All-Electric Buildings Are Healthy Buildings

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Many homes and businesses in the United States burn fossil fuels like gas to power appliances that heat and cool indoor spaces, heat water, dry clothing, and cook food. This has a number of health and climate impacts. One-tenth of US carbon emissions come from burning fossil fuels for these purposes.[1] Gas appliances also release harmful air pollutants including nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$), and carbon monoxide (CO).[2] Exposure to these pollutants can cause a range of health issues, from respiratory illness to premature death.[3]

What is Building Electrification?

Building electrification means replacing gas, fuel oil, or propane appliances with more efficient electric ones. Other important steps include eliminating leaky windows and doors to keep electricity demand (and utility bills) low. Battery storage and solar panels can be useful additions during power outages. At the end of the day, all-electric buildings are climate-friendly, save consumers money, and prevent harmful air pollutants from being released indoors and outdoors. While the economics can vary based on region and heating fuel source, the outlook is increasingly positive for building electrification.[4] RMI recommends all-electric appliances in newly constructed homes and retrofits of existing homes.

Which Appliances Need to Be Electrified?

Home heating and cooling. Rather than a furnace generating heat, heat pumps are an alternative that use electricity to transfer heat between two locations using a refrigerant.[5] A ground-source heat pump uses the Earth's relatively cool temperatures in the summer and warm temperatures in the winter to regulate a home's indoor temperature. An air-source heat pump can heat a home by transferring outdoor heat indoors, or cool a home by transferring indoor heat outdoors. Heat pumps are energy-efficient, provide heating and cooling in a single appliance, and do not release pollutants inside or outside the home.

Water heaters. Heat pump water heaters, or hybrid water heaters, heat up water using the same technology described above.[6] While they are more efficient than gas or electric water heaters, they may not be the cheapest in terms of upfront cost. An RMI review of factors to consider provides a good starting point for consumers looking to make the switch.[7] Subsidies—combined with energy cost savings—can make these water heaters a cost-effective option in the long run.

Clothing dryers. An estimated one-fourth of dryers in the United States run off gas, venting harmful nitrogen dioxide outside the home.[8] Electric clothing dryers eliminate this pollution, but traditional models can be energy hogs. Efficient heat pump electric dryers are now available that use at least 28 percent less energy than standard models.[9]

Stoves. A growing body of research has connected indoor air pollution from gas stoves to respiratory issues like asthma in children and adults.[10] A 2013 study found that children living in homes with gas stoves have a 42 percent higher risk of experiencing asthma symptoms and a 24 percent higher risk of being diagnosed with asthma.[11] Induction stoves are the most energy-efficient option and will help eliminate harmful pollutants like nitrogen dioxide. They work by creating an electromagnetic field below a glass cooktop surface that transfers current directly to the cookware, causing it to heat up.

The Benefits of Building Electrification Include:

Healthier indoor air. Preexisting health conditions like asthma, chronic obstructive pulmonary disease (COPD), heart disease, and diabetes can be aggravated by air pollutants like NO_2 that come from gas stoves.[12] Reducing indoor pollutant exposure by electrifying gas appliances will be beneficial to high-risk groups like children, pregnant women, individuals with preexisting conditions, and low-income individuals and many people of color, who are more likely to be exposed to pollutants.

Healthier outdoor air. A 2021 study estimated that $PM_{2.5}$ from burning fossil fuels, wood, and biomass in commercial and residential buildings is responsible for about 18,300 early deaths and $205 billion in US health impacts annually.[13] Since gas appliances like furnaces and water heaters are vented outdoors, electrification would reduce the $PM_{2.5}$ vented into the air and lead to fewer premature deaths.

Efficient heating and cooling. Heat pumps efficiently heat and cool buildings using less energy compared to gas furnaces. In the past, heat pumps' usefulness was limited in colder climates, but units rated for cold climates are now readily available.[14] The ability of heat pumps to more efficiently maintain comfortable indoor temperatures is particularly important for older adults, children, and those with chronic conditions, who are more vulnerable to the health risks associated with extreme temperatures.[15]

Equity. Pollution from buildings disproportionately impacts low-income communities and communities of color.[16] Climate technologies and programs have historically failed these communities by ignoring their starting-line disparities and needs.[17] Electrification work in low-income communities and communities of color would lower the burden of air pollution.[18] Policies must be equity-driven to prioritize racial and environmental justice, access, and affordability.

Safety. Poorly adjusted, maintained, or ventilated gas appliances can result in gas leaks or incomplete combustion that expose individuals to dangerous and potentially fatal levels of carbon monoxide.[19] Carbon monoxide poisoning is not a risk with electric appliances.

What about Wood?

Burning wood to heat homes or cook food can generate significant $PM_{2.5}$ emissions both inside and outside the home. These particulate emissions have a significant impact on human health.[20] A 2021 Harvard University study estimates that $PM_{2.5}$ emissions from burning gas, wood, and biomass in buildings now have more negative health impacts than the emissions of coal-fired power plants in many states.[21] Reducing particulate matter by burning less gas, wood, and biomass is key to healthier cities.

Image credit: pexels.com/@beccatapert

Endnotes

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