

How IoT is revolutionizing the HVAC Industry

Executive Summary

Building intelligence, smart buildings, and building automation are fueled by a common denominator—the Internet of Things (IoT). Connectivity between individual devices allows commercial building owners and managers to capture operational savings that were never possible before. These IoT-enabled efficiencies are opening the door to more granular levels of system control.

The commercial HVAC industry in particular is benefiting from IoT disruption. The days of having standalone HVAC units that can't communicate with one another or a building management system (BMS) are fading into the past. Building owners and managers now expect IoT-connected systems that provide greater control over HVAC energy efficiency, maintenance needs, and lifecycle costs.

This whitepaper will help contractors, manufacturing representatives, engineers, and architects understand the current capabilities of IoT in commercial HVAC products. Data collected over Internet connectivity significantly improves HVAC performance through energy savings and equipment longevity.

IoT and Smart Building Operation

The unique capabilities of IoT are rooted in its ability to connect devices across a network. Real-time data transferred over this virtual network can then be applied to a host of operational parameters. For HVAC systems, everything from efficiency and demand, response to maintenance alerts and push notifications are enabled by IoT.

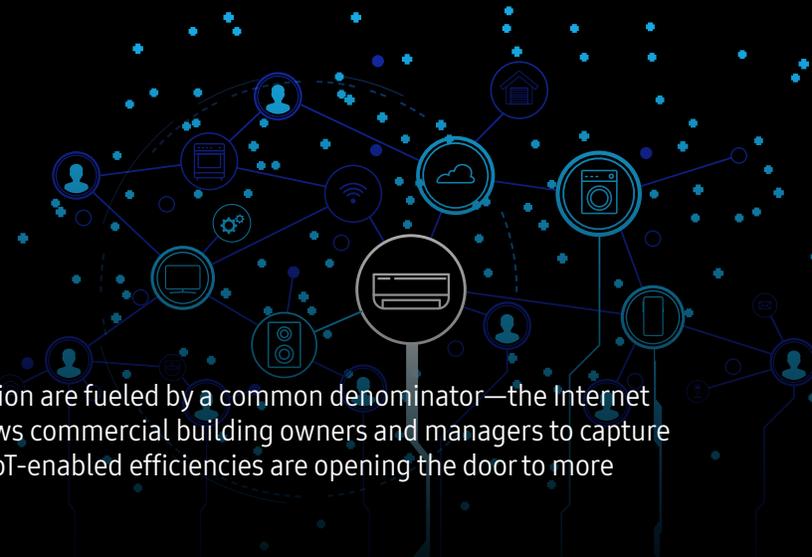
“It is important to note that the IoT is not a specific device or technology—it is a conceptual framework, driven by the idea of embedding connectivity and intelligence in a wide range of devices,” the Continental Automated Buildings Association (CABA) declared, which commissioned the 2017 Intelligent Buildings and the Impact of the Internet of Things (Executive Summary): A Landmark Research Report.¹

The 2017 research report specifically defines an IoT device as having 1) embedded connectivity to the Internet or an IP-addressable device, 2) a wired or wireless connection, and 3) multiple sensors and a user interface, though these are optional.

The report also outlines two categories of advantages that IoT automation can deliver:

- Bottom line impacts such as reduced energy consumption, improved efficiency, enabled predictive maintenance, easy remote access, and better occupant comfort.
- Operational benefits such as notification if systems are operating outside normal parameters, notification if a device is on the verge of failure, monitoring building systems remotely, and viewing energy consumption data.

HVAC systems with IoT connectivity are capable of realizing a wide range of operational efficiencies. Building owners and managers are especially interested in the ability to curb energy consumption and stay ahead of equipment malfunctions.



IoT Growth Expanding Rapidly

The Internet of Things (IoT) is on pace to rapidly increase in both commercial and consumer markets. As the technology continues to deepen and expand, exciting advances for HVAC systems are on the horizon.

- “By the end of 2025, there will be around 70 billion IoT-connected devices and annual shipments will have reached 18 billion devices per annum” (CABA, 2017).¹
 - “The total installed base of Internet of Things (IoT) connected devices is projected to amount to 75.44 billion worldwide by 2025, a fivefold increase in ten years” (Statista Research Department, 2016).²
 - “Worldwide spending on the Internet of Things (IoT) is forecast to reach \$745 billion in 2019, an increase of 15.4% over the \$646 billion spent in 2018. Worldwide IoT spending will maintain a double-digit annual growth rate throughout the 2017-2022 forecast period and surpass the \$1 trillion mark in 2022” (International Data Corporation, 2019).³
 - “The combined markets for the Internet of Things (IoT), including hardware, software, systems integration, and data and telecom services, will grow to \$520 billion by 2021 – more than double the \$235 billion spent in 2017” (Bain & Company, 2018).⁴
 - “500 billion devices are expected to be connected to the Internet by 2030” (Cisco, 2016).⁵
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IoT and Performance

Capturing energy savings is the primary advantage of IoT-enabled HVAC systems to commercial building owners. A building automation system connects to many pieces of equipment, but IoT is what enables individual devices to send data back and forth between each other.

Collected data can then be analyzed to provide trends and forecasting. Real-time data empowers facility professionals to finetune their operations and conserve energy demand. It’s similar to how a car can calculate miles per gallon, instantaneously providing the driver with information they can use to modify their driving habits.

IoT can boost HVAC efficiency with real-time data through a variety of methods:

- Apply local weather and occupancy data to inverter settings on outdoor units, which decreases energy consumption while maintaining thermal comfort.
- Participate in demand response by automatically adjusting thermostats when the utility sends an event notice.
- Adjust HVAC settings remotely through an app. Facility managers don’t need to be onsite to make changes, view estimated energy usage, run trends, or receive alerts.

By setting rules in a building automation system (BMS), commercial facilities can also program IoT data to initiate a sequence of events. For example, a building has a rental space that should be set at 75°F (24°C) when unoccupied but lowered to 65°F (18°C) when occupied. This sequence can be automated through a standard BMS protocol, but what happens if an event is canceled last minute? With IoT connectivity, this new information can be automatically relayed between the room reservation program and individual thermostats. IoT prevents a facility manager from having to manually change the settings in the BMS interface or physically adjust individual thermostats.

IoT and Maintenance

On the maintenance side of HVAC, IoT has the power to extend equipment longevity. This is largely thanks to the ability to flag performance irregularities that indicate the likelihood that a unit is experiencing an error or malfunction. These notifications are pushed to facilities professionals by an app within seconds of detecting a deviation, allowing for a prompt inspection. Faster response time lowers the risk of the equipment consuming excess energy for prolonged periods of time or resulting in a system failure.

Remote error notifications are also more precise than a red blinking light or a warning buzzer. They can be as specific as “the condensation float switch has been tripped” or “a drain pan has overflowed.” Depending on your system permissions, this same message can be sent to external contractors or other service providers.

IoT also enhances the effectiveness of HVAC maintenance reminders. Beyond standard service reminders, IoT-enabled units can communicate when maintenance is required ahead of schedule. This is called conditions-based maintenance. Many HVAC issues are time-consuming and difficult to identify with manual inspections—IoT allows facility managers to quickly and efficiently respond to issues as they arise.

For example, if a unit reports a pressure differential, an automatic notification to clean the filter is sent. Clogged or dirty filters impede airflow, causing the unit to consume more energy. The automated maintenance alert allows facility managers to take corrective actions only when a unit’s performance indicates there’s a problem.



Divine Lorraine Apartments

Resurrecting the historic Divine Lorraine building was a major challenge for developer Eric Blumfield. The 1894 landmark in Philadelphia, Pennsylvania, has an impressive history as luxury apartments, a hotel, and then a hub for the International Peace Mission movement.⁶ However, after a period of abandonment for over a decade, the 10-story building required major renovation.

Blumfield had to balance preserving the original 19th-century design while providing modern comfort. Despite its historic charm, the site afforded little support for traditional HVAC engineering requirements. Challenges included limited space to locate and conceal indoor and outdoor HVAC equipment, the need for individual tenant monitoring, and independent zone control.

Project partner Pennergy Solutions recommended Samsung's DVM S Heat Recovery VRF system. Its zoning capabilities allow users to adjust individual climate settings, making it a perfect fit for the Divine Lorraine's lobby and 101 apartment units.



Samsung's Pulse Input Module (PIM) technology used in conjunction with the Data Management Server (DMS 2.5) BACnet Gateway enabled the Pennergy Solutions team to design the system for energy monitoring. The PIM allows the landlords to log in and pull data for each apartment and accurately bill each tenant for individual usage rather than an average.

The DMS also allows building management to remotely monitor and control the Divine Lorraine's on-site air conditioning needs.

With heat recovery and IoT control, Samsung HVAC delivers ideal occupant comfort while helping the Divine Lorraine retain its historic beauty and charm.

Samsung offers a wide variety of light commercial and commercial HVAC solutions with IoT capabilities. Our SmartThings app connects to air handlers, chillers, outdoor units, ceiling cassettes, ducts, and heat recovery systems. Remotely connect, automate, and manage your heating, cooling, and ventilation needs.

Visit [SamsungHVAC.com](https://www.samsunghvac.com) to learn more.

References

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