effectively. We focus our attention in this response to these challenging applications.
- **General comment.** Though a lot of attention is given to 100% all-electric buildings, particularly for new construction, the vast majority of the building stock is already built and will remain in use for many decades to come. Meeting the carbon reduction targets of SB 32 by 2030 and B-55-18 by 2045 simply cannot be done solely by designing new 100% electric buildings. Existing buildings must be prioritized and targeted for scalable, cost effective, and available retrofit technologies that reduce HVAC carbon intensity. However, converting existing buildings, particularly large commercial, at scale to be all-electric is deeply impractical and uneconomical, even when considering externalities. Therefore, the term "decarbonization" should be broadly understood and distinguished from the term "electrification" to allow for inclusion and prioritization of methods that significantly reduce carbon intensity, even if 100% all-electric is not attained and is not the target.
- **Time-averaged independent energy recovery (TIER).** TIER is a novel central plant design that addresses the practical challenges and cost barriers for providing all-electric heat to large buildings. Though all-electric heat is relatively simple for small to medium commercial buildings, it is more challenging from practical, first cost, and space constraint perspectives to provide for medium to large commercial buildings. TIER is a solution that is generally lower cost, more energy efficient, and requires less outdoor equipment space than other design alternatives. The TIER solution combines heat recovery chillers, air-to-water heat pumps, and thermal energy storage (TES) to provide a relatively compact, cost-effective, and energy efficient solution for all-electric heating and cooling plants, and the TES provides ability for grid-responsive control. This is a built-up HVAC system that requires custom design and expertise from design engineers using conventional and available HVAC/BAS equipment. Promoting this design approach will support industry decarbonization by helping designers that may otherwise be developing ineffective or less practical or less cost-effective central plant designs. More information on the TIER design approach is available in the ASHRAE Journal article:

  - Gill, Brandon. 2021. “Solving the Large Building All-Electric Heating Problem”. ASHRAE Journal. October. https://tayloreng.egnyte.com/dl/hHI2ZkZRDC/ASHRAE_Journal_-_Solving_the_Large_Building_All-Electric_Heating_Problem.pdf_
- **Advanced Variable Air Volume Reheat HVAC Systems.** Multiple zone VAV reheat systems are the most common HVAC system type for medium to large commercial buildings and have been in use for decades. Unfortunately, VAV reheat systems have a reputation as being inefficient and most installations were designed that way and do still operate inefficiently. When designed properly to code-minimum standards, and installed correctly, VAV reheat systems can have low carbon intensity and be very practical and cost effective HVAC systems. Some resources:
  - Advanced VAV Design Guide
  - Advanced BAS Best Practices Guide
  - EPIC Best in Class Project Brief
  - ASHRAE Guideline 36