Electrify Everything

Buildings

The Green Worcester Plan of 2020 reports that residential and commercial buildings account for about 40% of the city's overall emissions. Heating buildings alone is one of the largest sources of emissions in Worcester.

Worldwide, buildings account for 32% of energy use and 19% of greenhouse emissions. Buildings pull from natural-gas lines or the electric grid to heat, cool, and light the spaces within them, and to power appliances and machinery. But up to 80% of the energy consumed is wasted. For example, lights and electronics are left on unnecessarily, and gaps in a building's envelope allow air to seep in and out.

A broad swath of research concludes that the lowest-cost pathway to eliminate direct emissions from residential and commercial buildings is to electrify. Here electrification primarily means installing environmentally and economically sound electric heat pumps to replace combustion fuels for space and water heating, and conventional air conditioning.

Although the name can be confusing, an electric heat pump is essentially an air conditioner that is modified slightly so it can run in two directions, cooling the building in summer and heating it in winter. Heat pumps produce roughly half the emissions of burning natural gas in your home, and are even more efficient than fuel-oil heat.

Retrofitting the Built Environment

Much of the attention paid to green buildings is in new construction, but retrofitting the existing built environment – replacing old heating and cooling devices with new, energy-efficient, economical systems – ultimately improves the experience of being inside the building. Retrofitting starts by examining the systems that cool or warm inhabitants, how heat and cold are escaping or entering the building, and how spaces are illuminated. Yet of the world's 1.6 trillion square feet of extant building stock, a mere 1% is green.

Retrofitting older buildings, such as the thousands of triple-decker houses, and public and historic buildings in Worcester and other communities, can be challenging. It is common for owners of older buildings to not have proper documentation of how the building's heating and cooling systems operate. Incomplete blueprints and missing manuals make it difficult to get a holistic view of how the various machines and sensors are working together, if at all. One solution to this challenge is to recreate the entire documentation on-site.

Retrofitting is a well-understood practice, and good building performance data is making it increasingly effective. For example, a recent retrofit of New York's iconic Empire State Building will cut energy use by 40% and avert 105,000 tons of greenhouse gas emissions annually. Depending on the building, the average payback on retrofits is five to seven years.

Distributed Internet of Things (IoT) assets – "smart" thermostats, water heaters, pool pumps, lighting systems, building-management systems, and countless other devices – are being deployed in homes, buildings, and factories across the globe. These assets play a critical role in keeping the power system balanced by providing flexibility when and where it is needed. They will also enable innovative utility companies to achieve new revenue streams and ways of diversifying. To accomplish

this convergence, utilities themselves will need to upgrade and digitize their information and operational systems.

Learn more at [How to drive fossil fuels out of the US economy, quickly](#).