Advancing Construction through the Buildings Workforce

Preprint

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2 U.S. Department of Energy Building Technologies Office

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INTRODUCTION

Buildings are America's energy hogs, consuming more than 70% of all electricity and more than 50% of all natural gas produced across the country.[1] Achieving a clean energy future requires us to reinvent how buildings manage energy resources and how consumers demand it. The U.S. Department of Energy (DOE) is investing in a range of technological advancements that are paving the way to a future in which buildings are no longer simply energy consumers, but rather are part of an integrated system that helps manage energy resources in a way that supports the electricity grid. This paradigm shift presents an opportunity to increase the efficiency of the built environment but will only be realized if we build a knowledgeable workforce to design, construct, and operate these high-performance buildings[2] in step with the rate of technological advancement.

DEMAND FOR EFFICIENT, HIGH-PERFORMING HOMES AND BUILDINGS

Generational shifts are driving demand for sustainable, healthy, and energy-efficient buildings. Together, Gen Z, millennials, and Gen X[3] represent 207 million Americans (approximately 62% of the projected 2020 total population count)[4] and most home buyers, renovators, innovators, community leaders, and commercial enterprise owners. The preferences of these generations influence what products are made, sold, and installed in the built environment, with greater influence stemming from the larger (millennial) and future consumer (Gen Z) generations.

An article published by the Associated General Contractors of America states that "Gen Z is known for being mindful and health conscious, and they will actively seek opportunities to reduce their carbon footprint. As such, the generation will look for properties that make it easy to live 'green,' such as those that feature built-in support for electricity, water and waste reduction." The article goes on to say that

> "Gen Z will be motivated about features such as lighting controls and window coverings that automatically adjust with the sun's position; HVAC systems whose fans operate only when motion is detected; and plumbing systems that optimize water flow based on usage. Those amenities will no longer be a value-add for residents—they will be expected."[5]

A Pew Research Poll shows that Gen Z's views about the environment are almost identical to those of millennials and not markedly different from Gen X.[6]

Even current commercial buildings owners and operators are showing similar preferences to those of our youngest generations. The U.S. Chamber of Commerce and United States Gypsum Corporation conduct a quarterly survey of U.S. commercial construction firms and publish results in the Commercial Construction Index. The Q2 2018 Commercial Construction Index states that "sustainable building appears to be an emerging area of opportunity," with almost half (45%) of respondents reporting that sustainable building gives them a competitive advantage and four out of five stating that that their customers request energy-efficient materials for their projects.[7]

High-performance buildings and energy-efficient technologies are poised to make significant improvements in our nation's building stock, and the market is ready to adopt these technologies.

EMERGING TECHNOLOGICAL ADVANCEMENTS

DOE invests in a range of activities that improve the efficiency of the built environment through new building materials and technologies. These activities also include supporting the advancement of the buildings industry workforce that installs, commissions, and maintains these technologies.

Through its Advanced Building Construction (ABC) Initiative, the DOE Building Technologies Office (BTO) invests in new technologies and processes that enable quickly deployable, higher-performing buildings by minimizing on-site construction. Shifting from on-site construction to a modular construction process allows for utilization of more efficient production and potentially improved quality installation of technologies that are complicated to install on-site. Research will assess if this approach accelerates production schedules, enables greater certainty of production costs and higher quality installations, or improves energy performance of the building.[8]

Another exciting area of research aimed at increasing the energy efficiency of the built environment is DOE's Grid-Interactive Efficient Buildings (GEBs) initiative. GEBs are energy-efficient buildings that utilize distributed energy resources such as solar photovoltaics, batteries, and electric vehicles to manage energy loads and demand. GEBs are

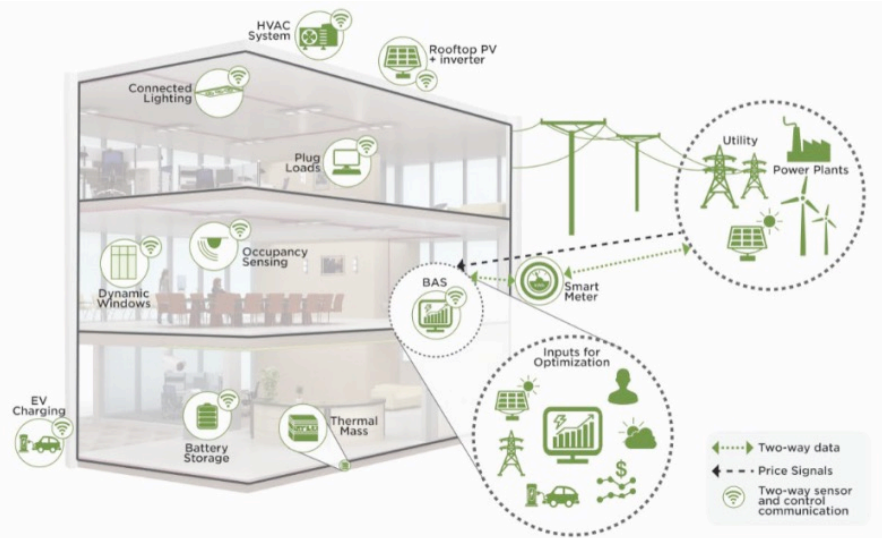

Figure 1. Example grid-interactive efficient commercial building. Image from Navigant Consulting.

designed to reduce energy consumption by embedding sensing and control capabilities to manage multiple distributed energy resources in ways that benefit the power grid, save energy and money, and keep occupants comfortable. GEBs have the potential to achieve 29% savings in site energy of the U.S. commercial building stock with state-of-the-art sensors and controls.[9] Figure 1 illustrates a building automation system utilizing data analytics supported by sensors and controls to optimize energy use for occupant patterns and preferences, utility price signals, weather forecasts, and available on-site generation and storage.

BTO WORKFORCE DEVELOPMENT ACTIVITIES

As scientific discovery continues to push new technologies into the built environment, the workforce must be able to adapt. DOE recognizes that a greater emphasis on building science and multidisciplinary teams is needed to facilitate adoption of GEBs and ABC technologies and funds a suite of activities aimed at preparing the workforce for the future built environment.

One of the longest-standing programs is the U.S. Department of Energy Solar Decathlon®. Since 2002, more than 20,000 students have participated in the competition. Through Solar Decathlon, cross-disciplinary student teams design and build highly efficient buildings powered by renewables while optimizing for key considerations, including affordability, resilience, and occupant health. The Solar Decathlon provides a hands-on experience and unique training that prepares competing students to enter the clean energy workforce, often as architects and engineers. In the past 5 years alone, the Solar Decathlon has engaged 143 collegiate institutions across 23 countries. Teams are provided building science training before participating in the competition.

New activities launched in 2020 include five new workforce development projects under the ABC Initiative, addressing gaps in education and training for building operators and equipment installers with the Better Buildings® Workforce Accelerator. The Better Buildings Workforce Accelerator supports efforts that raise the level of building science and energy efficiency knowledge in the nation's building-related workforce. The goal is to set the United States on a course toward a more energy-efficient and high-performing building stock. This 3-year effort will support the vision of the U.S. building workforce as a global leader in delivering quality efficiency products and services to American residents and businesses, thereby increasing energy affordability across the economy.

For more information or to become a Workforce Accelerator partner, visit https://betterbuildingssolutioncenter.energy.gov/accelerators/workforce.

ENDNOTES

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2. The National Institute of Building Sciences defines a high-performance building as a building that "optimizes performance attributes like energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operations".
3. Gen Z includes people born after 1995, Millennials were born between 1980 and 1995, and Gen X includes those born between 1965 and 1979, according to https://www.kasasa.com/articles/generations/gen-x-gen-y-gen-z.
4. Statistica.com estimates the 2020 U.S. population to be 343 million.
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