Shaping Tomorrow's Global Built Environment Today

BUILDING ELECTRIFICATION

THE ISSUE

Building electrification is often viewed as an essential strategy for building decarbonization, but electrification, in and of itself, does not necessarily guarantee decarbonization. Building electrification refers to transitioning all or portions of building systems to electricity instead of on-site fossil fuel-based, non-electric energy. Space and water heating, some chilled water generation, snow melt, cooking, laundry, and emergency power backup commonly use on-site fossil fuel-based energy.

Electrification of building services contributes to decarbonization when the source of electricity comes from low-[1] or zero-carbon energy sources such as solar, wind, tidal/wave, hydro, waste to energy, green hydrogen, and nuclear. Utilities are pursuing grid decarbonization goals by transitioning to low- or zero-carbon generation. Some regional grids have decarbonized significantly, putting building electrification on a "fast track" toward total building decarbonization.

At a higher level, beneficial electrification can go beyond decarbonization. It may provide additional outcomes, including a healthier indoor environmental quality through reduced fossil fuel combustion, improved outdoor air quality through reduced particulate pollution, energy cost reduction (depending on utility rates), and a more flexible and resilient grid.

The growth of building (and transportation) electrification could require a significant increase in electrical grid capacity, emphasizing energy efficiency, energy storage, grid-interactive building design and control, and alignment of consumption with carbon-free electricity generation (i.e., demand flexibility) to minimize the increase in peak demand. Building electrification can increase capital and operating costs, strand existing fossil fuel equipment, and present retrofit challenges without careful planning and implementation. Many highly energy-efficient buildings with all-electric systems are already being designed, built, and retrofitted. Further technological improvements and local and national policy incentives will accelerate building electrification, improve system performance, and reduce installation and operating costs.

ASHRAE's ROLE

ASHRAE stands at the forefront in developing standards, guidance, and education for the design, manufacturing, installation, and operation of building systems and equipment. These resources can also provide governments with a technical foundation for beneficial building electrification policies. ASHRAE's relevant consensus-based standards include new proposed standards and those being updated to specifically reflect decarbonization specifically:

- *Standard 90.1, Energy Efficiency Standard for Sites and Buildings Except Low-Rise Residential Buildings*
- *Standard 90.2, High-Performance Energy Design of Residential Buildings*
- *Standard 100, Energy and Emissions Building Performance Standard for Existing Buildings*
- *Standard 105, Standard Methods for Determining, Expressing and Comparing Building Energy Performance and Greenhouse Gas Emissions*
- *Standard 201, Facility Smart Grid Information Model*
- *Standard 211, Standard for Commercial Building Energy Audits*
- *Standard 228, Standard Method of Evaluating Zero Net Energy and Zero Net Carbon Building Performance*

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- *Proposed Standard 240P, Evaluating Greenhouse Gas (GHG) and Carbon Emissions in Building Design, Construction and Operation*

Additional technical resource guides have been developed by ASHRAE's Center of Excellence for Building Decarbonization – See www.ashrae.org/decarb:

- *Grid-Interactive Buildings for Decarbonization: Design and Operation Resource Guide*
- *Decarbonizing Building Thermal Systems: A Guide for Applying Heat Pumps and Beyond*

ASHRAE's VIEW

ASHRAE supports the global need to reduce emissions from buildings, including through beneficial electrification. ASHRAE encourages policymakers to consider the following:

1. High-efficiency all-electric appliances and technologies can reduce greenhouse gas (GHG) emissions from buildings using zero-carbon or low-carbon emissions electricity.
2. Hybrid (partial) electrification retrofits can be beneficial where climate and/or heating load profiles currently make complete electrification uneconomical.
3. Replacement of fossil-fuel heating equipment before end-of-life can have a negative impact on embodied carbon and refrigerant emissions. Therefore, electrification retrofits should be analyzed from a whole life cycle carbon perspective, and transitions should be phased over time and at equipment end-of-life, as necessary.
4. This shift towards high-efficiency all-electric appliances, combined with an increasingly clean grid, has the potential to improve indoor and outdoor air quality and lower GHG emissions.
5. Widespread electrification of building heating and domestic hot-water systems could require a substantially larger electrical grid infrastructure, unless there are commensurate reductions in building energy demand through energy efficiency, energy storage, and smart building-grid integration.
6. While future HVAC equipment will utilize much lower global warming potential (GWP) refrigerants, implementing high-GWP phase-out plans and refrigerant management will dramatically reduce the current impact of refrigerant leakage on overall building GHG emissions.
7. The ability of buildings to interact with the electric grid can help maximize the use of low- or zero-carbon electricity and optimize the use of on-site energy storage, allowing for dynamic operation to align with real-time renewable energy availability, reduce peak demand, and manage load.
8. Current heat pump technology has become more energy-efficient, can generate much higher supply temperatures, and can operate across a broader range of outdoor ambient temperatures. This has improved its compatibility with existing heating distribution systems and effectiveness in cold climates. Heat pumps can also efficiently provide cooling in climates that require air conditioning.
9. Building electrification and decarbonization requires support for workforce training for all who design, build, install, operate and maintain building systems.
10. Collaboration between policymakers, HVAC equipment manufacturers, architects and engineers, and other industry stakeholders is needed to advance the development of efficient, scalable building electrification technologies suitable for a wide range of building types and climates.

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