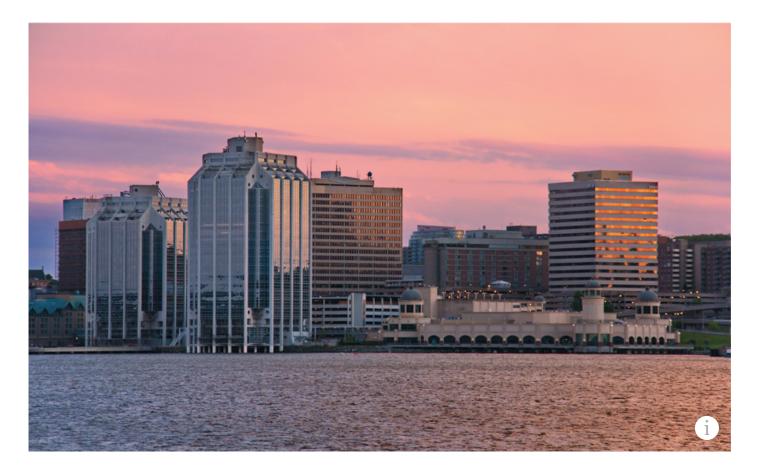# Using Artificial Intelligence To Reduce Energy Consumption

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Our city buildings have evolved into far more than just brick and mortar. Thanks to the explosion of the "internet of things" (IoT) devices and the data they provide, artificial intelligence (AI) applications are evolving our buildings into sophisticated and intelligent ecosystems.

So, what is artificial intelligence? In simple terms, it's the ability of machines to mimic human cognition, to think and learn without encoded commands.

The term "artificial intelligence" was first coined by John McCarthy at the Logic Theorist event in 1956 *(Editor's note: Logic Theorist is a computer program developed in the 1950s; it is described as the first artificial intelligence program)*. Top researchers, scientists, mathematicians and philosophers from around the world gathered at Dartmouth College to discuss the concept of AI. The conclusion was that while AI was indeed achievable, it would prove to be challenging due to the lack of computer storage, processing and funding. For perspective, in the 1950s, only the largest institutions could afford a computer. Leasing costs were about $200,000 per month and the required space was roughly one hundred square meters. They required thousands of vacuum tubes, consumed over a hundred kilowatts and needed a full-time operating and maintenance staff.[1]

Fast forward six decades, and artificial intelligence is commonplace in our everyday lives: from mobile banking, to social media to online shopping, AI is routinely around us, though often invisible. In the built environment, it's transforming how facility managers are controlling buildings, including power demand prediction, management of lighting, elevators, water, HVAC, tenant comfort and even alerting maintenance teams when the toilet paper runs low. AI platforms capture and process relevant data, analyze, alert, notify and control; enabling real-time decision-making and improved operational efficiencies.

One of the factors driving these initiatives in building management is the commercial readiness of AI platforms, many of which have been driven by the movement for responsible energy efficiency. In 2018, global investments in clean energy totalled more than $332 billion.[2] Companies like California-based Verdigris, who leverage AI to optimize energy consumption by using meters that collect data to pinpoint electrical anomalies and create energy usage reports and Israeli based PointGrab, who track occupancy for improved workplaces, are amongst many playing a significant role in creating smart buildings.

One company taking advantage of the new technology is Crombie REIT, based in Halifax, Nova Scotia. They took the step of installing AI software into their large office complex, Cogswell Tower.

The company had made a commitment to focus on environmental sustainability as part of their everyday decision-making. "We felt that AI is a large step towards a smarter facility and by taking advantage of powerful analytics, we could significantly reduce energy consumption and make great strides in achieving our carbon reduction goal," said Dan Bourque, Crombie's Director of Operations, Atlantic.

Mr. Bourque is just one of many early automation adopters. According to a recent study published by the IBM Institute for Business Value, an astounding seventy-six percent of Chief Operating Officers reported that increasing automation in both facility and asset management will have a positive impact on operational efficiency. Energy efficiency and renewables rank among the highest priorities as global initiatives and government mandates seek to drastically reduce the impacts of climate change. On a global scale, buildings and building construction sectors combined are responsible for 36% of global final energy consumption and nearly 40% of total direct and indirect CO_2 emissions.

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In June 2018, Crombie REIT's Cogswell Tower became the first commercial building in North America to integrate and control their building management system (BMS) using AI technology that harnesses the thermal mass of a building for heating, cooling and ventilation. There are few solutions which utilize a building's thermal inertia currently on the market and Crombie REIT chose to install Ecopilot®, an AI system that intelligently controls their BMS.

The technology provides an offset to the BMS to make automatic and continuous energy management decisions based on the short and long-term heating and cooling needs of the building. This AI offering is housed in the cloud and communicates to the BMS via a secure gateway.

Most control systems in use are set to instantly compensate and react for each temperature variation that occurs in a building, but these systems often work against the buildings natural thermal inertia, which can lead to the overlapping and waste of both cooling and heating capacity. The application behind this AI product harnessing the existing thermal energy is simple and is based on the building being partitioned into different thermal zones, each with its own thermodynamic properties. Each zone's local time constant is the length of time it takes for the natural release of heat from the building, given the building's construction materials and contents. These partitions also take into consideration factors such as sunlight, the effect of the wind and other known heating and cooling loads. Using temperature sensors and other contributing factors in each zone, the AI technology collects all the data and proactively adjusts each zone's internal temperature in accordance with the client comfort requirement. Essentially, these AI systems are comparable to recommissioning a building every few minutes based on ever-changing internal and external climate variables.

The results of the AI integration are impressive. In just four months, Cogswell Tower reduced energy consumption by 29 percent and delivered 22 percent in dollar savings compared to the two previous years. There was a noticeable improvement in internal climate, measured by the reduction in tenant temperature complaints. Most importantly, Crombie has significantly reduced their carbon footprint, something Mr. Bourque acknowledges is an important consideration for their Canadian Maritimes-based tenants when assessing office space.

Nova Scotia is aiming to reduce greenhouse gas emissions by 45 to 50 percent of 2005 levels by 2030, and Canada has issued ambitious climate change objectives to reduce greenhouse gas emissions by at least 30 percent of the 2005 levels.[3] According to the Canada Green Building Council, focusing on how to retrofit old buildings will be key to reaching these aggressive goals and Crombie REIT is on board to be a corporate leader in the field. They're showcasing what's possible by the integration of IoT and AI to reduce energy consumption.

"I was skeptical about using artificial intelligence to control our building management system as a means of energy reduction," reflected Pat Poirier, Manager of Engineering & Sustainability. Crombie's goal for Scotia Square and their associated office properties, including Cogswell Tower, is to reduce energy consumption by 1,000,000 kWh per year. "As a result of our AI integration and creating a more intelligent building, we are well on our way to achieving those savings, reducing consumption by 246,487 kWh in the first four months of operation just in Cogswell Tower — almost a quarter of our goal," Poirier added.

As the world becomes increasingly aware of earth's environmental challenges, business and government are leveraging the potential of AI to be a real game changer in transformative environmental solutions. Access to big data, processing power and a connected globe are the factors converging to bring AI from research labs to our everyday lives. As technology pioneers move forward in the research, development and investment of AI, the future of energy solutions is endless with possibilities. Imagine what the next six decades will bring.

ENDNOTES

1. Garner, Robert, Early Popular Computers, 1950 — 1970, Engineering and Technology History WIKI, **https://ethw.org/Early_Popular_Computers,_1950_-_1970#Citation**

2. BloombergNEF, Clean Energy Investment Exceeded $300 Billion Once Again in 2018, ©2019 Bloomberg Finance L.P. January 16, 2019, **https://about.bnef.com/blog/clean-energy-investment-exceeded-300-billion-2018/#_ftn1**

3. Tutton, Michael. CTV News Atlantic. Tuesday, October 23, 2018.