Energy Management in Buildings

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Data analytics and optimization is powerful tool for building energy management. UBC CERC researchers use data science and advanced analytics to help organizations achieve their building energy efficiency and sustainability goals.

Zero-Energy Building

As estimated by the UN, buildings represent 40% of the final energy consumption and 33% of the global greenhouse gas emissions. A zero energy building (ZEB) is a building that produces as much energy from renewable sources as it consumes annually. Although the idea of ZEB is promising for energy management, economic justification for designing ZEBs remains challenging. A mismatch between energy generation and consumption patterns will cause ZEBs to exchange a substantial amount of electricity with the grid, even though its annual net energy consumption is close to zero.

To find the most cost-optimal size of thermal and electrical devices for a ZEB, data analytics and optimization can be leveraged to consider the nonlinear behaviour of several technologies, including photovoltaic panels, solar thermal collectors, heat pumps and battery storage technology and determine the optimum size of each energy production and storage device. To build a robust model, sensitivity analysis can be performed to evaluate the effects of external uncertainties in weather forecasting and demand pricing.

Smart Buildings

A5G technology is capable of higher speeds, lower latency and increased reliability. Smart buildings use real-time data from interconnected devices to generate actionable insights. By integrating 5G-enabled IoT sensors and advanced analytics in their control strategy, smart buildings can increase user comfort and improve building safety and sustainability. Key parameters, such as temperature, humidity, ventilation and occupancy levels, can be collected using IoT devices and funneled into smart Energy Management Systems (EMSs) for real-time monitoring.

With the help of advanced analytics and machine learning algorithms, a smart EMS will reduce building energy consumption by intelligently controlling smart thermostats and enforcing optimal scheduling for electrical appliances such as lighting, heaters, servers and lab equipment. A natural synergy between 5G technology and mobile edge computing helps support the implementation of resource-hungry and data-intensive machine learning algorithms. 5G-enabled technology and data analytics offer incredible opportunities in building energy management to help organizations achieve their sustainability goals. Large buildings in particular, have huge energy savings potential and would benefit immensely from 5G-enabled advanced analytics to optimize energy and space usage.