Every building owner and facility manager looks for the crowbar that can pull costs out of their operations. Building automation can be that tool—but only if you know how to leverage it.

An obvious place to start is with HVAC, which consumes 40% of the typical building’s energy spend. Companies like Daikin Applied are pushing HVAC costs down by bringing the power of the Internet of Things (IoT) to equipment management. Their Intelligent Equipment® doesn’t just cut costs—it puts HVAC on autopilot, with automated reporting of energy use and preventative maintenance issues.

The core of this innovation is an IoT gateway and power measurement module installed on Daikin Applied equipment. This gateway leverages Intel’s industry-leading computing and networking technology to create an information flow that maximizes energy monitoring and analysis, operational efficiency, and active decision making.

The potential upside for IoT-enabled equipment is huge, but deciding which IoT technology is right for you can be a daunting challenge. This white paper takes a closer look at the reasons HVAC can be a major cost center, the savings available with Intelligent Equipment, and the 6 factors to consider when selecting IoT-enabled equipment.

**WHY HVAC COSTS DESERVE YOUR ATTENTION**

Most building owners don’t know how much power their HVAC units are consuming. That’s a problem: An average HVAC unit consumes 1KW of power per ton of cooling, with inefficient older units using more.

Maintenance is also a challenge. On one hand, service calls are expensive and should be kept to a minimum. On the other hand, deferred or overlooked maintenance can result in:

- Costly emergency service visits
- Unvalidated work order requests and billings
- Shortened equipment life
- Downtime that disrupts your business

The risks are even more significant for chillers, which serve the entire building. Chillers are more expensive to service than rooftop units, so maintaining good running order is critical. Plus, there are fewer chillers on a given site, so uptime is more important.

**6 KEY ATTRIBUTES OF IOT-ENABLED SOLUTIONS**

The bottom line is that you can’t manage what you can’t measure. Building owners have been crippled by their inability to measure HVAC operation in enough detail to manage it efficiently – and thus leverage their sizable investment.

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HOW INTELLIGENT EQUIPMENT LEVERAGES OPERATING EFFICIENCIES

Cloud Consolidates the Data and Building Intelligence

Equipment data is transferred via cellular, WiFi, or LAN to the internet, where specialized analytics extract key performance indicators. Unlimited storage capacity in the cloud means that trending information is available over any time period since commissioning. Intel-based gateways secure the data against hackers.

Internet-Enabled Equipment Creates and Communicates Data

Rooftop HVAC units and air-cooled chillers incorporate sensors that create as many as 150 data points in real time. This internet-enabled solution is pre-engineered and needs no set up or integration at the building site – just switch it on. Factory installed on new intelligent equipment, the solution can also be installed on existing equipment in less than two hours.

Building Managers and Service Techs Take Control of Costs

The data consolidated in the cloud appears in separate, user-friendly displays for building operators and service techs. Owners can see benchmarking trends and maintenance alerts to avoid running their equipment to failure. Technicians can resolve some problems without traveling to the site. For other problems they can determine parts needed before arrival on site.
IoT-enabled solutions can turn that situation on its head. The stream of intelligence from these systems can simplify equipment management, keep occupants comfortable, and add to the bottom line all at the same time.

“Sharing and processing equipment performance and status information is accelerating buildings to a new level of intelligence,” says Christine Boles, General Manager of Intel’s Smart Building Solutions. “Daikin’s Intelligent Equipment shows the reality and the benefits of IoT in buildings.”

However, not all IoT solutions actually supply this transformational level of control and efficiency. To identify a solution that will actually deliver on its promises, look for the following characteristics:

1) **CAPABLE**
   For starters, the solution must do more than gather data—it must give building owners actionable intelligence. Daikin Applied’s approach is a good example of how the right solution can turn complicated data into simplified management.

   With Intelligent Equipment, building owners can manage and index tenant comfort to the ASHRAE 55-2010 standard while linking directly to ENERGY STAR’s Portfolio Manager for instantaneous benchmarking performance against similar buildings. They can compare the performance of equipment before and after completion of work orders.

   More benefits accrue to the building owner through more efficient service technicians who can utilize Intelligent Equipment’s remote diagnostics and software updates. If a service call is warranted, technicians already have some diagnostic data and can prepare for the solution with the necessary parts. They also have a simple means to compare equipment performance before and after their work is completed.

2) **COST EFFECTIVE**
   The bottom line is the ultimate consideration. Look for solutions that take HVAC out of “run to failure” mode and instead optimize maintenance and energy use.

   In terms of initial cost, setup should be easy. For example, Daikin Applied uses Intel-based intelligent gateways with built-in cellular connectivity for plug-and-play installation.

   In terms of lifecycle costs, the Intelligent Equipment solution reduces service visits and downtime through preventive maintenance alerts. Also, the life of equipment is extended, creating further savings. Finally, energy consumption is reduced by 20% or more.

3) **SIMPLE**
   To manage equipment with minimal time and effort, controls must be easy to understand, with alerts so you know when action is needed.

Consider how this works with Intelligent Equipment: Owners get intuitive cloud dashboards that can be customized to focus on whatever they care about most. The dashboards automatically adapt themselves for smartphones, so you can view status on the go. And proactive alerts ensure that problems don’t go unnoticed.

Because data is stored in the cloud, storage limits are not an issue. Intelligent Equipment maintains all performance records so building owners can spot trends and identify problems. The solution also documents maintenance calls so owners have a full service history at their fingertips.

4) **SEAMLESS**
   “Rip and replace” of existing assets is expensive. It’s much better to find IoT solutions that are compatible with installed equipment and existing systems.

   For example, the Daikin Applied solution supports multiple local networking options for seamless integration with building management systems (BMS) and building automation systems (BAS). Its cloud interface is similarly interoperable with existing IT systems.

5) **SCALABLE**
   Avoiding equipment replacement is not just a one-time consideration. The best solutions are scalable so building owners can upgrade it over time, and deploy it across their entire portfolio.

   Thanks to its on-board Intel processors, Intelligent Equipment has enough on-site power to run future workloads, including life cycle optimization, utility incentives and automated demand response. As more buildings are added to a portfolio, the Intelligent Equipment cloud platform can scale up to provide centralized control, monitoring, and status/condition for all.

6) **SECURE**
   Given worldwide cybersecurity threats, no building owner can ignore the possibility of threats related to their building systems. And for good reason. Hackers recently found a back door through the BMS of a large building occupied by Google. In the summer of

   The Intel technology in Daikin’s Intelligent Equipment provides comprehensive security at the cloud, operating and boot levels.
2016, investigators from Bat Blue, a cloud security company, simulated a successful ransomware attack through a smart thermostat.

The Intel technology used by Daikin provides security at the cloud, operating system and boot levels. For example, Intel’s whitelisting technology defends the IoT gateway against malware tampering and unauthorized software.

The Daikin cloud infrastructure is similarly private and reliable. Building owners can maintain complete control over their data and who has access to it.

**EQUIPMENT SOLUTIONS VS. BUILDING SOLUTIONS: WHAT ARE THE BENEFITS?**

While the functionality of Intelligent Equipment may sound much like that of building automation systems (BAS), each is, in fact, very different in terms of its solution and application.

Because it involves a direct connection to HVAC equipment, the Intelligent Equipment solution knows a unit’s exact maintenance requirements. It also knows the true run times and energy consumption of each unit. In contrast, a BAS can only estimate maintenance needs and usage based on predetermined schedules, and only if someone has programmed the BAS with that information.

Intelligent Equipment works similar to plug-and-play options for personal computing – the individual components of the solution recognize each other and function together as soon as they are connected. Anyone who remembers the earlier days of computing, before plug and play, recalls the effort needed to make different pieces of equipment work together, much like setting up a BAS today.

This difference between BAS and Intelligent Equipment solutions has a direct impact on initial costs. The setup for a BAS requires a technician to map each data point at a cost of roughly $500 each or $10,000 for 20 points. In contrast, the Intelligent Equipment solution provides 150 data points each year for a subscription cost equivalent to the setup for a single

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**DASHBOARD FOR BUILDING OPERATORS EXPEDITES EFFICIENCY**

This intuitive dashboard designed for nontechnical managers registers unit energy consumption, validates occupant comfort, and sends notifications for required maintenance. Trending data and benchmarking performance enhance decision making. The result: peak operating efficiency and reduced life cycle costs.

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*continued on page 6*
Intelligent Equipment Passes the Test at Two Universities

While situated in vastly different climate zones, facilities at two universities are profiting from Intelligent Equipment.

At the University of California, Berkeley, stringent climate control was required to protect the stored artwork and artifacts of the treasured Regatta Museum Collections. For a major renovation of the warehouse, the university sought bids for new HVAC equipment.

Two 10-ton Daikin Rebel rooftop systems were specified with a rating of 500 cfm at peak design dehumidification conditions and 90% of the load as outside air. Tolerances were 68 degrees F. +/- 2 degrees and 50% relative humidity +/- 5%. Both installed Daikin units have the Intelligent Equipment technology, which was used to calibrate them during a six-week startup and commissioning process for this critical-control application where packaged rooftop units are seldom used.

“With some fine tuning only possible with Intelligent Equipment, Daikin was able to optimize the control of the Rebel units to meet the required tolerances,” says Matt Dodds, Daikin application engineer for commercial rooftop units.

“Intelligent Equipment provides a window into trending information on base temperature and humidity, and other control points such as compressor speed, fan speed, and unit state, giving engineers the ability to adjust the settings and troubleshoot,” adds Dodds. “On a remote basis, you can go into the data for a deeper level of insight than you would by talking to a service technician standing by a unit on the roof.” The Intelligent Equipment platform gave access to diagnostic points unobtainable from the facility’s building automation system (BAS) and reduced the cost of technician services. Remote troubleshooting capability eliminated several service calls during the commissioning process.

Solving Dorm Dehumidification

At Bethel University in St. Paul, MN, the Intelligent Equipment platform has solved dehumidification problems in two residence halls. Existing rooftop units on the 1970s-era buildings were overworked while attempting to keep up with adequate ventilation and comfort levels for dorm residents.

New 7-ton Rebel rooftop units provide high part-load efficiencies at 20.6 IEER (Integrated Energy Efficiency Ratio), surpassing ASHRAE’s 90.1 standard by 84%. The direct expansion (DX) technology in the units allows the university to bypass large amounts of chilled water from its central chiller plants in a two-pipe system.

Two of the Rebels – one on each residence hall – feature the Intelligent Equipment controls solution for real-time data that benchmarks performance and monitors system operation. “Our energy managers use Intelligent Equipment to gather data and we use it to see the detail of operational data and monitor the units. We also appreciate that we can connect remotely to the units on laptop or smartphone,” says Chuck Broz, HVAC technician supervisor at Bethel University.

“In the winter, we’ll use Intelligent Equipment to look at the energy side to optimize use of the energy wheels, instead of using building heat, especially as it relates to the restrooms and showers. In the summer, we use Intelligent Equipment to see if we’re doing an effective job of keeping the dewpoint and humidity at low levels,” Broz explains.

From his office laptop, Broz can access all the details. When away from the office, he gets them on his smartphone.

For more information on these and other case studies, visit www.daikinapplied.com/case-study.php. Intelligent Equipment capability is currently available on rooftop units and air-cooled chillers. IE is being rolled out to all Daikin HVAC lines.

To protect stored artwork of the Regatta Museum Collections, Intelligent Equipment at the University of California, Berkeley, maintains tight tolerances for humidity and temperature.

Intelligent Equipment installed in residence halls at Bethel University in St. Paul, MN, have dramatically reduced the volume of water required from the central chiller plant.

Energy recovery wheels at Bethel University draw 60% more humidity from the air stream for substantial energy savings and increased comfort for dorm residents.
point in a BAS. Moreover, due to its hard drive technology, a BAS system has memory for only 30 to 60 days of operation, while cloud storage offers unlimited memory.

Despite the differences in core technology, Intelligent Equipment is compatible with any existing BAS, allowing the combination to provide even greater efficiency. An HVAC unit with Intelligent Equipment can share its formidable data array with a BAS via an Ethernet connection while simultaneously streaming its data through the cloud.

**SMARTER EQUIPMENT FOR A STRONGER BOTTOM LINE**

With Intelligent Equipment from Daikin Applied, backed by the power and security of Intel, your HVAC equipment will pay you a steady stream of dividends by optimizing unit performance, tenant comfort and energy efficiency. Intelligent Equipment is the best way to manage and operate your HVAC equipment.

Whether you are replacing equipment in an existing building or planning a new facility, Daikin Applied can help. Our solutions experts can assist with upgrades and new equipment for all HVAC systems.

For more information on Intelligent Equipment or a live demonstration, contact your Daikin Applied sales or service office or visit www.DaikinApplied.com.

This dashboard helps ensure that HVAC equipment operates at peak performance from initial commissioning through ongoing maintenance and operation changes. Technicians can adjust setpoints and diagnose operation issues remotely, reducing costs and time for maintenance tasks.