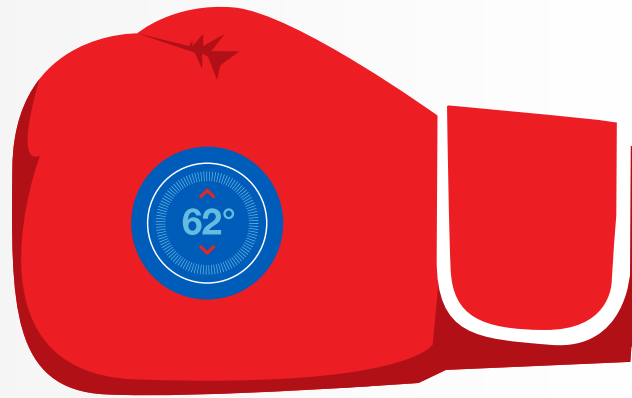
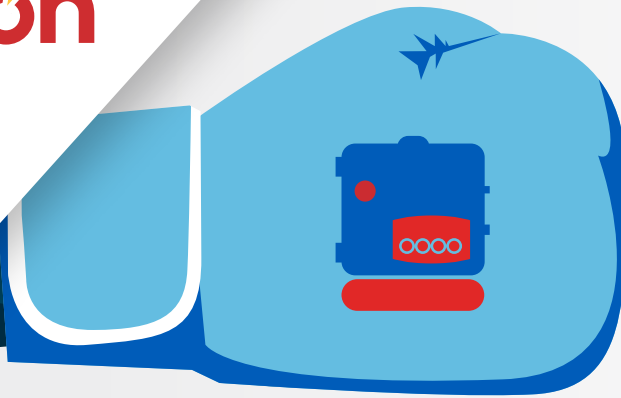




Comparing Adoption, Performance & Cost for Demand Response Program Effectiveness:

A Portfolio Approach to Smart Thermostats & Load Control Switches

INTRODUCTION

Today, Itron provides our utility customers with two primary demand response (DR) models for direct control of residential loads:

- 1. Traditional Load Control Switch (LCS)** programs where the utility or energy provider installs a LCS for direct load control of pool pumps, water heaters, HVAC and similar loads either by interruption of power to the load or by interruption of low voltage control wiring such as the “call for cool” wiring from a thermostat. LCS programs utilize existing advanced metering networks and/or public/private cellular networks.
- 2. Thermostat control, often via “Bring-Your-Own” (BYO)** demand response programs for customer-owned devices (usually smart thermostats) connected through the homeowners’ Wi-Fi network.

This briefing compares the costs and operational impacts of LCS and BYO thermostat programs, including upfront costs, total life-cycle return on investment (ROI), and short-term versus long-term program implications.

The goal is to provide energy provider utility leaders with the tools to create a clear, data-driven comparison of total program costs and key drivers (integration fees, customer incentives, device longevity, operations, maintenance, etc.) to inform program strategy.

UPFRONT COSTS AND VENDOR INTEGRATION

Initial Capital Outlay. LCS programs entail higher upfront costs. The utility purchases and installs load control devices on customer equipment, incurring hardware and labor expenses at each participant’s premise.

By contrast, BYO thermostat programs can have lower initial deployment costs by leveraging devices customers already own or purchase themselves. Likewise, BYO thermostat programs eliminate the need for professional installation visits, resulting in immediate savings on installation and hardware expenses.

While BYO programs shift the initial labor and equipment cost burden from the utility to the customer, there are several other important trade-offs to consider.

Integration and Platform Fees. BYO programs require integration with third-party thermostat vendors or an aggregator platform. Managing multiple thermostat brands can add complexity and vendor costs.

While BYO programs avoid some one-time device costs, they introduce new integration intricacies and expenses. Utilities must weigh these ongoing fees against the hardware costs of a utility-owned load control switch program. Notably, modern LCS programs typically utilize the utility-owned communications network or an affordable commercial cellular network with minimal or no third-party fees after deployment.



CUSTOMER ACQUISITION AND INCENTIVE COSTS

Enrollment Incentives. Both two-way LCS and BYO programs usually offer enrollment incentives and annual participation rewards, which are a key cost driver. Traditional DLC programs (utility-installed thermostats and switches) often provide bill credits or gift cards to encourage sign-up and ongoing participation. For example, in a large East coast utility's legacy switch program, customers at the standard cycling level received \$50 upon sign-up and \$50 each year for allowing peak-day AC cycling. While BYO programs tend to employ similar incentive structures, the amounts usually differ. A nearby utility offers an \$85 one-time enrollment credit and \$25 per summer season for each BYO thermostat, contingent upon the customer's participation in at least 80% of event hours.

While the dollar values vary by utility, the general trend is that LCS program incentives need not be higher than those of BYO programs. Both programs incur incentive costs to acquire and retain participants, but LCS programs do not inherently require higher payments.

DEVICE LIFESPAN AND RELIABILITY

Asset Life and Depreciation. One often-cited advantage of LCS devices is their long service life and reliability. Utilities have deployed millions of these products over the past several decades, and these units are designed and built to remain in the field for up to 15 years or more. It's common for an LCS device on an air conditioner or water heater to remain operable for decades with minimal maintenance.

Since utilities can capitalize the upfront cost of these devices and amortize it over a long useful life, the switch is a long-term infrastructure asset. Studies commonly cite a 15-year economic life is assumed for load control switches – a testament to their proven longevity. This long horizon can make the initial investment more palatable when viewed over the whole lifecycle.

Smart thermostats, while extremely useful, are consumer electronics devices and tend to have a shorter functional life in practice. Manufacturers and regulators might assume a 10–15 years useful life for a thermostat, but homeowners tend to replace or upgrade their thermostats more frequently for technological or aesthetic reasons. Each time a participant changes out a thermostat, the utility loses a DR-enabled device unless the new unit is re-enrolled. This churn adds to program costs over the long run, as the utility must

continually recruit new enrollments to replace devices that have fallen out of the program due to attrition or home sales.

Connectivity Can Impact Reliability. LCS hardware receives signals directly from the utility (via meter and cellular networks) and it ensures high availability. Since program operators have direct connection to deployed LCS, any non-responsive devices can be investigated and cellular or meter network issues can be immediately addressed. Service visits can be scheduled for exterior installations without requiring active participation of the customer.

Whereas BYO devices operate over each customer's broadband and can become stranded due to local Wi-Fi issues or changes to the router password. Due to churn and internet connectivity issues, utilities typically need to recruit 10-15% more customers (or in some cases, a higher percentage) to maintain program participation levels compared to 2-way LCS devices.

MAINTENANCE AND VERIFICATION COSTS

Ongoing Maintenance. After deployment, maintaining program equipment is another key cost driver for the program. With LCS programs, the utility owns the hardware at the customer's premise and is responsible for its upkeep. If an LCS loses connection to the head end or stops detecting optional load data, the utility can dispatch technicians for inspection to determine if the device has failed or is bypassed. And since demand response air conditioning switches are typically located outside, this can be accomplished without requiring a customer appointment.

In BYO programs, the utility has no indication as to why a device is offline. The device may have failed, been upgraded to a newer model, or there may have been a change to the local Wi-Fi network that took the device offline. With LCS programs, program operators have visibility into cellular or meter network outages and can respond accordingly.

Access to Device Data. Both BYO programs and modern switch systems offer two-way communication for event verification. This capability reduces uncertainty and the need for after-the-fact field checks. It streamlines event verification and high-level performance data is rapidly and readily available.

However, specific telemetry and operational data provided by BYO thermostats can be subject to manufacturer policies on availability and ownership.

With LCS Programs	With BYO Thermostat Programs
The utility owns all device data	The utility often pays annual fees for device access
One platform. One EULA (End User License Agreement)	Data ownership rights subject to customer EULAs (End User License Agreements) for each thermostat manufacturer
Individual LCS data is available 24/7/365	Data may only be available at specific times and/or only in aggregate
Uniform operational and telemetry data	Available data varies by thermostat vendor
Utility managed network	Home network dependent

kW Factor Comparison. Different thermostat vendors support different control strategies. Some allow cycling, some allow temperature offsets, and some do not allow insight into control methods. Temperature setback strategies typically provide a good first-hour kW reduction, but are often less effective for longer control events.

Similarly, the availability of BYO device event data can vary from vendor to vendor, making program effectiveness more complicated to quantify. The inconsistency in data offered by various manufacturers also makes cross-portfolio performance comparison difficult.

Contrasting that to a two-way LCS program, the utility can manage loads at their discretion and retrieve runtime and (optionally) actual consumption data. Additionally, as an improvement over simple temperature offset control, today's load control switches can autonomously adapt load duty cycles to achieve load reduction as needed.

This all adds up to a better kW factor for LCS programs. A recent program evaluation presented at the 2025 spring PLMA event showed an average kW factor improvement of over 75% for a two-way LCS vs. a smart thermostat event.



OTHER COST DRIVERS AND CONSIDERATIONS

Several additional factors influence the cost-effectiveness of LCS vs. BYO thermostat programs:

Adoption. Potential participants often prefer load control switches over BYO thermostat programs, as switches are viewed as straightforward and less intrusive. Thermostat control, by contrast, can raise concerns about privacy and autonomy, with some customers perceiving that the utility is directly interfering with their home comfort settings. This creates a ‘big brother’ perception that

can negatively affect program acceptance, whereas switches are generally regarded as a simpler, lower-friction solution.

Installation. LCS programs use professional installers at each premise. This brings with it the benefit of a brief but professional assessment of the connected equipment, including tonnage. In fact, Itron installation teams follow a rigorous process that includes documentation and photographs at each installation. This is valuable information when evaluating customer claims and questions. Having eyes on the actual installation and on-site equipment also helps prevent program free riders.

Where BYO programs incentivize the purchase and/or self-installation of a thermostat, program operators have no indication of the condition, tonnage or state of the customer's equipment. Therefore, performance estimates of BYO programs are generally calculated based on runtime data but do not account for equipment size.

Customer Experience. Moving beyond installation, load control switches quietly wait to be activated. From the customers' perspective, they are out of sight and out of mind. And well-designed load control program managed by experienced operators can be implemented with minimal or negligible customer impact and typically generates few customer calls.

Conversely, “high touch” programs tend to drive a higher number of customer center calls.

Multiplicity. While BYO programs focus on “connected” devices, LCS programs allow access to other non-connected loads. A single LCS device can harness multiple loads such as A/C compressors, heat strips, water heaters, pool pumps, etc. allowing the utility to utilize the switch in both summer and winter programs. In fact, more than half of all Itron load control programs are multi-asset programs.

Equal Access. A load control switch installed by the utility offers consumer access to the program regardless of their ability to provide broadband access or to provide and operate a smart thermostat. This is not just a societal benefit, but a financial one as well. It gives utility access to more curtailable loads than broadband-based BYO programs.

The Pre-Enrolled Customer. In the case where the utility already has a legacy one-way LCS program, there is also the option of a streamlined “tech-refresh” strategy. In this scenario, the utility already has an enrolled base of participants, agreements, and a reward structure in place, resulting in greatly avoided or reduced customer acquisition costs of \$75 to \$100. In some cases, a simple bill insert and email campaign is all that is required to begin immediate rollout of a new two-way switch program.

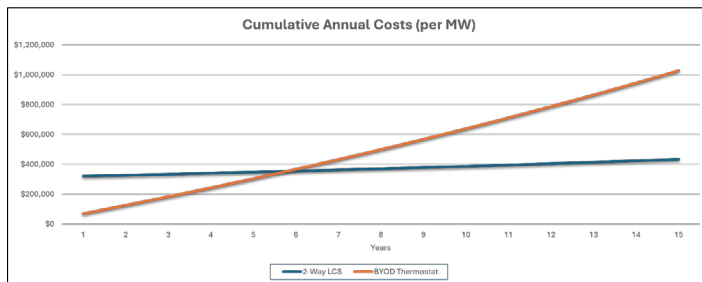
SHORT-TERM VS. LONG-TERM COST OUTLOOK

When considering regulatory and cost recovery factors, accounting treatment can also influence perceived cost. LCS hardware and installations can often be capitalized (with regulatory approval) and included in a rate base, meaning the utility earns a return on that investment over the device's life. BYO thermostat program expenses (incentives, vendor fees) are typically classified as operational expenses. Each utility will need to consider how cost recovery mechanisms treat LCS vs BYO thermostat expenditures when evaluating long-term cost-effectiveness.

When viewed holistically, LCS programs tend to have a cost advantage in the long term as low recurring costs and the benefits of the initial capitalized investment pay off over the 15-20 years a switch can stay in the field.

A front-loaded LCS program incurs much of the expense in equipment and labor. This makes the initial cost per kW of load shed higher for LCS than a BYO thermostat. However, once those switches are installed and paid for, the ongoing costs of an LCS program are relatively low. The devices can perform year after year with only modest annual maintenance and incentive payments. Over the typical 15-year lifespan of a load control switch, the total cost of ownership for a well-run LCS program is very attractive, particularly if the utility is leveraging capital recovery.

The example below represents an actual cost-benefit analysis viewed over time for an existing Itron customer. Initially, the BYO thermostat program's cost per MW appears attractive, at less than a quarter of the LCS deployment cost. However, real-world Itron meter data has shown that the equation flips as early as year five or six, as the total cumulative LCS program costs remain flat while recurring vendor fees and thermostat churn weigh down the BYO program. Over a fifteen-year program, the cumulative annual costs per MW more than double for the BYO program.



With a direct install LCS program, the utility “pre-pays” for a long stream of load relief and enjoys returns for years following. For example, BGE’s 350,000-device PeakRewards program (launched in the 1990s) had such scale and sunk infrastructure costs that it remained highly cost-effective for decades, with benefit-cost ratios around 3:1 when evaluated as a mature portfolio¹. The heavy lifting was in the past; later years were primarily only maintenance and incentive costs to keep the program going.

BYO thermostat programs, on the other hand, continue to incur costs each year for new enrollments to offset churn and vendor services. If the lifespans of smart thermostats or customer loyalty end up being

¹ documents.dps.ny.gov

shorter than expected, a BYO thermostat program could face even higher long-term acquisition costs than initially assumed.

CONCLUSION

In many cases, the best strategy is not either/or but a portfolio approach. Utilities can utilize BYO thermostat programs to quickly and cost-effectively capture engaged, tech-savvy customers, while still leveraging existing direct load control infrastructure for those who don’t have smart thermostats or prefer a utility-installed solution. Some utilities run concurrent offers (e.g., a free switch or a discounted thermostat option) to maximize participation across customer segments. This approach can tap the strengths of both models – the low upfront cost of BYO thermostat and the long-term durability and high data availability of utility-controlled devices.

For specific applications (e.g., controlling electric water heaters or pool pumps), a direct switch may remain the more straightforward and more cost-effective tool. The same is true for specific customer segments (e.g., income-constrained or low digital literacy). For these scenarios, a load control switch is the obvious choice.

From a cost perspective, BYO thermostat programs offer immediate cost savings by shifting device and installation expenses to the customer and reducing operational costs for enrollment and verification. LCS programs require a higher upfront cost but provide a reliable, long-lived load control asset that can yield dividends over a prolonged period with minimal intervention.

Ultimately, BYO thermostat programs are attractive in the short term due to their ease of program launch, while LCS programs, with their long-term amortization and reliability, provide long-term value and a wider range of load and customer diversity.

Many utilities are finding success blending the two approaches to maximize grid reliability at optimal cost. The decision need not be binary – it can be tailored. Itron recommends utilities consider the specific cost factors detailed in this report in the context of their service territory: existing infrastructure, customer demographics, technology trends, and regulatory treatment of program costs. By doing so, one can craft a demand response portfolio that delivers peak-load reduction at the lowest total cost over both the short and long run, keeping rates low and customers satisfied.

Beyond DR – The IntelliFLEX Platform. No technology provider is as well-positioned as Itron to deliver both BYO and LCS programs, not only together, but as part of a larger ecosystem of advanced grid edge DERMS.

Itron’s IntelliFLEX suite of solutions integrates Grid Edge Intelligence (GEI) to enable utilities to orchestrate a wide ecosystem of flexible loads and distributed generation—from load control switches and smart thermostats to solar PV, batteries, and bi-directional EVs. IntelliFLEX delivers DER-powered grid services, including economic dispatch, non-wires alternatives, local grid balancing, and decarbonization.

Wherever you are in your energy transformation journey, Itron offers proven solutions to help you achieve your goals today—and stay ready for tomorrow. Let’s start the **conversation**.

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