



An engineer points to a screen showing the energy management system software.

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Insights

Practitioner Insights: Building a Low Carbon Future

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According to the International Energy Agency, 55 percent of the carbon emissions reductions required to achieve a 450 parts per million scenario and limit climate change by 2035 will have to come from energy efficiency. Many of these reductions will have to come from buildings, which currently account for more than one-third of energy-related carbon dioxide emissions globally.



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One of the challenges to achieving the large potential of building energy efficiency is the market represents the aggregation of many small investments that owners and developers make while constructing, renovating, and managing buildings.

For more than a decade, Johnson Controls has surveyed executives responsible for making energy and facility management investments in commercial, industrial, and institutional building portfolios. The 2017 Energy Efficiency Indicator surveyed more than 1,500 executives from the U.S., Canada, Mexico, Argentina, Brazil, Colombia, France, Germany, Poland, China, India, and Singapore. The good news is interest and investment in energy efficiency and renewable energy is increasing globally. The findings revealed several trends:

Energy efficiency is becoming increasingly important. This year's survey found that 70 percent of organizations are paying more attention to energy efficiency than one year ago, and 58 percent are expecting to increase investments next year. Investments in heating, ventilation, and air conditioning equipment was the most popular improvement made last year, reported by 75 percent of respondents.

On-site renewable energy and energy storage are key areas for future investments. When asked about planned investments during the coming year, on-site renewable energy leads with 57 percent of organizations planning to invest. Energy storage is gaining momentum, as well with 48 percent planning to make investments in the next year.

More than half of organizations are targeting net zero. Increased investment in on-site renewable and electric storage could be driven by increasing interest in net-zero energy buildings, energy security, and resiliency. Fifty-four percent of organizations are planning to achieve near-zero, net-zero, or energy-positive status for at least one building within the next 10 years.

Critical weather conditions are affecting how organizations think. Seventy-one percent of respondents said maintaining critical operations during severe weather events or extended power outages is very or extremely important when considering future infrastructure investments. Additionally, 52 percent of respondents said they are “very” or “extremely likely” to have one or more facilities able to operate off the grid in the next 10 years.

It pays to be green. The market for sustainable buildings continues to increase with 43 percent of organizations willing to pay a premium for space in a certified green building. Building owners also are increasingly likely to consider other benefits of investments in energy efficiency, such as the ability to attract and retain employees and customers and improved brand image and reputation.

The results of the 2017 Energy Efficiency Indicator also shed light on why organizations are increasingly investing in energy efficiency. The findings suggest that global growth of the building efficiency market is being driven by both government policy and market forces. Fifty-two percent of organizations globally rated government policy as a very or extremely significant driver for investment.

Building performance benchmarking and certification was rated as the most effective policy followed by government leadership in leasing, building design, and retrofits. In the U.S. and Canada, 92 percent of respondents rated greenhouse gas emission reduction as “very” or “extremely important” drivers for investment compared with 67 percent of organizations globally, which was the second-highest-rated driver.

Goal Setting to Cut Emissions

Previous Energy Efficiency Indicator studies have shown that organizations that set public energy or carbon reduction goals were twice as likely to have invested in energy efficiency and renewable energy in the past year and were three times more likely to increase investments in the next year. This increasing focus on public commitments and low-carbon investment was evident at the 23rd Conference of the Parties Climate Conference in Bonn last fall, where 132 countries included buildings in their nationally determined contributions, which document their climate action plans.

The Global Alliance for Buildings & Construction was launched during COP-21, in Paris, with the mission of facilitating the transition to a low-carbon, efficient, and resilient buildings and construction sector. The alliance held several events at COP-23 as did a number of local government organizations, including the C40 Cities Climate Leadership Group; ICLEI—Local Governments for Sustainability; and the Global Covenant of Mayors for Climate & Energy, which includes 7,500 local authorities. The World Green Building Council launched an initiative to coordinate public- and private-sector action toward achieving 100 percent net-zero carbon buildings by 2050.

Cities, states, universities, and businesses also were active at COP-23, committing support for the Paris Agreement and sharing best practices for low-carbon development. The U.S. Climate Action Center was host to more than 100 U.S. leaders at a number of events, including those sponsored by the We Are Still In coalition. This coalition includes 230 cities, nine states, 320 colleges, and 1,700 businesses. The U.S. Climate Mayors group—which includes 386 cities representing 68 million American citizens—also committed to achieving the Paris Agreement climate action goals.

While national governments are the entities that legally commit to the Paris Agreement, their cities, states, universities, and businesses will be the ones to take local action on climate change and encourage increased national ambition. Johnson Controls participated in COP-23 as a member of the U.S. Business Council for Sustainable Energy delegation. Our company has had a long commitment to climate action and low-carbon development. We have reduced our greenhouse gas emissions by more than 42 percent since 2002 and committed to double our energy productivity from 2009 to 2030, as the first U.S. business to join the Climate Group's EP100 initiative. We also met our 10-year U.S. Department of Energy Better Plants Challenge commitment of a 25 percent energy intensity reduction three years early in 2016.

While our internal carbon and energy reductions are significant, our greatest climate impact is through our products and services. Since 2000, guaranteed energy savings performance contracts have reduced carbon emissions for our customers by more than 26 million metric tons of carbon dioxide. Our next-generation high-efficiency, low-global warming potential (GWP) refrigerant chillers promise even greater annual energy and carbon savings, while reflecting our commitment to the Kigali Amendment, an agreement 197 countries made in 2016 to take actions to address greenhouse gas emissions through the phase-down of short-lived climate pollutants, including of HFC refrigerants. Finally, our start-stop battery technology, which is installed in 20 million vehicles worldwide, saves an estimated 381 million gallons of fuel, while cutting greenhouse gas annual emissions by 3.4 million metric tons, or the equivalent of carbon captured by 2.8 million acres of forest in one year.

The burgeoning market for these energy-efficient products and services is telling. It reflects a growing global awareness of the risks climate change poses and recognizes that the transition to a sustainable, low-carbon economy is good business. A 2017 CDP analysis showed that 89 percent of the world's biggest, most environmentally impactful companies now have carbon emissions targets, with a fifth planning low-carbon into their futures to 2030 and beyond. Many

other public- and private-sector actors also are setting ambitious goals and taking significant strides toward emission or energy-specific reduction targets.

A higher education organization that has shown particularly strong leadership in low-carbon investment is Stanford University in Palo Alto, Calif. In 2009, the university developed a comprehensive energy and climate-action plan called Sustainable Stanford, which called for 50 percent of campus energy to be generated from on-site and off-site renewable sources. The plan also called for decommissioning a 100 percent fossil-fuel fired cogeneration plant and constructing an all-electric central energy facility using heat recovery chillers, hot and chilled water storage tanks, and an advanced predictive control system. The control system optimizes facility performance based on seven-day-ahead weather forecasts, campus heating and cooling load forecasts, and the price of electricity from the grid. The system also is able to meet 90 percent of campus heating needs using waste heat from chillers. In addition, the facility reduces water consumption by 15 percent and will save \$420 million in operating costs, while reducing carbon emissions by 68 percent.

Another example of leadership in low-carbon development is Hawaii. The state relies on fossil fuels for more than 90 percent of its energy, at a cost of over five billion dollars. Gov. David Ige created the Hawaii Sustainability Plan with the goal of developing 100 percent renewable energy sources by 2045. In response, the Hawaii Department of Transportation has invested \$245 million in improvements to airports, harbors, and highways in the largest single-state energy savings performance contract in U.S. history. With performance contracting, energy infrastructure improvements are paid for over time through energy and operational savings, saving taxpayer or ratepayer dollars. The multiphase project includes energy efficiency improvements and renewable energy generation that will reduce energy use by up to 50 percent, with guaranteed savings of \$680 million over the 20-year contract.

Cities are really the front lines of climate action. A great example is Louisville, Ky., which committed to reducing energy use per capita by 25 percent by 2025. The city's sustainability plan, Sustain Louisville, was launched in 2013 to "protect the environment; reduce the metro area's carbon footprint; ensure the health, wellness, and property of all citizens; and create a culture of sustainability." The city entered into an energy savings performance contract, investing \$27 million in energy and water efficiency upgrades in nearly 200 public buildings. The project will provide \$2.7 million in guaranteed annual energy savings and is expected to reduce carbon emissions by 19,900 metric tons CO₂ annually. The project has also created 400 jobs, 90 percent of which will remain in the community and exceed city targets for women- and minority-owned business participation.

Partners Spur Innovation

Public-private partnerships and collaboration will be critical to providing the required expertise and financial resources needed to drive greater innovation and investment in building efficiency.

On the innovation front, the U.S.-China Clean Energy Research Center Building Energy Efficiency Consortium is a public-private partnership to develop and deploy new technologies and policies driving adoption of low-carbon buildings by 2030. China is a critical market for building efficiency investment, with half of all new construction planned there through the next decade, and resulting in a 40 percent increase in energy demand during the next 15 years. Through this partnership, more than 70 researchers from more than 50 government, university, and industrial organizations have launched 12 new products and released 13 new copyrighted software tools. The new Johnson Controls Asia-Pacific Headquarters in Shanghai, China, is participating in the project as a research test bed and showcase for advanced sensors and controls, indoor air quality technology, and building-to-grid integration.

Another successful public-private partnership focused on building efficiency at the city level is the Sustainable Energy for All Building Efficiency Accelerator, organized by the World Resources Institute with Johnson Controls serving as the industry co-convener. The Building Efficiency Accelerator supports cities in the development and implementation of building efficiency policies and practices by facilitating access to global expertise and finance while providing a venue for engagement with private sector partners. During the past two years, the accelerator has engaged with 254 cities and worked closely with a network of 30 cities around the world to make commitments to introduce new policies, implement projects, track progress, and share best practices and lessons learned. Projects under development in nine network cities have an investment potential of \$1.5 billion while programs in six cities have the potential to reduce carbon emissions by 5.6M metric tons CO₂equivalent.

With thousands of cities, states, universities, and businesses publicly committing to low carbon and sustainable development in support of the Paris Agreement, many are facing a “now what” moment where ambition needs to turn into specific action. While the global EEI study shows growing interest and investment in low-carbon building technology and solutions, the level of investment is insufficient to achieve the needed improvements and realize the many benefits of low-carbon, energy efficient, and resilient buildings. While technology development will continue to reduce the cost of low-carbon building construction and renovation over time, public-private partnerships will be critical in the near-term to accelerating the rate of technology deployment and the availability of third-party financing critical to scaling investment and impact.

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