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Energy demand management has evolved: How IoT and AI are more effectively reducing HVAC costs, improving comfort control, and reducing carbon footprints

WHITE PAPER

ENCYCLE

INTELLIGENT BUILDINGS MADE EASY

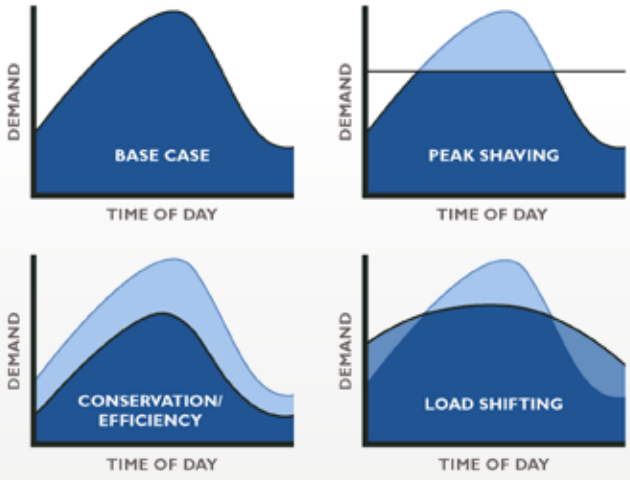
Energy use has become one of the highest costs of doing business and corporate environmental responsibility is now a necessity. Today, it is more crucial than ever that companies reign in energy costs to remain competitive while reducing their carbon footprint to meet sustainability goals. For commercial buildings, heating, ventilating, and air conditioning (HVAC) accounts for 35%-50% of total electric energy consumption. This presents building owners and facility managers with a huge challenge – and opportunity – to reduce HVAC-related energy consumption while maintaining comfort.

But what is the best energy control strategy? And what will it require from your facilities team, which is probably already stretched thin trying to manage multiple day-to-day activities? The answer is an autonomous, cost-effective demand management solution. The evolving practice of energy demand management (DM) has undergone a shift since its inception decades ago. Here we explore that evolution, comparing traditional DM strategies with new alternatives made possible by advanced, energy efficiency technologies that allow companies to achieve their energy reduction and sustainability goals.

What are the most common traditional DM strategies?

Energy demand management can encompass a wide range of actions, all aimed at controlling the rate of electricity use in a facility. The practice places particular emphasis on peak demand times when the price of electricity is at its highest. For HVAC, DM is often accomplished through traditional strategies that commonly include:

- **Demand response (DR) programs** – Electricity usage (load) is reduced or shifted during peak periods in exchange for financial incentives offered by utilities. DR is often implemented in a response to a shift in electric market prices or when the power grid is in jeopardy of overload.
- **Load rotation schedules** – This process systematically matches the use of HVAC equipment with occupancy schedules in a predetermined sequence.
- **Pre-cooling buildings before peak demand hours** – Cooling building spaces down earlier in the day can be more economical than running multiple HVAC units during the hottest time of the day.
- **Load randomizing** – HVAC equipment can be programmed to operate at random on/off intervals in an attempt to prevent all equipment from running at the same time.
- **Turning off HVAC equipment completely** – Some companies have taken this limiting action during business closures or reduced operating capacities. Facility managers are realizing that leaving these systems turned off for extended periods can cause stress on equipment when turned back on, leading to failures.



Source: www.usaid.gov

Why aren't traditional DM strategies more broadly adopted?

Traditional DM strategies involve a static, one-size-fits-all approach to achieving energy savings with no ability to adapt to continually changing business landscapes or other conditions. These strategies often have negative implications on comfort. Some of these techniques result in drifting temperature control and uncomfortable increases over setpoints. Additionally, DR events generally have a "snap back" periods of higher usage, masking some of the actual results of the event. Besides their lack of flexibility and responsiveness, traditional approaches have other downsides:

Lack of expertise
Many traditional DM strategies lose value due to the high degree of technical expertise required to implement them. To overcome the complexity of demand management, a professional energy manager must have the technical knowledge and experience to know which actions will deliver concrete results.

Time intensive
It takes significant time for team members to analyze any new program or strategy. This inherently results in missed opportunities to unlock new revenue streams.

Individual site customization
Because commercial and industrial buildings vary widely by size and design, DM strategies often need to be customized for each facility. This can be disruptive and cost-prohibitive for enterprise companies with multiple sites.

May require capital investment
Some DM strategies require metering devices and other equipment that must be purchased upfront to measure energy data. These CapEx investments may take years to recoup any substantial return and do not provide insight into actual consumption sources.

IoT and AI offer a more attractive buy-in and immediate savings

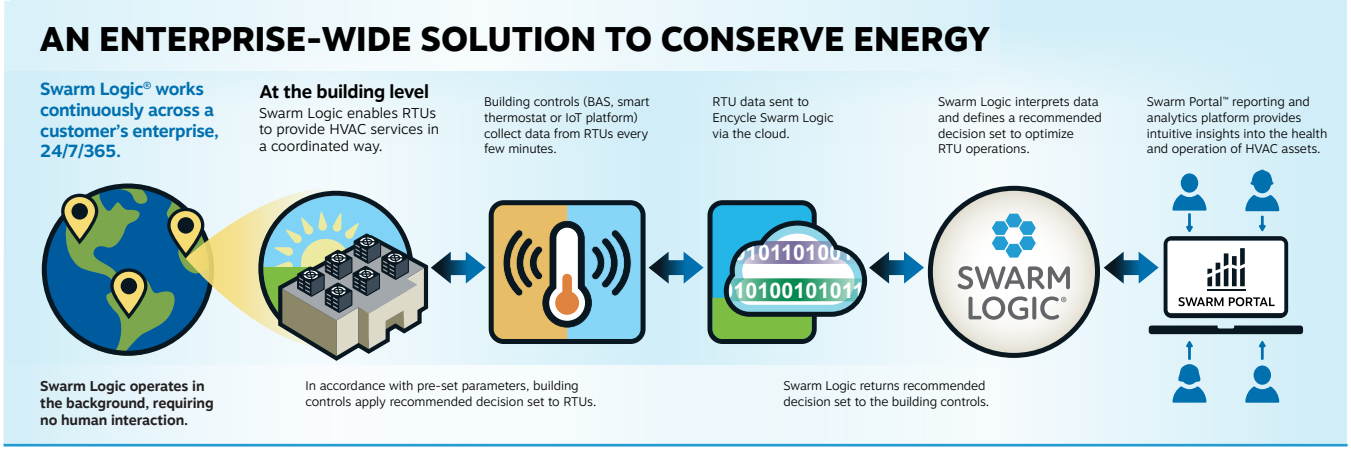
IoT-based technologies and artificial intelligence (AI) help companies quickly realize savings for a fraction of the cost. Alternative strategies like Encycle's Swarm Logic® software offer behind-the-meter solutions that can be used to complement an array of DM programs or deployed individually to achieve significant energy savings without capital outlay.

The determining success of any energy efficiency program now revolves around the availability of real-time granular data and proactive action. Whether it's outdoor temperature, building zone temperatures, or compressor and blower status, Swarm Logic aggregates this data with historical data to determine a recommended action autonomously carried out by the HVAC system. The result is an energy efficiency solution that's simple to deploy and requires no effort to maintain.

What is Swarm Logic?

Swarm Logic is Encycle's unique, heavily patented, data-driven energy management technology that continually and automatically collects HVAC asset and building operational data, sending it to the cloud where Swarm Logic interprets the data and uses artificial intelligence to determine optimal control decisions. Swarm Logic synchronizes power-hungry rooftop units (RTUs), enabling them to respond efficiently to changing conditions such as outdoor temperature, building occupancy, or equipment performance. Instead of operating in isolation, the RTUs become part of an IoT-based, closed-loop system that coordinates their activity, apportioning energy consumption more logically without any human intervention. By balancing the activation of certain RTUs in stages based on their need to run, Swarm Logic delivers a more precise and effective energy control strategy over curtailing equipment.

Customers who deploy Swarm Logic typically reduce their HVAC energy demand, consumption, and costs by 10%-20% with little or no required capital investment resulting in a simple payback in months and a three-digit internal rate of return (IRR).



How Swarm Logic solves typical DM issues

Encycle's Swarm Logic technology deployment can solve many of the issues and challenges associated with traditional demand management strategies.

	Swarm Logic Technology	Traditional DM Strategies
Implementation	Requires no extensive site studies or upfront capital. The cloud-based technology integrates seamlessly with existing building controls (building automation systems, smart thermostats, or IoT platforms). Installation is typically done in less than a full day without any disruption.	May require site studies, significant upfront hardware and sensor expenses, and disruptive installations at each facility. Implementation can take weeks to months.
Complexity	Operates autonomously as an enterprise-wide solution without the need for human intervention to maintain or monitor its actions.	Strong engineering expertise is often needed to design custom control strategies at each site that need periodic adjustments. As equipment changes or needs maintenance, new programming may necessary.
Risk	There is no large upfront capital investment or risk of equipment becoming obsolete.	Often require capital investments in meters, sub-metering, and other equipment that require maintenance, monitoring, and replacement. For utility incentive programs, tariff changes can negatively impact energy costs.
Adaptability / Responsiveness	Within minutes of enablement, Swarm Logic dynamically begins to respond every five minutes to multiple conditions, using new and historical data. Unexpected changes in cooling demand due to weather, occupancy, or RTU health are automatically met without the need for setting adjustment or reprogramming. This approach maximizes HVAC efficiency across multiple sites and avoids lost savings and increased costs involved in reconfiguring a demand control strategy.	Operate on pre-defined control tactics with no ability to adjust to changing conditions or implement change. Any "learning" requirements take months to complete.
Scalability	Adapts to each building's unique requirements and characteristics. The technology works 24/7/365 and can be easily scaled to multiple sites with remote operation and a robust analytics and reporting platform.	Often require unique energy/engineering studies to be conducted at each location.
Value	Provides continuously demonstrated savings and identifies underperforming HVAC equipment. It is a low-risk investment that delivers a return on program fees of 2X to 5X almost immediately after deployment.	Value is created only when peak electric demand thresholds are met. Hardware payback can take years to offset any initial investment, and the expertise required to manage DM initiatives adds personnel cost.
Comfort	Balances HVAC load within a building while closely adhering to desired space comfort.	Commonly just increase setpoint temperature, thereby compromising employee and customer comfort.
Equipment Maintenance	Swarm Portal provides HVAC unit operational reporting and analytics that shift maintenance activities from reactive to proactive.	Results presented to customers do not include details that help identify faulty or underperforming HVAC equipment.

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The future of building energy performance

IoT and AI are delivering practical energy-saving solutions today. The future will be powered by these and other evolving technologies, better building designs, and a commitment to use energy wisely. As efficiency opportunities continue to expand with innovation, Encycle is empowering some of the biggest retailers and other multi-site companies to combat HVAC-related energy challenges. The company's unique Swarm Logic technology autonomously monitors and controls HVAC equipment. It has been deployed on tens of thousands of HVAC systems to help customers save over millions of dollars in energy costs. The patented technology delivers smart building functionality where none may exist, and with proven savings that will inevitably follow.

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