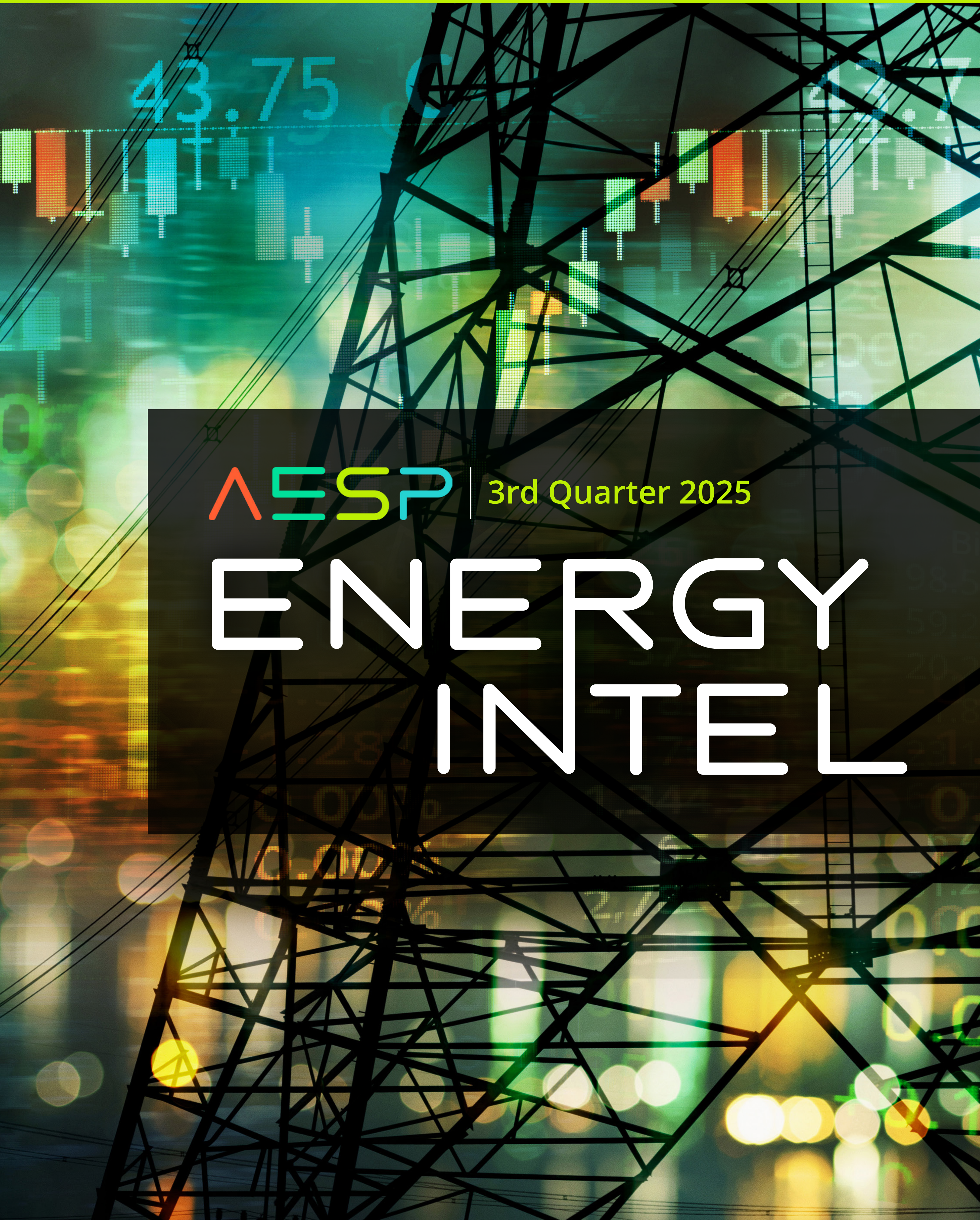

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A Letter From Our Board Chair

Knox W. Cameron, Director of Renewable Solutions, DTE

To the entire AESP Community,
Welcome to the Q3 edition of Energy Intel. More and more, it feels like we're not simply in the energy business. We're also in the business of transformation. Markets are moving faster than models, technologies are leaping from pilot to mainstream almost overnight, and communities are demanding that the clean energy future be fair, not just fast. The pressure is high, but so is the potential.

That's why this issue's theme, **The Business of Energy**, is so timely. Every step forward in decarbonization comes down to choices: how we regulate utilities, how we price energy, how we build a workforce, and how we connect with customers. Technology sets the stage, but business decisions determine whether the performance soars or stumbles.

THEMES EMERGING IN Q3

Rethinking Regulation
The old cost-of-service model has served its time. It built a reliable grid, but it's not built for what's coming next. Electrification is rewriting demand in ways that the old rules can't handle. If we keep rewarding spending instead of results, we'll hold ourselves back. Real progress means flipping the script and tying success to outcomes like lower bills, cleaner power, and fairer access.

Communities as Catalysts
Some of the most important energy decisions are being made close to home, in places like city halls, water districts, and municipal utilities. These aren't flashy stories, but they're powerful ones. By weaving efficiency and decarbonization into daily operations, communities are cutting costs, boosting resilience, and earning trust from the people they serve.

Workforce as Infrastructure
We talk a lot about transmission lines and charging networks, but the truth is, the energy transition can't happen without people. Contractors, technicians, and program implementers are the real infrastructure. Right now, the shortage of skilled workers is one of the biggest bottlenecks we face. Building that workforce is as essential as any capital investment.

Equity in the Economics
Energy is never just about kilowatt-hours. It's about who pays and who benefits. Rate structures, incentives, and program rules can either open doors or shut people out. As costs rise and electrification accelerates, equity has to move from the margins to the center of the conversation. Affordability isn't an afterthought; it's a measure of whether we're truly succeeding.

CONTENT HIGHLIGHTS

Electrify Everything? Not Without Rethinking Regulation
Bill LeBlanc shows why electrification will falter if utilities keep getting rewarded for capital spend instead of outcomes. Performance-based regulation offers a way to spark innovation, keep costs in check, and align utility health with the public good.

Municipal Decarbonization: Water & Wastewater Facilities
Cascade Energy highlights how San Antonio and Clifton turned overlooked water systems into engines of savings and climate progress. Strategic energy management helped avoid millions in costs while strengthening resilience at the community level.

A Unicorn and a Pegasus Walk into a House
Joe Nunley points out the scarcity of true home performance contractors – the "unicorns" of the clean energy world. And when those contractors step into low-income programs, they're at Pegasus-level rarity. Without them, whole-home electrification stalls. Nunley's piece challenges us to think bigger about program design and contractor development so every household has a path forward.

California's Rate Design Revolution
Jordan Folks takes us inside California's bold experiment with rate design. From income-graduated fixed charges to electrification-friendly tariffs, the state is testing how to protect vulnerable customers while clearing the way for widespread electrification. The rest of the country will be watching closely.

The energy transition is not just a technical challenge. It is a test of leadership, policy, workforce, and equity. The business of energy is everyone's business, and our success depends on blending technical ingenuity with bold, human-centered decisions.

Thank you for being part of this mission. By sharing your insights, your challenges, and your successes, you are helping to shape an industry that is smarter, fairer, and stronger with each passing quarter.

Warm Regards,
Knox W. Cameron,
Director of Renewable Solutions, DTE

Redefining Leadership: Driving Industrial Energy Efficiency for a Sustainable Future

By Kenny Porter

Looking back over my journey in energy efficiency, I've realized that the turning points in my career rarely came from technical breakthroughs or the latest program design. Instead, they came from conversations. Sometimes those conversations happened in unexpected places—like during a lighting install at the Mother Cabrini Shrine, where I learned as much from the sisters who run it as they did from me, or at a cricket match behind a Super 8, where I connected with community members I never would have met otherwise.

These experiences reshaped how I think about leadership. Technology may drive efficiency, but it's people—and the way they connect—that determine whether organizations thrive. By reframing communication as a leadership practice, not just an interpersonal skill, we can unlock new pathways to innovation, equity, and resilience in the energy sector.

In our industry, conversations about decarbonization often revolve around technologies and regulatory drivers. These are critical factors in making progress toward decarbonization, but they shouldn't be our only focus. A less obvious—yet equally important—barrier to decarbonization is the way organizations define and practice leadership.

Too often, leadership is viewed as a position, not a practice. The people holding executive titles are seen as the only real leaders in the room, while the rest of the organization is expected to follow. Champions of this traditional top-down management style praise its efficiency, but in practice, it actually creates bottlenecks, hinders innovation, and misses opportunities to engage the organization's front lines.

Why should we be thinking about leadership differently in the context of energy efficiency? Right now, our industry is at a pivotal moment. On one hand, we're facing enormous challenges—climate urgency, tightening regulations, and decarbonization mandates. On the other, the energy landscape is evolving at a faster pace than many organizations can keep up with. Technologies are shifting, funding models are changing, and stakeholder expectations around sustainability are higher than ever before. And yet, many leadership teams still treat energy performance and carbon management as peripheral—a function of compliance, or just a line item in the operations budget.

Companies who integrate energy performance into their leadership frameworks are gaining a competitive edge while also fostering long-term sustainability. These are the organizations that will stay ahead of policy shifts, attract forward-thinking talent, and respond to the market with agility. This requires moving beyond the idea that leadership is confined to the C-suite. It means recognizing and cultivating leadership capacity at every level of the organization.

I've identified four key tenets that allow organizations to redefine leadership in industrial energy efficiency:

1 Empower All Levels of Leadership

The traditional top-down management structure means that most organizations today only empower the few at the top to make decisions, even though those decisions affect all in the organization. Essentially, this means the people closest to the work, from the account managers to the field team, carry out orders without the opportunity to use their valuable insights from the frontline.

Consider these scenarios: An opportunity to work with a new customer disappears because the decision-maker who could approve a creative solution isn't available for a couple of weeks. Alternatively, an engineer in the field identifies a fix that could save thousands, only to have it die somewhere in "the process." Even if your organization's leaders are well-intentioned, they may be unwittingly participating in a system that sidelines the voices that could speed decarbonization forward.

Instead, empowering staff at all levels to make decisions (within clear parameters) not only removes bottlenecks, it also fosters a culture of ownership and accountability. When departments are encouraged to operate like a small business, staff are more likely to innovate, take initiative, and pursue solutions tailored to customer needs. This approach also signals trust, which can be a powerful motivator for employees. An empowered workforce is more engaged, more adaptable, and more invested in organizational success.

2 Develop Essential Skills Beyond Technical Expertise

Technical qualifications, along with certifications such as CEM, CLP or EEP, remain important. But we need to go even further. The leadership we need in order to make real progress toward decarbonization must also develop "soft" skills that aren't taught in these courses.

Communication and strategic thinking are essential. These skills enable customer-facing staff to translate complex technical findings into actionable steps for different audiences and connect project outcomes to broader organizational goals. Perhaps most importantly, clear and direct communication of lessons learned on past projects can be integrated into future project planning, creating more efficiency in the organization. Strong communicators can bridge the gap between engineering teams and facility operators. Strategic thinkers can identify pathways that align technical possibilities with customer priorities.

Additionally, companies should provide training in data-driven energy management, carbon accounting, and sustainable operations. This ensures the leaders we've just empowered to make their own decisions are making well-informed choices and creating solutions that are long-lasting for the health of the organization.

3 Engage Communities as True Partners

Decarbonization is a team effort. Our communities play a central role in both the success of programs and the credibility of the organizations delivering them. When entering a new market or community, it's best to cast a wide net. This includes reaching out to housing authorities, local nonprofit organizations, community-based groups, and cultural networks. It's also particularly important to reach out to those parts of the community that have historically been underserved, rather than defaulting to the loudest voices or easiest-to-reach stakeholders. To make meaningful progress, community engagement must be genuine and built on listening and mutual respect, not simply fulfilling a contract requirement or checking an outreach box.

Because many in our communities are often wary of utility companies, building trust requires consistency and a willingness to invest time before expecting results. The payoff is significant: long-term relationships yield stronger participation, better program outcomes, and a foundation for future collaboration. When customers feel heard and understood, they are more likely to engage. Studies and field experience alike show that customers who interact more frequently with their utility consistently report more positive experiences.

Recently I had a chance to work on a project for an oft-forgotten community: the incarcerated population. Prison facilities use massive amounts of energy, but the incarcerated community that lives in that space is rarely considered. When Colorado's Department of Corrections came to Michaels Energy for solutions that would better serve their facilities and community, we jumped at the chance. By working across multiple utilities (Black Hills and Xcel Energy) we built a customized portfolio that accounted for different energy landscapes, staff capabilities, and operational realities. This approach showed us that leadership in energy isn't just about the measures you implement—it's about how you empower teams, tailor solutions, and create accountability at every level.

4 Shift from Reactive to Proactive Leadership

Many organizations still default to a reactive mode of operation, addressing issues only after they arise. While problem-solving is an important leadership function, it is not enough for sustained progress.

Proactive leadership means anticipating customer needs, identifying opportunities for improvement before they are requested, and framing solutions in a way that aligns with customer priorities. This approach transforms the relationship from one of service provider to strategic partner. Remember: you don't want your team's first customer interaction to be with an unhappy customer. Mitigate complaints by understanding the way the customer uses your product and then offer ways to improve their experience. For instance, rather than introducing a demand response program only when customers face high bills or operational constraints, proactive leaders engage early, explaining the long-term benefits and positioning it as an opportunity rather than a remedy.

To put these leadership principles into practice, organizations can start by asking:

- Are decision-making responsibilities clearly defined at all levels?
- Do staff have the skills to communicate effectively with both technical and non-technical stakeholders?
- Are there intentional strategies for engaging communities beyond traditional outreach channels?
- How often does the organization initiate contact with customers or partners proactively rather than reactively?

Addressing these questions creates a roadmap for integrating leadership development into broader decarbonization strategies.

Industrial decarbonization depends on technology, policy, and financing—but, it also deeply depends on people. Organizations that redefine leadership to empower staff at every level, expand skillsets beyond technical expertise, engage communities authentically, and lead proactively will meet decarbonization goals faster while building organizational sustainability.

In the end, the most sophisticated technology is only as effective as the people leading its implementation. Redefining leadership is a strategic imperative for the industrial energy sector's sustainable future.

Kenny Porter
Associate Director of Account Management, Michaels Energy

Kenny Porter is the Associate Director of Account Management for Michaels Energy. In his role, he provides leadership to the Account Management team and brings his experience and expertise to the Programs group focusing on the outreach and delivery to multiple clients across Colorado.

Kenny has spent most of his career in Energy Efficiency. Before joining the Michaels team in 2022, Kenny worked at CLEAResult as a direct install coordinator in Tulsa, OK. He then received a promotion to lead the direct install program in Denver. Kenny then moved into an outreach role that required him to wear lots of hats from launching pilot programs to implementing retail lighting programs and commercial and residential audits. After 7 years, Kenny joined Resource Innovations as an Outreach Service Provider supporting large municipal customers for ComEd.

Kenny has built a strong track record in energy efficiency by helping turn complex ideas into clear, practical solutions. He supports team growth and creates customer-focused approaches that help programs succeed and move decarbonization forward.

Electrify Everything? Not Without Rethinking Regulation

By Bill LeBlanc

A Utility Model Built for Yesterday

The U.S. electricity system is in the midst of the most profound fundamental shift in 50 years, with electrification, renewable supply, electric vehicles, battery storage and a host of other macro-changes hitting the market. Yet the regulatory model guiding utilities remains stuck in the mid-1900s. Utilities are often still rewarded based on building infrastructure — power plants, substations, wires, charging stations — rather than for achieving the outcomes society actually needs: lower costs, lower carbon, higher reliability, and equitable access to clean energy.

This mismatch creates real costs. Consumers pay more than they should, carbon emissions fall too slowly, and innovation stalls. Regulators spend endless hours approving specific activities rather than steering the industry toward measurable high-level goals. The result: a system that too often misplaces investments and misses opportunities.

The electrification wave makes the stakes even higher. Electric vehicles (EVs) have been the fastest-growing new load on the grid, but they are far from the only one. Data centers, heat pumps, electric water heating, induction cooking, and emerging industrial electrification will together add demand on a scale unseen in decades. Managed wisely, these loads can improve system efficiency, lower bills, and slash carbon. Managed poorly, they could raise costs, exacerbate inequities, and overwhelm aging infrastructure.

The moment calls for a new regulatory compact — one that rewards utilities not for how much they spend, but for what they deliver. Performance-based regulation (PBR) offers exactly that pathway.

Shifting Risk and Responsibility

Traditional cost-of-service regulation makes regulators the de facto architects of utility activities. Commissions approve line items for capital projects and programs, utilities earn a return on those capital expenditures, and performance is judged largely on whether spending was prudent.

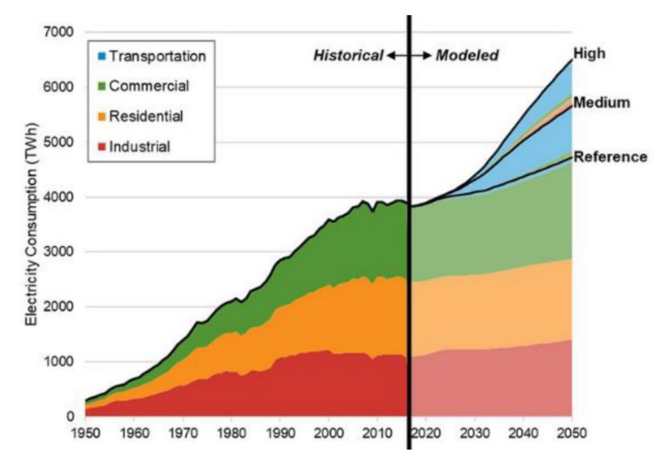
PBR flips that model. Regulators set the destination; utilities choose the route. Instead of dictating activities, regulators establish societal goals, performance metrics, and rewards. Utilities are free to innovate, and they earn more only when they meet and exceed long-term results.

This shift is profound. It transfers more responsibility — and more opportunity — to the utility. It requires regulators to get out of the business of micromanaging programs and into the business of setting outcomes. Done well, it aligns the financial health of the utility and its shareholders with the wellbeing of its customers, the grid, and society as a whole.

The Societal Goals of Electrification

Any re-regulation must start with clarity about the end goals. For electrification, four pillars consistently emerge across states and industry stakeholders:

- Grid Optimization & Cost Containment. Electrification should manage load shapes, improve asset utilization, and defer new infrastructure, putting downward pressure on rates.
- Carbon Reduction. Shifting end uses from fossil fuels to clean electricity is one of the most powerful climate strategies available.
- Adoption Acceleration. EVs, heat pumps, and water heaters won't scale fast enough if we are in an endless loop of pilot programs and extended evaluation periods.
- Equity. Benefits of electrification must extend to all customers, including renters, low-income households, and communities affected by pollution.



Notably, none of these goals require utilities to spend more capital as the primary method of achievement. But they do require utilities to assess all of the tools at their disposal to achieve those key societal outcomes. If they do a great job, rewards should follow.

These goals cut across the full electrification landscape — from EVs to heat pumps to data centers — but that doesn't mean regulators must tackle everything at once. In fact, starting with a single end use, like EVs or data centers, can build confidence before expanding PBR more broadly.

Performance Incentive Mechanisms: The Core of PBR

The heart of PBR lies in Performance Incentive Mechanisms (PIMs). These are metrics, targets, and financial rewards (or penalties) tied directly to outcomes. Unlike prescriptive rebates or program mandates, PIMs measure whether the utility achieved a goal — and let the utility decide how.

Here are sample PIMs across electrification sectors:

Transportation (EVs)

- Reduction in peak load growth attributable to EV charging. (Note that this doesn't need to be just system load, but can be localized for the distribution system.)
- Percent of EV load shifted to off-peak periods.
- Percent of EVs enrolled in managed charging programs (utility-direct or third-party).
- EV market penetration benchmarks (registrations as % of new sales).

Buildings (Data Centers, Heat Pumps, Water Heating)

- Shifts in overall heating/cooling/operational efficiency in the population.
- MWs of building electrification under flexible control.
- Carbon reduction per dollar of incentive spending.
- Comfort and bill savings for low-income households adopting heat pumps.

System-Wide

- Downward pressure on rates.
- Improvement in overall system load factor.
- Carbon intensity of marginal kilowatt-hours consumed by new electrification.
- Equitable distribution of program benefits across income levels and geographies

Why Activity-Based Regulation Falls Short

Consider a common pattern in today's utility electrification plans. A utility offers rebates for EV chargers or heat pumps. Customers install the equipment, the utility reports the number of rebates issued, and regulators chalk it up as progress.

But does that guarantee off-peak charging? Or that the heat pump actually displaced gas usage? Or that low-income households benefited? Not necessarily.

Activity-based regulation rewards the act of spending, not the act of delivering. It locks utilities into compliance mode instead of discovery mode. By contrast, outcome-based PIMs pay only if the intended benefits materialize — forcing utilities to innovate, test, and adapt until they find what works.

Table 1 provides examples of what electric transportation PBR might look like along a spectrum of modest to advanced PIMs. Today, EV load impacts are already showing up by stressing transformers in neighborhoods with high EV penetration. Fleet operators seeking to transition to EVs are finding years-long waiting periods for upgrades, but different solutions that minimize the need for upgrades are not implemented due to today's regulatory limitations.

A recent report titled *The Utility Playbook: Turning EV Grid Risk into a $30 Billion Opportunity*[1] highlights exactly the downward pressure on electricity costs (compared to business as usual) that could be achieved through intelligent control of electric vehicles. Yearly savings of $30 billion nationally is a highly significant influence on costs even for those without EVs, and this savings is unlikely to be delivered if utilities are rewarded for capital expenditures vs. savings through grid optimization.

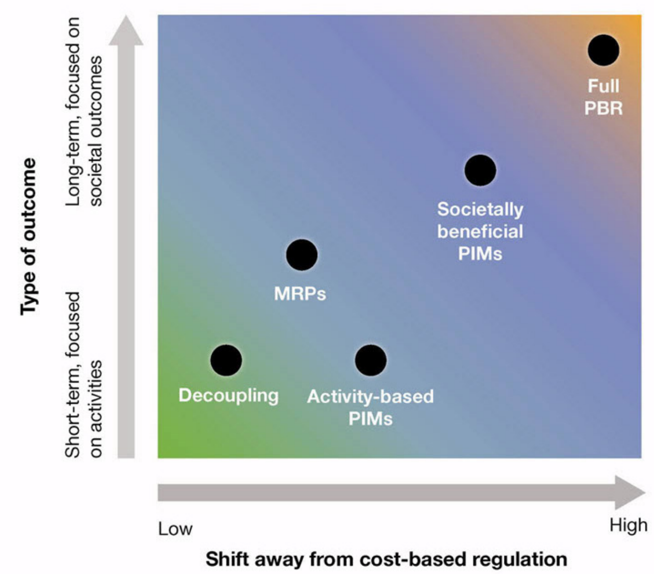
EXAMPLES for Various Degrees of PIMs for PBR	Traditional program/ activity oriented	Traditional plus customer goal	Light PIM	Aggressive PIM	Societally-beneficial outcome-oriented PIM
EV Charging Management, Minimize Rate Increases Caused by Transportation Electrification	PUC approves program spending for TOU rates and managed charging programs, and rebates for charging equipment	PUC adds goal for number of participants for TOU and managed charging programs	PUC sets goals for per customer shift in EV charging to off peak periods, independent of method used, and number of customers participating	Goals focus on overall system load shifts due to transportation, or kWh peak vs. off peak, utility determines methods	Utilities have rewards based on level of cost containment driven by TEP charging patterns, including locational constraint identification
Accelerating Environmental Improvement	PUC approves EV charger rebates, with uncertain impact on EV adoption	PUC adds target for number of participants in EV charger programs	PUC sets a goal for % of time customers charge in times of high level of renewables	Goals focus on overall carbon and local pollution reduction for EVs on utility programs, with the utility incented to influence times for EV charging	Utilities have rewards based on accelerating carbon reduction and local pollution beyond set benchmarks
Accelerate EV Adoption, Lowering Costs of Transportation for Customers	PUC approves education & outreach spending to encourage EV adoption	PUC adds goals to reach a minimum # of customers with outreach methods	PUC/utility track awareness and intent to buy EVs among customers	Goals focus on specific EV purchasing metrics, including visits to EV purchase sites, EV registrations, distribution of EVs among target audiences	Utilities have rewards based upon EV adoption compared to set benchmarks

Why This Isn't as Risky as It Sounds

Skeptics worry that PBR exposes utilities to too much uncertainty. What if EV adoption lags? What if customers resist heat pumps? It's easy to stick with the status quo.

The answer is to **design incentives with the right balance of risk and reward**:

- Upside-Only Incentives for experimental areas (e.g., vehicle-to-grid pilots, early HPWH enrollment). Utilities can earn bonuses for success but aren't penalized for failure.
- Symmetric Rewards/Penalties for established metrics (e.g., peak load reductions with air-conditioning, carbon intensity improvements). Utilities share in both the upside and downside.
- Earnings Sharing Mechanisms that cap excessive returns (or losses) and redirect surplus savings to ratepayers.



Note: MPRs = multiyear rate plans; PBR = performance based regulation; PIMs = performance incentive mechanisms. © E Source

In other words, regulators don't have to hand utilities a blank check. They can provide real financial motivation while still protecting customers.

Dynamic Management of Electricity Demand

For decades, load management has focused on what typically causes the peak system loads, namely air-conditioning and sometimes winter heating. Now, EVs are coming quickly into the mix with not only their flexible timing for charging, but the future promise to provide power back to the grid. But which end-uses should have the most attention and investment? The answer is...we don't know as much of this is new. However, regulators and rate cases are not able to keep up with the pace of technological change.

Option 1: Stick with today's regulation, and fall more behind each year as EVs, data centers, and heat pumps are installed but not optimized to the grid of tomorrow;

Option 2: Shift to performance incentives for electrification which rewards societally beneficial outcomes and speed to market.

With the right PIMs, utilities have strong motivation to integrate these loads into system operations.

Lessons from the States

Several states offer insights into how PBR can be deployed — though most have focused on reliability, affordability, and carbon, rather than electrification specifically.

- **Hawaii:** Facing the nation's highest electricity rates, Hawaii adopted a comprehensive PBR framework in 2020. Its PIMs include renewable integration, DER interconnection speed, and equity targets. Key lesson: start narrow, but design for scalability.
- **Minnesota:** Through the E21 initiative, stakeholders designed PBR pathways for vertically integrated utilities like Xcel. Their process shows the value of collaborative, multi-stakeholder design rather than adversarial rate cases.
- **New York:** The "Reforming the Energy Vision" (REV) effort created Earnings Adjustment Mechanisms (EAMs) tied to carbon reduction, customer engagement, and DER adoption. It also highlighted the importance of real-time metrics rather than years-delayed program evaluations.

The takeaway? PBR creates flexibility. It can start with a narrow electrification focus and expand over time. States that succeed pair bold outcome goals with pragmatic guardrails.

A Practical Roadmap for Electrification PBR

For regulators considering this shift, here's a sample stepwise approach. A collaborative process is needed to succeed in each jurisdiction:

1. **Start Narrow, but not Shallow**. Pick one or two areas of focus such as EVs and data centers. Build confidence before expanding.
2. **Define Clear Goals.** Anchor them in societal outcomes: lower bills, lower carbon, equity. Capital expansion will be essential, but optimizing the capital spend is the key.
3. **Design Balanced Incentives.** Use upside-only rewards for new or experimental areas, symmetric mechanisms for established ones.
4. **Set Guardrails.** Apply innovative methods to reward shareholders while also providing majority benefits to all customers.
5. **Engage Stakeholders.** Bring utilities, consumer advocates, technology providers, and community groups into the design process from day one.
6. **Iterate Quickly.** Use pilots and real-time data to refine metrics and incentives...but work using continuous improvement methods vs. multi-year pilots and evaluations.

This roadmap doesn't eliminate risk. But it channels risk into innovation, rather than into traditional infrastructure spending.

Equity: More Than Equal Access

Equity is often an afterthought in electrification plans, addressed with carve-outs for chargers in underserved neighborhoods. But equity isn't about equal access; it's about **meeting actual needs**.

For renters, that may mean access to portable heat pumps or flexible billing plans. For rural households, it may mean load-shifting water heaters that reduce winter peaks. For urban low-income communities, it may mean targeted pollution reductions from bus electrification.

Outcome-based PIMs can focus on these end results — for example:

- Reduction in specific pollutants in identified geographic areas.
- Verified bill savings for low-income heat pump participants.
- Adoption of electrification technologies by renters or multifamily households.

By rewarding utilities for delivering these outcomes, regulators can ensure equity is not just a box checked, but a goal achieved.

The Bottom Line: Electrification Demands Regulatory Reinvention

Electrification is not a boutique trend. It is the central force reshaping the grid for the next three decades. EVs, heat pumps, and water heating alone could add as much demand as a dozen new nuclear plants. Done wrong, that demand will drive up costs, deepen inequities, and slow carbon reductions. Done right, it can lower bills, clean the air, and make the grid more resilient.

But "done right" requires regulators to move beyond the century-old model of cost-of-service regulation. It requires utilities to be rewarded for outcomes, not activities. And it requires all parties — regulators, utilities, advocates, and customers — to embrace a model where innovation and performance matter more than paperwork and prescriptive spending.

Performance-based regulation is not a panacea. But it is the best tool we have to align utility profit motives with public policy in the electrification era. The sooner we put it to work, the sooner we can ensure that every new kilowatt-hour of demand delivers maximum value for customers, the grid, and the planet.

Bill LeBlanc
Director, Tierra Resource Consultants

Bill LeBlanc has particular expertise in EV adoption, consumer behavior, demand-side management program design, rate design and managed charging, design thinking, and utility strategy. He focuses on helping his utility, government, and business clients with new product development, utility program design and communications, market strategy, and utility thought leadership. Bill has over 20 years of experience working for E Source, EPRI, EV smart charging software companies, consulting firms, and PG&E, and he has given over 50 keynote addresses at events throughout the industry. He was named one of only seven people by the Association of Energy Services Professionals on their list of Game Changers of the past 30 Years. He's also had stints at Disney, Apple, and as a stand-up comedian

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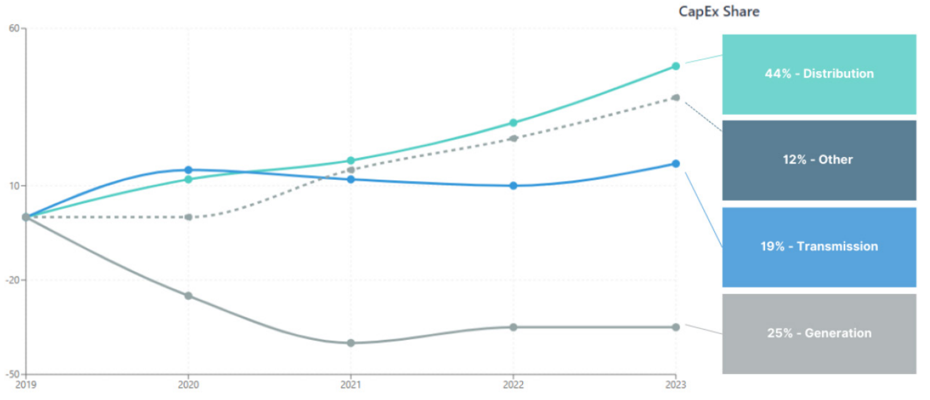
i Powering Paradise: How Hawaii Is Leaving Fossil Fuels and Forging a Path to a 100% Clean Energy Economy , Dan Cross-Call, Jason Prince, Peter Bronski, February 2020

Addressing affordability concerns head-on: how DERs can support whole-system cost prudence

By Chris Broadhurst

US utilities face a mounting consumer affordability crisis that's reshaping regulatory relationships. With bills rising and political pressure intensifying, regulators demand one thing: **proof that utility decisions deliver consumer value**.

Figure 1. Δ Annual capital expenditure (%)

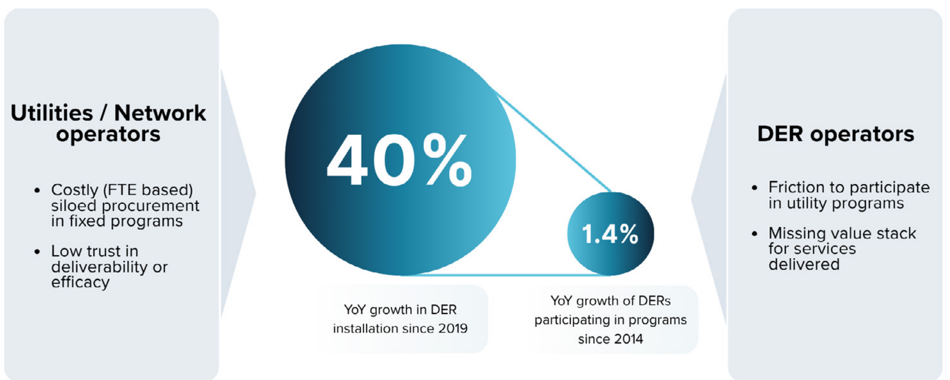


Source: Berkeley Labs, "Retail Electricity Price and Cost Trends: 2024 Update", 2025

The challenge is how fast the system is now evolving, and how much of this is happening at the grid-edge, with data from [Berkeley Labs](#) showing that 44% of utility capital expenditure is now occurring at distribution level (Figure 1.).

DER flexibility offers a fast, low-cost solution to this problem, but utilities are struggling to leverage them at scale. A report from ESIG has shown a large disparity between DER deployment - growing 40% annually – and utility program participation - only increasing 1.4% annually (Figure 2.).

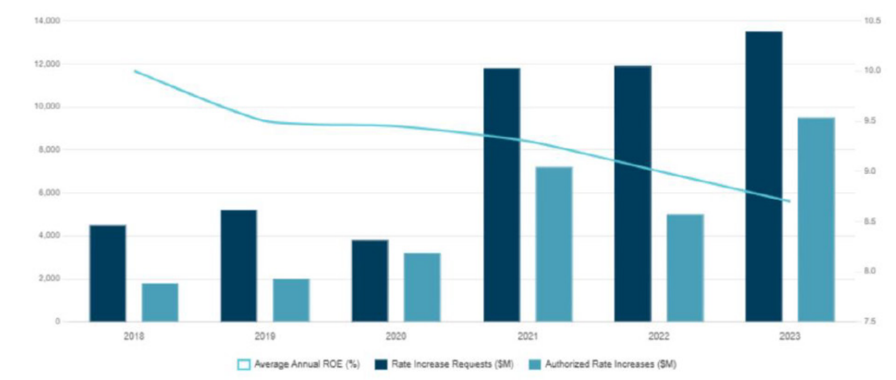
Figure 2. DER installation vs. participation growth



Source: Energy Systems Integration Group, "Gaps, Barriers, and Solutions to Demand Response Participation in Wholesale Markets", Distributed Energy Resources Working Group, 2025, based on data from the U.S. Energy Information Administration

Regulators are taking notice. Rate case approvals now require stronger cost/benefit justification as political pressure mounts for affordability. This pressure is flowing through to utilities' regulated returns, with data from [S&P Global](#) showing how Return on Equity (ROE) has dipped in recent years, in line with a drop in authorized rate increases (Figure 3.).

Figure 3. Analysis of utilities' rate cases and return on equity



Source: S&P Global, "Underearning spread widens for gas, electric utilities in ROE analysis", 2024

Wherever you are, regulators will always look to protect consumers

Regulators across the US operate under one fundamental principle: protecting consumers. The Massachusetts Department of Public Utilities' mission is "to ensure that consumers' rights are protected, and that utility companies are providing the most reliable service at the lowest possible cost". The Public Utility Commission of Texas aims to "protect customers, foster competition, and promote high quality infrastructure." California's Distribution Resources Plan (DRP) requires the California Public Utilities Commission (CPUC) to "minimize overall system costs and maximize ratepayer benefit from investments in distributed resources." This consumer protection focus transcends frameworks, political cycles, and policy trends. Regulators consistently demand evidence-based performance metrics that withstand public scrutiny:

- Transparent data showing direct consumer benefits
- Auditable results that can proactively demonstrate prudence to regulators
- Measurable outcomes linking utility actions to consumer cost impacts

Walking the tightrope: balancing affordability and load growth

Another key challenge utilities face is demonstrating cost prudence whilst simultaneously dealing with unprecedented levels of load growth. This makes network reinforcement a must. But given the scale and urgency of this problem can often leave utilities questioning whether DERs are at the scale or reliability levels needed to play a role.

The reality is, it doesn't need to be an either/or question. By bringing DERs into the planning and operations cycle, we can a) leverage DERs where they have the scale and reliability to meet the grid need and b) use the availability or price of DER flexibility as a counterfactual that can clearly justify the need for proactive grid investment where it's needed most.

This shift in mind-set turns DERs into a grid asset. But it's going to take more than a change in mindset to unlock the value of DERs.

The technical and operational challenges of integrating DERs

There are several technical and operational challenges utilities need to address to integrate DERs into planning and operations.

Firstly, data. DER data is often siloed and spread across multiple teams and systems. From a planning and regulatory engagement standpoint, this makes calculation of costs, consumer benefits, and demonstration of cost-effectiveness to regulators difficult.

This data challenge also bleeds into the operational domain, creating a lack of visibility into where DERs are located, how much capacity they can offer, or their value to consumers. This data issue is naturally compounded by the fact that DER data isn't typically in the utility's control.

This disconnect creates unclear value attribution, restricting how cost-effectiveness can be proven to regulators or consumers.

Another challenge to address is the mismatch between infrequent planning cycles and the increasingly dynamic nature of the grid. This can create missed opportunities where the system needs and DER capabilities aligned but hadn't been accounted for in the plan and so went untapped.

This planning/operations dynamic has been a problem in the UK too. There, flexibility markets have evolved beyond simply holding DER capacity in reserve. Through real-time dispatch markets, distributed resources are actively managed to maintain grid stability and optimize system performance moment by moment.

This frequent coordination of DER flexibility creates dual benefits - enhanced system reliability through active grid management and consumer value through optimized resource utilization. The DER data captured through this coordinated approach can provide the performance insights to inform both operational decisions and long-term planning. It reveals how distributed resources behave and respond to different price signals.

The dynamic interplay between flexibility markets and network planning represents a progression from static infrastructure decisions to adaptive resource optimization – optimization that can reduce consumer costs when executed effectively.

Critical questions then emerge that directly impact consumer costs: How responsive can customers be to sharper price signals? How much will utilities pay to procure flexibility and when will it be available? This information helps determine where and when the next best network upgrade should take place, creating potential savings for consumers.

Using DER flexibility as consumer affordability proof

And therein lies the insight that can transform utility-regulator relationships: DER flexibility serves a dual purpose for consumer affordability. It can address grid needs directly to reduce costs, but it can also provide evidence to justify traditional infrastructure spending when flexibility isn't available at consumer-beneficial prices.

Picture this scenario: A utility runs an open market seeking DER flexibility to defer an expensive infrastructure upgrade. They discover that available flexibility costs more than the infrastructure investment would save consumers over time. Now they have transparent, auditable evidence that traditional grid infrastructure was the most cost-effective decision for customers.

This is consumer value justification backed by market data. Utilities can demonstrate to regulators: "We explored every option to reduce consumer costs. We tested the market for cheaper alternatives. Here's the transparent evidence proving this infrastructure investment delivers the best value for customers."

This approach transforms regulatory relationships by providing exactly what regulators want: proof that utility decisions optimize consumer affordability. Instead of defending spending after the fact, utilities can demonstrate proactive cost optimization that puts consumer value first.

Consumer affordability can't wait for the right policy

Consumer costs will continue mounting if we wait for ideal regulatory conditions. The opportunity for utilities now is to demonstrate affordability and cost prudence through real world results.

By bringing DERs into planning and operations, and treating them as a grid asset, we can drive real consumer value and take a big step towards consumer-focused grid operations.

Sometimes that means building more grid, sometimes deploying DER flexibility. The important thing is showing the evidence base to back up the decision.

Utilities that demonstrate consumer value today will build the regulatory confidence needed to shape tomorrow's DER policies and incentives.

Chris Broadhurst
CCO, Electron
Chris Broadhurst is the CCO at Electron, a gridtech company helping grid operators orchestrate the full value of DERs using a market operations layer. With over a decade of experience in energy, Chris has a passion for driving the adoption of disruptive technologies that can accelerate the transition to Net Zero. He is regularly invited to speak on panels and webinars such as Distributech 2025, PLMA workshops, and ESIG webinars, to name a few. His past experiences span supply, consultancy, and technology, as well as advisory roles for the UK Government's Net Zero Energy Council.

Graph sources:
Berkeley Labs, "Retail Electricity Price and Cost Trends: 2024 Update", 2025

Energy Systems Integration Group, "Gaps, Barriers, and Solutions to Demand Response Participation in Wholesale Markets", Distributed Energy Resources Working Group, 2025, based on data from the U.S. Energy Information Administration

S&P Global, "Underearning spread widens for gas, electric utilities in ROE analysis", 2024

Decarbonization: Insetting and Offsetting Strategies to Reduce Carbon Emissions

By Diana Nash and Mohanad Qomsiya

Atmospheric concentrations of greenhouse gases (GHGs) have increased substantially over the past 150 years,[1] primarily due to human activities. Carbon dioxide (CO_2), largely from fossil fuel combustion, represents the dominant contribution. Methane (CH_4), nitrous oxide (N_2O), and fluorinated gases occur in smaller amounts but exhibit higher Global Warming Potentials (GWPs) and differing atmospheric lifetimes, making them important components of the overall GHG profile. Figure 1 below provides an overview of the contribution of each gas to total GHG emissions.

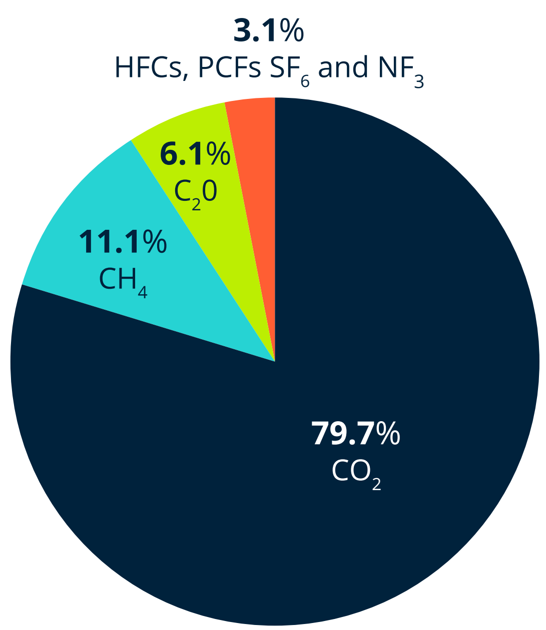


FIGURE 1 Overview of GHG Emissions[2]

Buildings are central to this challenge. They account for roughly 40% of total energy use in the United States, including about 35% of the nation's carbon emissions.[3] While decarbonization discussions often emphasize renewable energy deployment or electrification of transportation, addressing emissions from the building stock is equally critical. Figure 2 presents GHG emissions with electricity-related emissions distributed across economic sectors.

1 Sources of Greenhouse Gas Emissions. (2025). US EPA. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

2 Inventory of U.S. Greenhouse Gas Emissions and Sinks. (2025). US EPA. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

3 NREL Researchers Reveal How Buildings Across United States Do—and Could—Use Energy. (2025). NREL. https://www.nrel.gov/news/detail/features/2023/nrel-researchers-reveal-how-buildings-across-the-united-states-do-and-could-use-energy

Knowing that buildings account for a substantial amount of energy use and emissions is only the starting point. Transforming this understanding into effective action demands a systematic and rigorous evaluation. A Decarbonization Study provides this framework, applying standardized accounting methods such as the GHG Protocol to establish baselines, categorize Scope 1, 2, and 3 emissions, and identify priority reduction measures.

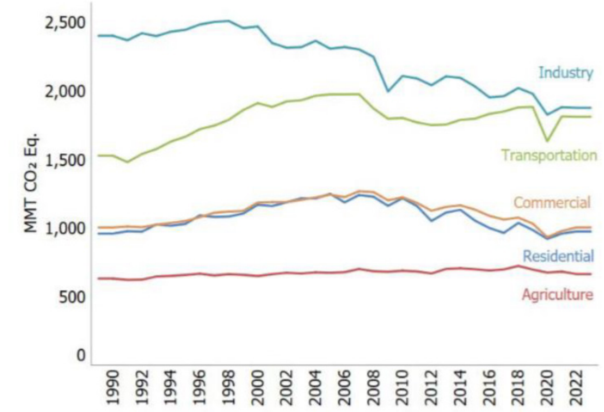


FIGURE 2
GHG Emissions with Electricity-Related Emissions Distributed to Economic Sectors

- **Scope 1**: Direct emissions from sources owned or controlled by the company (e.g., boilers, furnaces, fleet vehicles).
- **Scope 2**: Indirect emissions from purchased energy such as electricity, steam, or district heating.
- **Scope 3**: Indirect emissions from the value chain, including upstream and downstream emissions. Scope 3 emissions are trickier to quantify because many occur outside the operational boundaries of the reporting organization, and methods for measuring them are less standardized.

Figure 3 provides an illustration of the GHG scopes and emissions across the value chain.

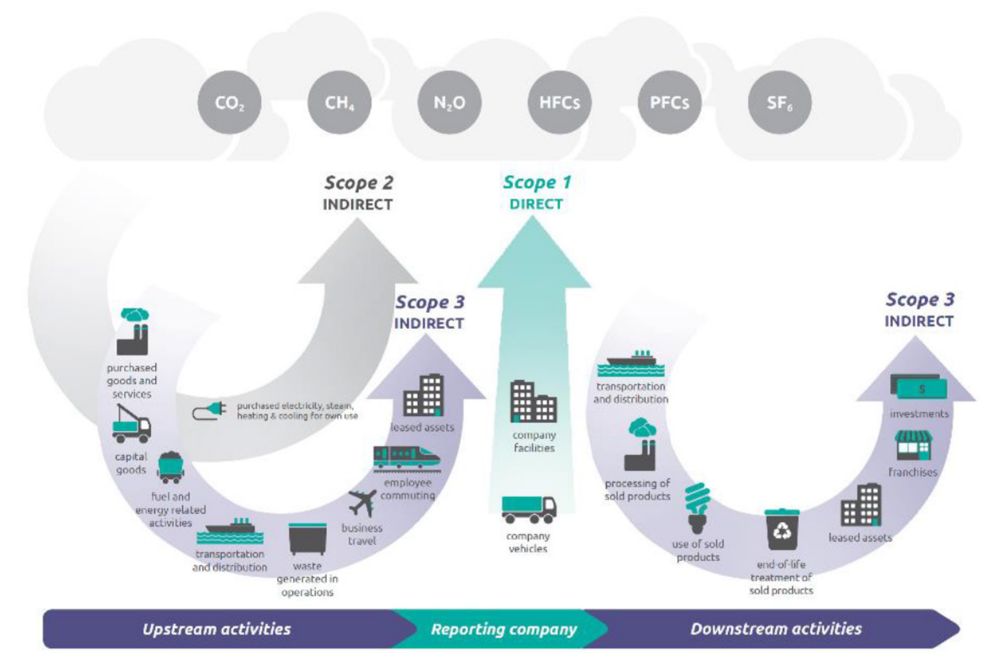


FIGURE 3 GHG Emissions with Electricity-Related Emissions Distributed to Economic Sectors[4]

PwC's Second Annual State of Decarbonization Report highlights that while many companies are making progress on Scope 2 emissions, only 46% are on track to hit Scope 1 targets, and just 54% are on track to hit Scope 3 targets. Yet the report stresses that progress is happening through "quiet, consistent action," and companies that effectively integrate climate targets into financial and operational strategy are better positioned for long-term competitiveness.[5]

Decarbonization typically relies on five pillars:

- Energy Efficiency: lowering consumption through efficiency measures.
- Clean Electricity: reducing carbon intensity of generation.
- Electrification: replacing fossil fuel uses with electricity.
- Clean Fuels: transitioning to low-carbon or renewable fuels.
- Carbon Capture: removing CO_2 from point sources or the atmosphere.

Energy efficiency remains the most cost-effective and immediate pillar. Reducing consumption at the source lowers operating costs, improves resilience, and frees capital for reinvestment. However, collecting and analyzing data is often the greatest challenge. While the five pillars form the foundation of decarbonization, organizations must translate them into practical, operational strategies. This is where carbon insetting comes in. Insetting focuses on direct interventions within an organization's operations and value chain, addressing emissions across Scopes 1, 2, and 3 by embedding efficiency, electrification, clean power, and sustainable design into the way business is conducted. Unlike offsetting, which relies on compensating for emissions elsewhere, insetting delivers reductions at the source. These two approaches will be explored further in the next sections.

4 Scope 1, 2, and 3 Emissions Explained. (2024). Carbon Neutral. https://www.carbonneutral.com/news/scope -1-2-3-emissions-explained

5 PwC's Second Annual State of Decarbonization Report Essential ingredients for achieving your climate ambition. (2025). PwC. https://www.pwc.com/us/en/services/esg/library/assets/pwc-sustainability-decarbonization-2025.pdf

Carbon Insetting

Carbon insetting involves an organization's efforts to lower emissions generated throughout its value chain. The value chain includes the company's operations, suppliers, and distribution networks. Offsetting, on the other hand, entails investing in external projects to offset emissions. Insetting is a longer-term strategy that is easier to manage and sustain once data collection and tracking methods are in place. Managing carbon insetting involves making internal changes and investments to decarbonize internal operations and the supply chain.

Examples of carbon insetting are:

- Performing an energy assessment and applying energy efficiency measures to lower baseline energy use.
- Investing in solar, geothermal, or other renewable energy sources within the supply chain.
- Collaborating with suppliers to motivate or support them in lowering carbon emissions.
- Redesign products and packaging to include sustainable design.

There are potentially significant benefits to incorporating insetting strategies into carbon emissions plans.

The benefits of insetting extend beyond pure emission reductions:

- It fosters a culture of sustainability, enables long-term efficiency strategies, and directly lowers emissions at their source.
- Supply chain-wide efficiency and sustainability are improved, often creating a ripple effect.
- Commitment to insetting can enhance brand reputation and competitive differentiation.
- Critically, effective insetting is central to mitigating Scope 3 emissions that originate throughout the value chain.

Carbon Offsetting

Offsetting involves investing in external projects that reduce or eliminate GHG emissions to balance out a company's emissions when it cannot cut them directly. The aim is to offset a company's carbon footprint by funding or supporting initiatives that decrease carbon emissions elsewhere.

Common offsetting mechanisms include:

- Participating in utility-sponsored renewable energy and gas programs.
- Purchasing verified carbon credits from external projects.
- Funding ecosystem restoration to sequester atmospheric CO_2.
- Supporting methane capture from waste or agricultural sources.

One advantage of offsetting is that some strategies, such as buying renewable energy through utilities, can be implemented more quickly and easily than other insetting strategies. Additionally, companies have a wide range of offset project options available.

Offsetting strategies have several potential drawbacks that must be carefully assessed before adoption. They are not a permanent solution, as they do not address the underlying causes of emissions within an organization's operations or value chain. Moreover, there is a risk that offsetting can be misused to delay or avoid making essential, long-term commitments to substantially lower CO_2 emissions at the source. A significant concern in offsetting is the possibility of double counting, where the same emissions reductions are claimed by multiple parties, undermining the environmental integrity of the offsets. Additionally, verifying the effectiveness of offset projects can be challenging due to transparency issues, inconsistent standards, and difficulties in accurately measuring and monitoring real emission reductions.

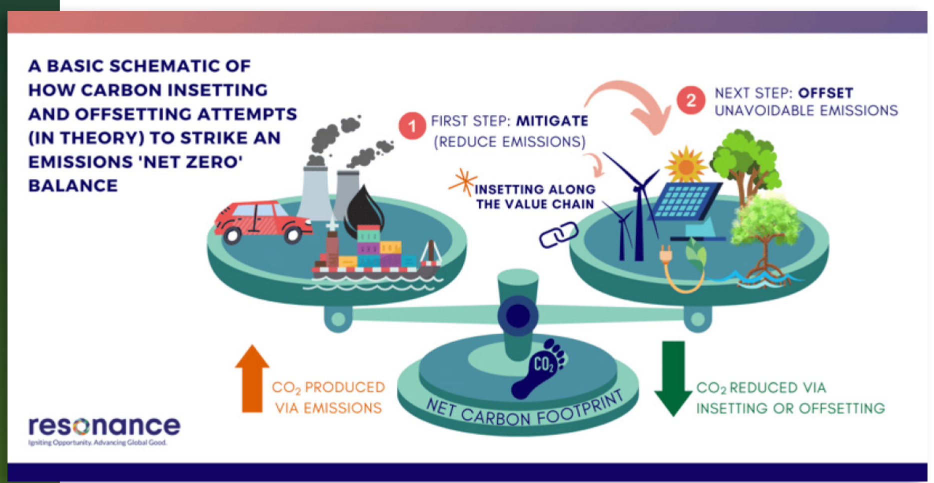


FIGURE 4 Schematic of Carbon Insetting and Offsetting[6]

Understanding the data and establishing a solid baseline are crucial for any successful decarbonization plan. As part of this process, it is vital to identify and analyze scopes 1, 2, and 3 emissions. Recognizing both insetting and offsetting carbon emissions is essential for decarbonization planning to achieve net zero and beyond. Figure 4 illustrates the balance between insetting and offsetting to achieve net zero balance.

The Bigger Picture: Net Zero and the Climate Imperative

The urgency of decarbonization is rooted in the global commitment to limit temperature rise and prevent the most severe impacts of climate change. International agreements, such as the Paris Agreement, set crucial benchmarks, urging nations and organizations to keep global warming well below 2°C, with an aspirational goal near 1.5°C. Achieving these targets requires reaching net zero GHG emissions within the coming decades—meaning that any remaining emissions must be balanced by equivalent removals or reductions elsewhere.

For businesses, this imperative translates into a strategic necessity to operate within a constrained carbon budget. Strategies like carbon insetting, which focus on permanent emissions reductions within a company's value chain, are becoming essential components of forward-thinking carbon management plans. By embedding sustainability throughout their operations and supply chains, companies can drive meaningful and lasting emissions reductions.

While energy efficiency and electrification offer significant opportunities to reduce emissions, substantial challenges remain. For example, the U.S. Department of Energy projects electricity demand could double by 2050[7], driven by data center expansion, new domestic manufacturing, and electrification in different sectors. This surge in demand highlights the urgent need for parallel investments in renewable generation, energy storage, upgraded grid infrastructure, and advanced demand-side management to ensure a reliable and decarbonized energy supply.

Equally important is addressing equity in the transition. Smaller suppliers, economically vulnerable communities, and emerging-market regions often face barriers to implementing decarbonization measures without support. Companies that extend insetting and efficiency initiatives beyond their direct operations to include upstream partners and communities are better positioned to foster durable, inclusive progress and strengthen supply chain resilience.

6 Carbon Insetting vs Offsetting: A Primer for Sustainability Leaders. (2025). Resonance. https://www.resonanceglobal.com/blog/carbon -insetting-vs-offsetting-a-primer-for-sustainability-leaders

7 Clean Energy Resources to Meet Data Center Electricity Demand. (2023). US DOE. https://www.energy.gov/gdo/clean-energy-resources-meet-data-center-electricity- demand

CONCLUSION

Leveraging Insetting and Offsetting for Effective Emission Reductions

Carbon insetting and offsetting form complementary pillars within the broader strategy to reduce carbon emissions. Insetting delivers direct value chain emissions reductions, boosting operational resilience and demonstrating climate leadership, while offsetting provides vital flexibility to address residual emissions that remain challenging to eliminate, supporting steady progress toward net zero.

Energy efficiency remains the most accessible and cost-effective starting point, providing immediate financial and operational benefits. However, carbon management must evolve to incorporate electrification, clean fuels, and ultimately carbon removal technologies to meet long-term objectives. In some cases, organizations may pursue carbon negativity by removing more carbon from the atmosphere than they emit, this is to help reverse historic emissions and contribute to broader climate restoration. These efforts must be undertaken with a clear focus on sustainability, equity, and alignment with broader climate goals.

As companies develop their decarbonization journeys, success will hinge on strategic planning, cross-sector collaboration, and ambitious commitments. Decarbonization should be embraced as a strategic imperative, one that drives innovation, strengthens supply chains, reduces costs, and secures a livable planet for future generations. By integrating carbon insetting alongside judicious offsetting, organizations will be well positioned to lead the transition to a resilient, low-carbon future.

About the Authors

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Diana is a Senior Consultant with nearly 20 years of experience strategizing, developing, and implementing energy-efficiency projects. She has deep expertise in leveraging utility incentive programs and energy efficiency financing to support initiatives ranging from lighting retrofits to Zero Net Energy (ZNE) buildings. Her skill set includes business development, client relationship management, technical training, and effectively communicating results to senior leadership. Before joining Energy Sciences, Diana founded the Green Team Coalition, where she oversaw developing energy efficiency and sustainability strategies across various industries, including healthcare, automotive, multi-tenant commercial buildings, and defense. She has completed graduate coursework for her MBA and Program and Project Management at the University of Michigan. Diana earned a B.S. in Economics from Eastern Michigan University and holds a LEED Accredited Professional (LEED-AP) credential and a Commercial Real Estate Broker's License.

Mohanad Qomsiya,
Engineering Manager

Mohanad Qomsiya is an Engineering Manager with over a decade of experience in mechanical engineering, specializing in energy efficiency, sustainable design, and retro-commissioning. He holds a master's degree in mechanical engineering from Lawrence Technological University and excels at leading cross-functional teams and implementing utility programs. Additionally, Mohanad spearheads QA/QC initiatives, establishing rigorous standards for engineering audits and procedures while fostering strong client relationships. His professional certifications include LEED Green Associate, Certified Energy Manager (CEM), and Certified Measurement and Verification Professional (CMVP).

Decarbonize and Thrive:

the crucial case for decarbonizing water and wastewater

By: Matt Jensen and Rob Sowby

Municipalities across the United States continue to focus on ambitious climate goals for economic growth, energy independence, and environmental health within their communities. Although a municipality's decarbonization initiatives depend on collaboration among various departments and team members, water and wastewater treatment facilities are often overlooked, despite their significant potential to support low-cost and climate-resilient solutions.

Municipal water and wastewater treatment facilities in the U.S. spend as much as 40 percent of their operating budgets on energy, and across the US, their energy use accounts for three to four percent of total US electric energy use. The associated scope 2 emissions (indirect greenhouse gas emissions from purchased electricity, heat, and cooling) are equally significant. These facilities are responsible for approximately 44 million metric tons of greenhouse gas emissions each year or the equivalent emissions from more than nine million gasoline-powered passenger vehicles.

In short, municipalities successfully decarbonizing rests on the ability of their water and wastewater treatment facilities to achieve deep, lasting, energy-use reduction and demand management processes. But it's no easy feat. Successful energy management and carbon reduction within these facilities requires a holistic approach that goes beyond merely constructing a sustainably designed administration building or retrofitting a solar-covered parking area.

It takes collaboration and trust. What our team has found through working with over 150 water and wastewater treatment facilities across the country is that it takes actively engaging operators, superintendents, and public works directors in energy management activities that are specifically aligned with their unique operational realities.

Decarbonization is often viewed as a technology challenge, but in our experience, it is a technology and a people challenge. Maximizing impact requires addressing both, and understanding energy intensity metrics can be a key opportunity for plants to reduce their operating costs and simultaneously provide a cost-effective strategy for cities to make progress toward their climate commitments. This article will outline two real-world scenarios of cities who were able to do just that.

San Antonio Water System Embraces Operational Energy Strategy

For most public water systems, the two largest operating expenses are people and energy. For the San Antonio Water System (SAWS), with 1,900 employees, supplying 90 billion gallons of water to 2 million people requires 500 million kilowatt-hours (kWh) per year and costs $47 million per year—and rising—in power bills.

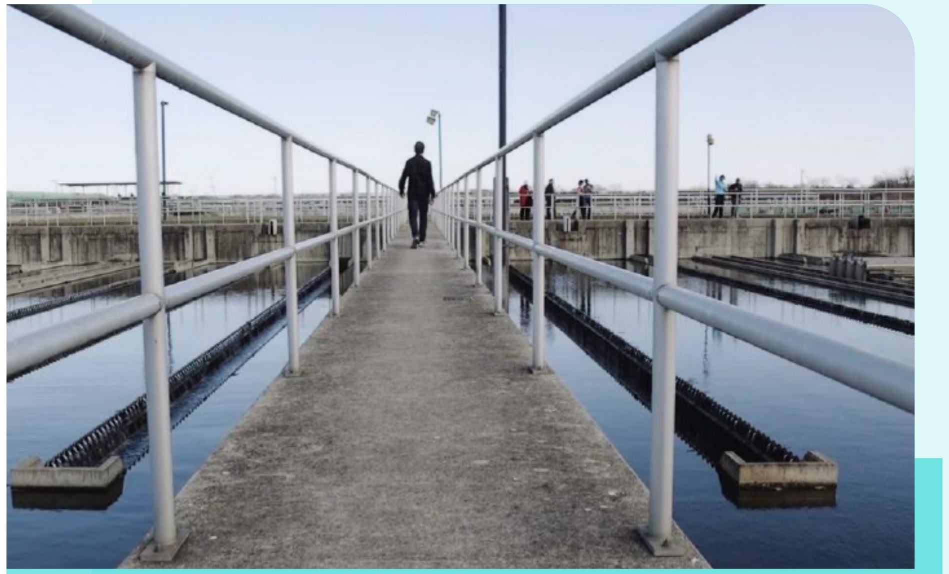
Despite the cost, energy was historically rarely considered in the operational decision-making process. For SAWS to reduce its utility expenses and support the City of San Antonio's climate action goals, that needed to change. The City of San Antonio has a Climate Action and Adaption Plan, which set a goal for the city to achieve carbon neutrality by 2050. In San Antonio, energy use is responsible for 48 percent of the city's greenhouse gas emissions, and SAWS is the local electric utility's largest energy user.

In a mega-organization like SAWS, change takes time and expertise. In 2019, SAWS hired a new energy manager to help. Recognizing the need for further support, in 2021, SAWS began a strategic energy management (SEM) engagement with consultants Cascade Energy and Hansen, Allen & Luce under the consultants' partnership, Aquafficiency.

The Aquafficiency team met with SAWS executives early in the process to discuss system challenges, energy training needs, and key personnel to involve. The consultants led a series of training workshops where water and wastewater operators, engineers, and managers learned about energy management practices. Throughout the training, SAWS leaders emphasized creating a decision-making process for better operations, asking, "What's the energy impact?" when considering how things ought to run.

SAWS created five energy teams across its water and wastewater system who participated in energy efficiency "treasure hunts," visiting water treatment plants, wells, distribution facilities, and wastewater plants to identify inefficiencies and discuss opportunities. The treasure hunts uncovered over 100 potential energy efficiency projects, which were sorted into a prioritized list. The most viable ones represent $6 million in avoided energy costs or 13 percent of the current expense. All the decision-makers were present for the treasure hunts, and a discussion about energy strategy helped develop trust among typically siloed departments.

In 2023, SAWS wrote and adopted its first ever Energy Strategy Master Plan (ESMP), which established the goal of reducing SAWS' energy intensity (kWh/unit) by 10 percent by 2028. The reduction in energy intensity represents approximately 25,000 metric tons of avoided carbon dioxide equivalent emissions per year, the equivalent of taking about 5,800 passenger vehicles off the road for a year. In 2024, the ESMP was formally adopted by SAWS' executive team and board, codifying the impact and importance of energy management to SAWS' operations for its effect on SAWS' financial operations and contributions to the City of San Antonio's climate goals.



Optimizing water and wastewater treatment is one technical subject of SAWS' energy management strategy. Staff training on energy issues is building capacity for the future. (Photo courtesy of SAWS)

Energy-Saving Actions

The new perspective of energy management embraced by so many employees led to many worthwhile ideas at SAWS. Here are just a few of the primary achievements:

1. SAWS operates an aquifer storage and recovery (ASR) project with 30 wells that can both recharge and recover water, but SAWS didn't have an organized strategy for which ones to use or when. Today, SAWS only uses a few at a time and prioritizes the most efficient ones. They also shifted behavior after an analysis suggested it's beneficial to recover larger water volumes at once.

2 2. SAWS' hydraulic model—a computer simulation of the water system—has been an important tool throughout. In partnership with the Aquafficiency team, SAWS updated the model for seasonal scenarios, water contracts, and new facilities; continues to train its own modeling team; and uses its hydraulic model for energy analysis as well as capital planning, development review, and water quality.

3 Water security has been a concern for SAWS. Historically, the water system drew nearly all its water from the Edwards Aquifer. As demands on the aquifer have increased and droughts have become more common, SAWS was determined to reduce its dependence on Edwards. Over the past two decades SAWS has made significant investments to secure additional water sources. Each of the now 13 water sources has a different energy intensity to produce and deliver water. SAWS reviewed energy and billing data to characterize the energy impacts of these water sources so that energy could be factored into its complex water-sourcing decision process.

4 In the water distribution system, crews found a few valves that had been left shut after repairs years ago, constricting network flows and making pumps work harder. The discovery—and the energy implications—justified additional modeling and searching until dozens more closed valves were found and fixed. The reduced head is estimated to save $300,000 per year in pumping costs, saving over 5 million kWh of energy in the process. Improved energy efficiency is also often more operationally sound.

SAWS crews found and opened dozens of accidentally closed valves that had been constricting water flow in the distribution system. The change is reducing friction and saving energy. (Photo courtesy of SAWS)

Breaking Barriers

Change takes time and expertise, but also persistence. Early on there were conflicting views about energy: energy vs. water quality, energy vs. permit compliance, energy vs. service pressure. As the training and the rest of the engagement unfolded, participants came to see energy management as an important part of water system operations: a resource that can work with, rather than against, other goals.

Even so, breaking old habits was tough. With millions of people depending on them every day, water operators were rightly cautious about changing how the system operated. The goal was not to complicate system operations but to enhance them. With the training complete, SAWS needed to entrust operators to think through the energy implications and empower them to make better decisions rather than go with the old ways.

For that to succeed, operators needed management support and psychological safety for any energy-motivated action that might backfire. Their supervisors provided that, and operators went to work on their energy assignments. When they asked themselves, "What's the worst that could happen?" the teams found that their system had sufficient redundancy to avoid anything catastrophic from happening because of an energy adjustment. Nothing backfired. It only got better.

As momentum built, internal peer pressure became a powerful motivator. An underperforming team at one SAWS facility felt compelled to re-engage in energy efforts when they saw another team cutting back kilowatt-hours or checking items off their treasure hunt to-do list. In this way, a large organization with some friendly internal competition has its advantages.

The initial engagement lasted two and a half years and many efforts continue today, so people and performance had to stay aligned throughout. It's easy to be pumped up immediately after a team meeting, but after a couple of weeks pass and other priorities arise, energy tasks are quickly forgotten. But the sooner those tasks are implemented, the longer the savings can accrue. Re-engaging the right people, over and over again, was critical. "Follow up, follow up, follow up," said one participant.

Anytime a weighty operational decision had to be elevated up the chain of command, the proposal had to be supported by evidence—and so did the rebuttal. Analysts had to keep showing hard data to back up correct decisions about why this valve should stay open or why that pump should stay off. Often there were reasons besides energy to do things one way or another, but the reasons had to be deliberate. No more "This is the way we've always done it."

The Future

The SEM engagement focused on low-cost operational adjustments to achieve energy savings. Results are still forthcoming, but the trend is positive. As of early 2025, SAWS has reduced peak demand by nearly 10 MW during demand response events and saves over 10 million kWh annually. Today, SAWS is positioning itself for high-cost capital projects such as enhanced automation controls, facility upgrades, and renewable energy to further advance its long-term energy strategy.

Clifton Water District Permanently Shifts Peak Load

In 2023, the Clifton Water District joined an SEM program sponsored by their power utility and led by Cascade. The main focus of the program, as with SAWS, is to identify low- and no-cost energy efficiency projects to reduce Clifton's operational costs and achieve verifiable energy savings for the utility. This utility program goes one step further, though. Through the long-term SEM engagement, Cascade and the power utility were able to build a deep technical relationship and trust with the participants, including Clifton, which allowed them to influence demand management and load-shifting opportunities as well. Not only that, but the program allowed Clifton to earn incentives for projects that shifted load outside of the power utility's peak hours.

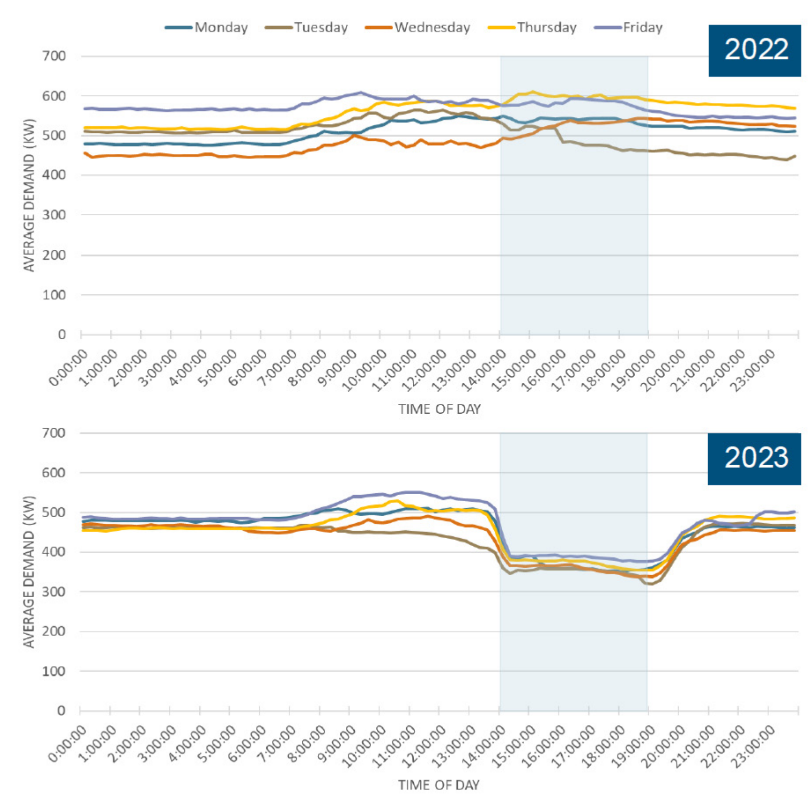
The grid is constrained from 2pm to 7pm on summer weekdays, and the SEM program turned into a critical tool in influencing permanent demand curtailment. Cascade used its technical expertise and conversations with Clifton about their operations to identify peak-load-shifting opportunities and then leveraged incentives and education on the electric rate structure to encourage participation.

Before they enrolled in the SEM program, Clifton staff used their reverse osmosis (RO) equipment as needed, not considering any specific time of use. After they learned about their billing structure details, cost savings, and available incentives from pursuing a peak load shifting project, they trained operators and ultimately included in their standard operating procedures that the RO system should not be run during the peak demand window. Through this project, they achieved 96 kW in demand savings, which led to an 18 percent reduction in their energy costs, including incentives.

> "I can't say enough about all the support Cascade has offered us during this process, and I also can't say enough about how it's made us work better as a team. It brought everybody in on a process that's normally a duty I handle, and it made it more of a team effort."

said Isaac Brown, water treatment plant supervisor at Clifton Water District.

The energy efficiency projects have a direct impact on Clifton's scope 2 emissions, and their demand-shifting project has important carbon implications as well. During the power utility's peak period each summer, demand eclipses what is available through renewable energy generation. Additionally, peak demand does not align with the times of day when the utility's solar and wind power are highest. As demand rises above what can be met through renewables, the utility leans more heavily on fossil-fuel based power, which means customers' energy use during the peak time doesn't just cost more — it emits more too.



If the utility were to increase its renewable generation capacity, at most times during the day, it would have excess power and no way to reliably sell that excess. Through peak-load-shifting projects, power utilities can shift demand to times during the day when they can offer reliable, carbon-free power without new renewable energy generation. They can achieve the same outcome as battery storage but at a fraction of the cost.

Clifton Water District pre- and post- load-shifting. The gray shading from 2pm to 7pm shows the power utility peak period.

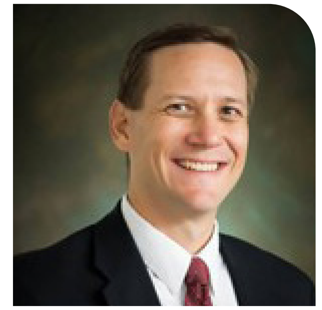
CONCLUSION

By equipping municipal water and wastewater systems with a clear understanding of the energy intensity associated with their operations, we can enable them to transition to more efficient, lower-cost, and lower-carbon production methods without negatively impacting water quality or other compliance priorities.

Additionally, when water and wastewater systems reduce their energy costs, they can maintain customer rates and help alleviate the cost burden of these resources for economically vulnerable customers. Through focusing on low- or no-cost changes that also have significant decarbonization impacts for their operations and their communities, these facilities can play an important role in cities around the country making real progress against their climate goals.

About the authors

Matt Jensen



Matt Jensen is a senior program manager and SEM coach for Cascade Energy, LLC. He leads strategic planning and operations for Cascade's water and wastewater services offering, Aquafficiency, guiding the expansion of these unique services across North America. Matt employs his in-depth technical knowledge of water, wastewater treatment, and industrial systems to help industrial and municipal facilities develop, analyze, and implement energy-saving strategies while protecting public health and the environment.

He has conducted energy audits for over a dozen water and wastewater systems, identifying savings through capital projects and low-/no-cost operations and maintenance measures and achieving 23 million kWh in energy savings from these systems from 2018 to 2023.

Matt is the lead SEM coach for SAWS energy management program, which won an award from AESP during the 2025 annual conference for commercial and industrial program design and implementation. He was a contributing author on a whitepaper for the American Council for an Energy-Efficient Economy (ACEEE) titled Water is a Finite Resource, with Hidden Energy Savings Floating Just Below the Surface as well as an article in Opflow titled Energy Management Program Leads to Operational Improvements.

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Rob Sowby is a civil engineer at Hansen, Allen & Luce (HAL) and an assistant professor of Civil and Construction Engineering at Brigham Young University with more than 15 years' experience in surface water and groundwater resources, hydraulics, hydrology, water supply, stormwater, and drinking water.

Combining research and consulting experience, Rob has contributed to over 200 water projects throughout North America. He offers expertise in the planning, modeling, and operation of drinking water systems. Rob has lectured and published nationally on urban water cycles, water system optimization, and the water–energy nexus. He received a M.Eng. in civil and environmental engineering from Massachusetts Institute of Technology and a B.S. in civil and environmental engineering from Brigham Young University. During his doctoral research at the University of Utah, he studied the energy requirements of public water supply and developed a public database of the results. Rob is the 2020 recipient of ASCE's Daniel W. Mead Prize for Younger Members. He holds a PhD in Civil and Environmental Engineering from the University of Utah and is a registered Professional Engineer in Utah and California.

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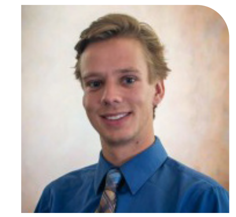
Chris Wilcut is a result driven energy and sustainability professional with nearly 15 years of experience and a technical background in energy and water efficiency. For the first half of his career, Chris worked for energy engineering firms where he specialized in ASHRAE energy auditing and development of ECMs (energy conservation measures). In 2017, Chris transitioned to the public sector and served as both a Senior Energy Analyst and Climate Program Manager for the City of San Antonio. It was in these roles that Chris found his true calling as a big picture, task-oriented project manager focused on implementing projects and programs that save energy and water and reduce greenhouse gas emissions.

Today, Chris is the Director of District Cooling and Energy Strategy for SAWS. San Antonio Water System is a municipally owned utility that serves more than two million people including 525,000 water connections and 470,000 wastewater connections. In this role, Chris is responsible for overseeing and growing SAWS' downtown and Port San Antonio chilled water systems and developing energy programs and projects aimed at reducing energy consumption and utility expenditures. Chris holds a BS in Natural Resources Management from Texas Tech University and is a Certified Energy Manager through the Association of Energy Engineers.

Brandon Leister, Office of Energy Strategy Manager, SAWS

Brandon Leister was born in San Antonio, Texas in 1971 and graduated from La Vernia High School in 1989. Brandon completed his undergraduate work in 1997 at Texas A&M University in College Station, Texas with a BA in Rangeland Ecology and Management with a minor in Environmental Science. Brandon has worked for San Antonio Water System for 25 years and currently works as the Energy Manager within the Office of Energy Strategy.



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Kai Kreiger is a Civil and Environmental Engineer at Hansen, Allen & Luce, Inc. (HAL), with seven years of experience on a variety of projects, largely related to planning, operation, and design of municipal water systems. Kai has assisted Saratoga Springs in reviewing development impacts on the existing water system and provided guidance on operational and capital improvements, which reduce costs, and improve water quality, and hydraulic performance. Kai has assisted water systems such as Valle Del Padres, and Highlands Water Company, in complying with Division of Drinking Water, Division of Water Quality, and Division of Water Rights requirements. His in-depth knowledge of each regulatory agency's rules has helped his clients navigate the complex, and many times expensive, regulatory rules in a fiscally responsible manner. Prior to his position at HAL, Kai worked as a staff engineer, providing assistance to professional engineers on projects related to groundwater remediation.

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Frederica Kolwey is a skilled technical and creative writer. In her current role, she develops a variety of marketing content to increase brand awareness and facilitate lead generation across Cascade's brands, including our Gazebo software platform and internal climate team, Fresh Coast Climate Solutions. She was the lead writer and project manager for the SAWS ESMP, coordinating between the Cascade and SAWS teams to collect data, develop graphics, and write the final plan. She previously spent three years as a proposal coordinator for Cascade, writing and coordinating technical proposals in response to utility client RFPs. She has a BA in environmental journalism from Western Washington University.

A Unicorn and a Pegasus Walk into a House—This Isn't a Joke

True Home Performance Contractors are hard to find when your programs need them most. What can you do about that?

By Joe Nunley

The state of our energy efficiency industry, and the energy industry at large, is at a critical inflection point. We need greenhouse gas emissions reductions to limit the impacts of climate change. The best way to do that is to limit our fossil fuel emissions by electrifying buildings while transitioning toward low-to-no emission electricity generating sources. Meanwhile, our power grid is strained; the further electrification of buildings will add more load and the transition to cleaner generation sources is being rapidly outpaced by the demand on the grid.

The solution to this problem is multi-faceted. So, let's start with something we should all agree on because the data doesn't lie: reducing our energy usage through energy efficiency is the most cost-effective part of the solution. Residential energy efficiency programs across the country understand this and are increasingly pairing their energy efficiency programs with electrification to impact the change necessary to meet our needs.

HVAC and Weatherization Industry silos created a long and expensive journey for a customer participating in these programs. Customers must have multiple assessments of their home by different contractors and essentially manage their own project by coordinating between the weatherization contractor improving their building envelope, the HVAC contractor installing high efficiency heat pumps and ventilation, and the plumber installing heat pump water heaters.

While I applaud efforts to create a "turnkey" program design that essentially creates a concierge service for customers, there is a better way to build this mousetrap while providing better service to your customers, creating jobs, and building the local economy.

Enter the home performance contractor, or HPC.

In this article I am going to discuss what it means to be a true HPC, the challenge program administrators and implementers are facing in finding HPCs, and some program design options to overcome these challenges and run a successful program.

What is an HPC and why are they important?

Before we dive right into program design, let's first discuss what it means to be an HPC since this classification is often used incorrectly.

To put it simply, an HPC is a contractor that has the capability and credentials necessary to perform any project on a home that improves the performance of that home from the standpoint of energy efficiency.

We have been taught since the emergence of the weatherization industry that the house is a system. The building envelope, HVAC systems, and water heating systems have dramatic interactive effects and should be addressed in conjunction. An HPC must have the capability to perform an energy audit, HVAC system sizing, and an electrification readiness assessment, as well as install building shell measures, HVAC systems, and water heating technology. All under one roof.

No matter how good a program is at marketing or how much is paid in incentives, the customer must fully understand and be onboard with the process for any project as complex as weatherizing and electrifying their home. It is important to remember that even with the best design, these projects take a long time, are invasive and, quite frankly, messy.

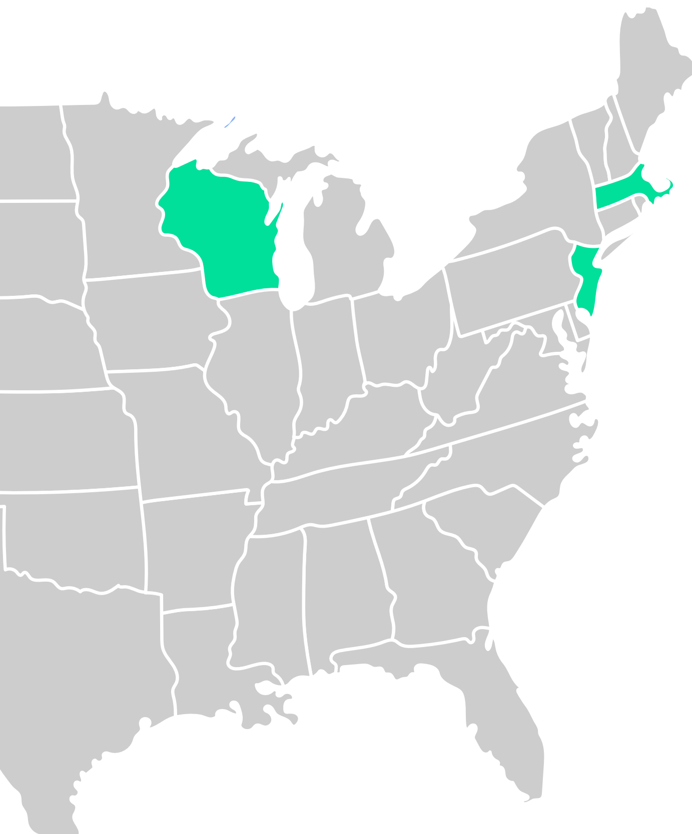
This is what makes HPCs critically important to any program. The customer is provided a single point of contact, a single point of failure, and the fewest number of appointments possible to complete a highly complex project. Add in an HPC's ability to effectively implement all the necessary project workflow processes and quality control practices and you have the best recipe for program success.

At this point, I hope you are thinking, "This makes so much sense, why doesn't every program just use HPCs?" That leads us to another problem. HPCs, as defined above, are few and far between. They are becoming unicorns in our industry (don't worry, I'll get to the Pegasus referenced in the title of this article soon!).

What Do You Mean HPCs Are Unicorns?

I know that unicorns are fictional creatures and that HPCs do exist. But a little humorous hyperbole never hurt anyone, right?
It is important to understand there are far fewer HPCs in the industry than necessary to meet program goals, let alone the goals of overarching climate policy objectives.
I could go on for 50 pages, profiling the nature of HPCs state by state, but this isn't an evaluation report or a potential study, and unlike either of those two, I'd actually like you to read this and get something from it.

Below are three key examples of the status of HPCs in states with robust energy efficiency offerings prime for HPC participation. These examples show the lack of HPCs in energy efficiency programs and represent a common theme throughout the country.



New Jersey

The largest utility company in New Jersey offers a Home Energy Solutions Rebate Program for its customers. The program offers incentives that cover a large percentage of home performance projects and the ability to access 0% on bill financing over five years for the remaining cost. The program lists 39 participating contractors, 32 of which offer services classifying them as HPCs. However, nearly 100% of the completed projects in the program include only air sealing and insulation. This indicates that the participating contractors are either not HPCs in their practices or that customers are only interested in air sealing and insulation services. The latter would be at odds with participation rates in HVAC rebate programs versus air sealing and insulation programs across the country, leading to the conclusion that very few, if any, participating contractors are HPCs.

Wisconsin

The utility companies in Wisconsin collaborate in offering one statewide energy efficiency portfolio called Wisconsin Focus on Energy. Having the same program offerings throughout the state is highly favorable to contractors and customers alike, making it much easier for a contractor to operate in multiple utility service territories while keeping processes and customer offers the same. However, the Program Administrator for the Focus on Energy Portfolio shared that only 1% of the contractors participating in their Whole Home Program offering are HPCs and they have been struggling to interest contractors in expanding their service offerings to become HPCs.

Massachusetts

The Mass Save Program has been the shining example of energy efficiency success for the last two decades. With approximately $1.5 Billion budgeted annually for the 2025-2027 program cycle, it is the largest utility driven funding for energy efficiency in the country. In the last two program cycles, a heavy focus on heat pump installations paired with weatherization services should lead to a robust market of HPCs. However, of the nearly 1,000 contractors participating in their contractor network throughout the Commonwealth, only approximately 8% offer the services to be identified as true HPCs.

What Makes an HPC a Pegasus?

The use of HPCs is a good first step in overcoming the challenges for energy efficiency programs with electrification. However, implementing these programs for market rate customers who can obtain project financing and often afford to pay for these projects when provided incentives is difficult enough. Attempting to offer these services for our most vulnerable low-income population adds a new level of complexity and difficulty.

Low-income populations are among the highest energy users and are at the mercy of programs that will fully subsidize energy efficiency and electrification projects and the contractors willing to work on these specialized programs. This is where the Pegasus comes in. A Pegasus is an HPC that works on dedicated low-income programs. If you are asking yourself, "How is a Pegasus any rarer than a unicorn? They are both fictitious." Just stop. You are missing the point.

The point is, even fewer contractors work on low-income programs because of the additional challenges, such as more restrictive program compliance requirements, a more complicated housing stock, an oftentimes more difficult customer base, and a lower overall profit margin for contractors. This is why most low-income program contractors are non-profit, community-based agencies.

However, as the need for low-income services grows and energy efficiency funding increases, the agencies can't keep up with the demand. Programs either expand to for-profit contractors or agencies subcontract to for-profit contractors.

While data on low-income program contractor networks is not as readily available as market rate programs, there is one glaring example that highlights the lower number of HPC Pegasi in the market. The Inflation Reduction Act Home Electrification and Appliance Rebate Program built into its design a bonus rebate to be paid directly to the contractor for every low-income job they complete, just for being willing to work in low-income homes. Why would DOE add this incentive if contractors were open to the challenges of working in low-income homes?

Program Design Options

Now that we understand the problem and what a unicorn and a Pegasus represent in this context. Let's look at what you, as a program administrator or implementer, can do about it. The Program Design Options below are presented at a high level. Each stage in the design requires thoughtful planning and a specified implementation strategy to fit the needs of your market.

HPC Identification

If you want to start designing your program around HPCs, you first need to understand the status of the contractors in your network and the services that they can provide. Below I have included an example HPC Identification Questionnaire with built in scoring logic. This tool is simple and automated to be used when evaluating each contractor. The example shows a perfect scoring HPC.

Once you have classified your existing contractors, you can more easily make an informed decision about the best program design option to fit the needs of your program. Each design option has its own challenges and benefits.

Service	Response	Scoring Key
Services Provided		
Energy Audits	1	Yes = 1 No = 0
Full Service Weatherization	1	Yes = 1 No = 0
Full Service HVAC System Installation	1	Yes = 1 No = 0
Full Service Water Heater Installation	1	Yes = 1 No = 0
Electrical Panel Work	1	Yes = 1 No = 0
Total Services Provided Score	**5**	**HPC**
Employee Certifications		
Service	**Response**	**Scoring Key**
BPI Certified Energy Auditors	2	All BPI Certified = 2 Some BPI Certified = 1 None BPI Certified = 0
BPI Certified Weatherization Crew Leads	2	All BPI Certified = 2 Some BPI Certified = 1 None BPI Certified = 0
BPI Certified Weatherization Crew Members	2	All BPI Certified = 2 Some BPI Certified = 1 None BPI Certified = 0
NATE Professional Level Certified Lead Installers	2	All NATE Certified = 2 Some NATE Certified = 1 None NATE Certified = 0
NATE HVAC Support Techinician Certified Technicians	2	All NATE Certified = 2 Some NATE Certified = 1 None NATE Certified = 0
OSHA Safety Certifications	2	All Field Staff Certified = 2 Some Field Staff Certified = 1 No Field Staff Certified = 0
State Electricians License	1	Yes/Not State Required = 1 No = 0
Equipment Manufacturer Certificiations	2	Multiple Certifications = 2 One Certification = 1 No Certifications = 0
Total Employee Certifications Score	**15**	**Maximum HPC Certifications**
Total HPC Identification Score	**20**	**HPC/ Maximum HPC Certifications**

Scoring Category	Score/Range	Results
Services Provided	5	HPC
	4	Almost HPC
	0 – 3	Not HPC
Certifications	15	Maximum HPC Certifications
	14 – 8	Good HPC Certifications
	7	HPC Certifications
	0 – 6	Needs HPC Certifications

HPC Prioritization Design

This design concept rewards HPCs by enrolling them into a higher tier of participation in your contractor network. HPCs shouldn't remain in your highest tier simply for being HPCs. You should ensure they are doing quality work on behalf of your program by establishing performance criteria based on the key performance indicators (KPIs) that are important for your program.

Some benefit options for a higher tier could include project lead referrals, co-branded marketing, direct access to program management, expedited application processing, etc.

Design Pros

- Better customer service
- Less attrition throughout the customer journey
- More comprehensive projects
- Higher savings and bill reductions
- Increased program participation
- Growth in the number of HPCs

Design Cons

- Risk of alienating non-HPC contractors
- Fewer contractors at launch, while the HPC market develops

Contractor Partnerships Creating HPCs Design

This design concept rewards contractors that form partnerships between companies to operate as HPCs, along with those that are already HPCs. You would provide all the same benefits as the HPC Prioritization design above while also including services to help contractors identify and form partnerships to operate as HPCs

Design Pros

- Better customer service (maybe not right away, see cons)
- Less attrition throughout the customer journey (maybe not right away, see cons)
- More comprehensive projects
- Higher savings and bill reductions
- Increased program participation
- Growth in the number of HPCs
- Less contractor alienation

Design Cons

- More complex and labor intensive to implement
- Longer lead time to build HPCs
- Multiple process kinks as multiple companies develop processes to work together for a seamless customer experience
- Multiple egos at play with up to three contractors per partnership needed to successfully execute
- Potential customer service issues (initially)
- Potential customer attrition throughout the customer journey (initially)

CONCLUSION

The reality is there is no single solution that is going to reduce our greenhouse gas emissions and the strain on our electric grid. This is an all-hands-on-deck situation. But for residential energy efficiency with electrification programs, the solution must lean heavily on existing HPCs and work to develop more quality contractors into HPCs. Let's make this myth a reality. Without it, a clean energy future where the lights always come on when you flip the switch will be the unicorn and the Pegasus.

Joe Nunley,
Partner, Green Energy Economics Group, Inc.

Joe Nunley is a Partner for Green Energy Economics Group (GEEG) where he works on Policy, Planning, and Implementation of Energy Efficiency for Utilities, Governments, and Advocacy Groups. Prior to joining GEEG, Joe served as the Vice President of Program Services at PSD. In this role Joe led the PSD Program Services Division, which implements Residential, Commercial, and Energy Code Programs throughout the Northeast, Mid-Atlantic, and Midwest. Joe has been in the EE industry since 2007. Prior to joining PSD, he was an Energy Efficiency and Conservation Senior Analyst with UGI Utilities, where he was responsible for managing the commercial and residential natural gas Energy Efficiency and Conservation Programs. Joe was also responsible for emerging technologies, customer satisfaction, and trade ally relations. Joe previously worked as an Energy Efficiency Trade Ally Manager with Puget Sound Energy in Seattle, WA. Prior to that position, Joe spent eight years as the owner of a Harrisburg, PA energy auditing firm, focusing on Utility Low-Income Weatherization Programs, and residential and small commercial energy audits. Rooted in a deep love for building science, Joe is an Association of Energy Engineers (AEE) Certified Energy Manager (CEM) as well as a Building Performance Institute (BPI) Certified Building Analyst.

CALIFORNIA'S RATE DESIGN REVOLUTION:

HOW THE GOLDEN STATE IS USING RATES TO FIGHT SOARING ENERGY BILLS AND ENERGY INEQUITY

By Jordan Folks

California is known for many things: Hollywood movie sets, delicious tacos, surf and sand, sweeping mountain ranges, and, unfortunately, sky high electricity rates. Customers of the state's three largest investor-owned utilities (IOUs)—Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E)—currently pay roughly double the US average for electricity. I encourage non-California readers to look up their electricity rate and compare that to what many Californians pay. Table 1 shows some example prices from all three IOUs.

TABLE 1 California IOU Residential TOU Rate (Summer Prices) Comparison (2025)

Utility	Rate Plan	Peak Hours	Peak Rate (¢/kWh)	Off-Peak Rate (¢/kWh)
PG&E	E-TOU-C	4:00 p.m.–9:00 p.m. Every day	59¢	45¢
SCE	TOU-D04-9PM	4:00 p.m.–9:00 p.m. Weekdays	58¢	36¢
SDG&E	TOU-DR2	4:00 p.m.–8:00 p.m. Every day	68¢	39¢

As seen in the table above, California IOUs focus on time of use (TOU) pricing plans that charge different rates at different times of day. Although most American utilities offer a TOU option, historically, few households outside California have been on them (though that is beginning to change as some utilities outside of the Golden State make TOU rates the default rate in their service territories). To put these California IOU prices in perspective, their off-peak rate is higher than many on-peak rates throughout the rest of the country (and their off-peak rates are also higher than many flat kWh pricing rates nationwide). With rates this high, it is no surprise that nearly one-fifth of California IOU customers are behind on paying their electric bills, according to a recent 2025 report from state regulators.

There are many reasons why electricity prices in the state are so high: rising transmission and distribution costs, much-needed grid modernization upgrades, solar cross-subsidies, lower than average per capita electricity consumption, and a litany of other arguably unavoidable costs. Fortunately, many of our industry colleagues have dedicated their careers to addressing the electricity affordability crisis in California. Through a variety of rate-based and other tactics, they have found ways to exert downward pressure on rates and provide much-needed bill relief to California households, especially for financially disadvantaged customers and others who need it most. Their work deserves a closer look, not only because it helps their fellow residents but also because it offers a ratemaking road map for the rest of the country.

Mitigating Impact: Rate Discounts and Programs for Income-Qualified Households

First and foremost, California is a leader in providing rate discounts to low-income customers. The California Alternate Rates for Energy (CARE) program provides a 30%–35% discount on electric bills and a 20% discount on natural gas for income-qualified IOU customers. Non-IOUs in California have similar programs. For instance, Sacramento Municipal Utility District's (SMUD) Energy Assistance Program Rate (EAPR) provides income-qualified customers a 48% discount on all electricity usage, with a maximum monthly discount cap of approximately $40. Enrollment in these programs is impressively high, with prior estimates reporting that over 80% of eligible IOU households were enrolled in CARE.

Flipping the Script: Default Time of Use Rates

Simple income-based rate discounts are not the only strategy California employs to ease the energy burden of its customers. By 2021, California IOUs and SMUD transitioned most of their residential customers to default TOU rates. With peak prices exceeding historical tiered kWh prices, initial public outcries of "price gauging" were common. But illogical as it might seem, charging more at certain times of day can save customers money in the long run. For one, TOU prices can lower peak demand, reducing the utility's capacity needs, resulting in downward pressure on rates—or at least, helping prevent further rate increases to accommodate spendy peak loads. According to Charlie Buck, who was interviewed for this article and leads load flexibility strategy on SMUD's distributed energy solutions team, "TOU has led to over 100 megawatts of lower peak demand in the summer, thanks to the impact of customer response to the rate. It's quite significant actually in terms of the way it's modified our load. So certainly at a territory-wide scale, that does result in capacity savings and every bit of capacity helps with affordability."

And despite expensive peak pricing periods, the extensive off-peak hours allow customers ample behavioral opportunity to save on their bills by concentrating their use of electric devices during off-peak times. Additionally, many customers will reap natural bill savings before making any behavior changes, simply thanks to tariff math that favors them. These customers are often called "structural benefiters" because they immediately save money once transitioning to TOU rates, as their natural load profiles tend to better align with TOU pricing signals. Low-income customers are often most likely to be structural benefiters, given their disproportionately flatter load profiles, which can result from living in smaller homes with fewer energy-intensive appliances, creating an opportunity for well-designed TOU rates to enhance energy equity.

Additionally, even though ratepayer advocates have expressed concerns about how low-income customers will handle TOU rates, research has found that when provided with the right information and support (through effective education campaigns and behavioral tools), these customers are not only able, but willing to make behavioral changes. In fact, low-income customers might be more motivated to implement changes to their routines to save on their bills. TOU rates can give them a new way to save money, beyond just cutting back on energy use, and without costly energy efficiency upgrades, which many cannot afford.

Designing Equitable Rates for Decarbonization

As electricity rates continue to climb in California, how can the state promote cost-effective decarbonization of residential homes and simultaneously establish safeguards to prevent affordability crises for the state's most economically vulnerable customers?

The California legislature has proposed a radical solution: income-graduated fixed charges, formally referred to as a "Base Services Charge." With implementation imminent, the California IOU electricity bills will include a fixed charge that operates on a sliding scale based on household income, with lower-income households who are enrolled in income-qualified programs paying a lower fixed charge than non-low-income households. The fixed charge is independent of electricity consumption. For example, a vacant home with an active electric account had the breaker totally turned off for an entire month and didn't consume any electricity will still incur and be responsible for the fixed charge. Table 2 shows the initial Base Services Charge that PG&E will be using:

TABLE 2 Base Services Charges Amounts, by Income Status

Category	Monthly Base Service Charge
Most Customers	$24.00
CARE Enrollees	$6.00
FERA Enrollees and Affordable Housing (Deed Restricted) Dwellers	$12.00

*The Base Services Charge is a cost-per-day per billing period. Total monthly Base Services Charge cost may vary slightly month-to-month based on the total days per billing period.

Customers will pay proportionately less for each kWh they consume in exchange for the fixed charge, effectively moving some of the tariff math to a different side of the equation without increasing IOU revenue. According to Erika Wasmund, who was interviewed for this article and serves as a Principal Marketing Strategist for Residential Rates in PG&E's Solutions Marketing Organization, "All customers will see about a five to six cent decrease on their electric kilowatt pricing once this is implemented for PG&E." Wasmund stresses that "it won't be a new charge; it's for some services customers are already paying for through PG&E's kilowatt pricing." Wasmund also acknowledges the equity and decarbonization benefits that the new Base Services Charge brings:

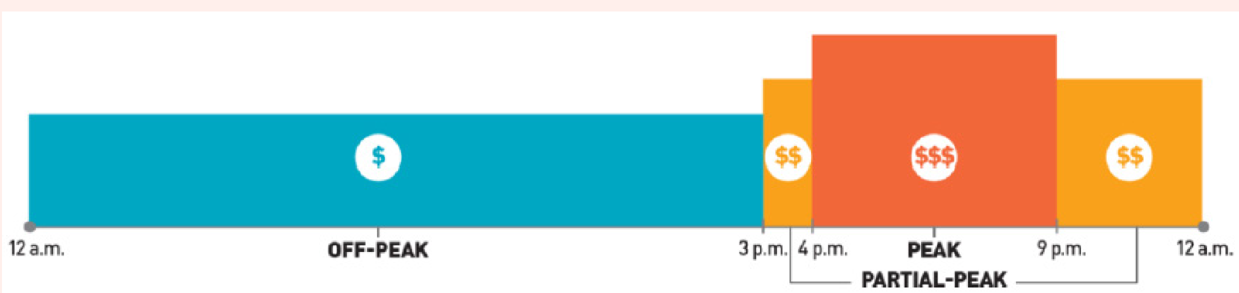
> "[L]ow income customers will not continue to bear a burden of paying for these services more than others because of the way that they use electricity. So the goal is two-fold really. It's to make electricity costs more equitable and transparent for all customers. It also in the long term is meant to encourage more electrification by bringing the kilowatt prices lower for all customers."

The California IOUs' Base Services Charge is groundbreaking for several reasons.

1. The fixed charge socializes the cost of electricity: more affluent customers will pay slightly more, whereas those who can least afford this basic need will receive a much-needed break in their electricity costs.
2. The reduced $/kWh price will make electrification more affordable, paving the way for increased decarbonization in California. While this approach is unprecedented and not without its fair share of controversy, it will undoubtedly be interesting to see the net result.

Another way PG&E is seeking to make electrification more affordable is through its relatively new Electric Home Rate Plan (E-ELEC), which is offered to residential customers with electric vehicles, battery storage, or heat pumps for water heating or space conditioning. E-ELEC also includes a $15-per-month Base Services Charge and $/kWh prices lower than PG&E's other rate plans. E-ELEC includes both peak and partial-peak prices, as well as a substantial discount on off-peak prices (Figure 1).

FIGURE 1 PG&E E-ELECT Peak Pricing Schedule



Wasmund explains that E-ELEC provides "an opportunity for customers who have adopted electric technologies to be on a rate plan that offers potential for the most savings if they are able to do things like run these high usage electric appliances during the off-peak hours between Midnight and 3:00 PM, [such as] charging their electric vehicle or running their heat pump water heater during the off peak hours." With approximately 20,000 customers enrolled since the rate launched in 2023, E-ELEC is gaining traction with smart energy users across PG&E's territory.

FINAL THOUGHTS

California faces an electricity affordability crisis, with customers of the state's three major IOUs paying roughly double the national average for electricity, with peak rates exceeding 50 cents per kWh. Despite unavoidable cost drivers like wildfire expenses and grid modernization, California has pioneered several innovative approaches to address affordability challenges, including low-income discount programs, electrification-friendly rates, capacity-shaving TOU rates, and income-graduated fixed charges. These interconnected strategies demonstrate how progressive rate design can simultaneously address affordability concerns for disadvantaged communities while promoting decarbonization goals. California's comprehensive approach of combining targeted discounts, time-differentiated pricing, income-based fixed charges, and electrification incentives provides a roadmap for other states grappling with rising electricity costs and climate goals, showing that equitable rate design can protect vulnerable customers while advancing clean energy adoption.

Jordan Folks,
Director of Demand Flexibility, Opinion Dynamics

Jordan is Opinion Dynamics' Director of Demand Flexibility, where he uses a social science lens to study the intersection of human behavior and energy consumption. Jordan has over a decade of experience conducting customer research for the energy industry, including countless process evaluations and market research studies to support demand flexibility programs – many of which have focused on low-income populations and increasing equity of utility offerings. In addition to his experience conducting research directly for utility clients, he co-chairs PLMA's Retail Pricing Interest Group and serves as a board member and research chair for the Smart Energy Consumer Collaborative.

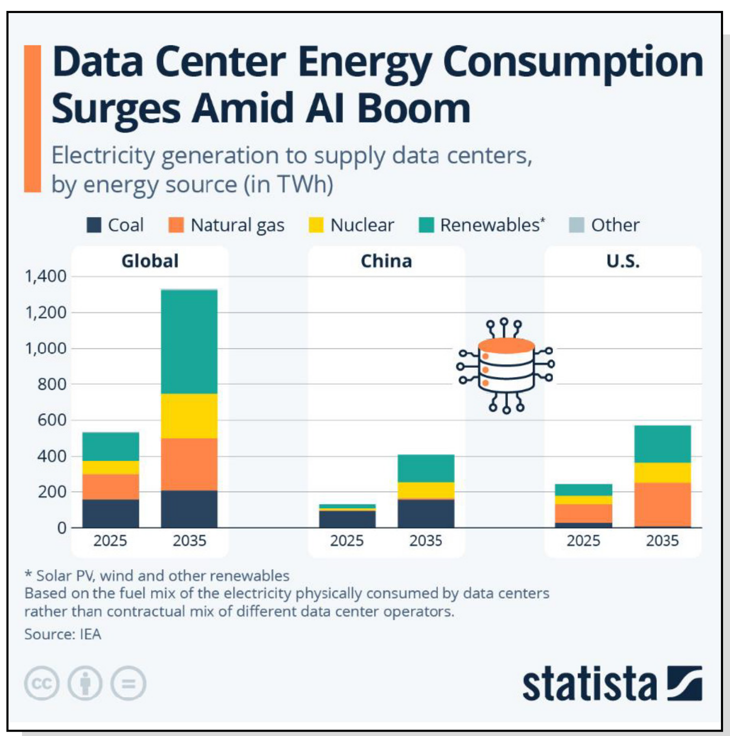
Critical Decarbonization Barriers and Opportunities: The Role of Automated Demand Response in Data Centers

By Kenneth A. Cottrell, M.A

Abstract
Data centers are among the fastest growing energy consumers in the digital economy, driven by the expansion of cloud computing, artificial intelligence, and data intensive applications. This rising energy demand presents significant challenges for decarbonization, as data centers often rely on grid electricity generated from fossil fuels. Automated Demand Response (ADR) programs have emerged as a critical strategy to reduce peak demand, enhance energy flexibility, and facilitate the integration of renewable energy into data center operations. This paper explores the critical barriers that hinder decarbonization such as inadequate real time pricing, infrastructure limitations, and regulatory gaps, and highlights key opportunities including the use of battery energy storage systems, advanced energy management technologies, and OpenADR frameworks.

Introduction

The rapid expansion of data centers has placed substantial strain on global energy systems. According to the International Energy Agency, data centers account for approximately 1 percent of global electricity demand, a figure projected to increase due to the rise of artificial intelligence and digital. Decarbonizing this sector is essential for global climate objectives, particularly as countries aim for net zero emissions by 2050. ADR programs offer an important solution by reducing peak energy consumption and enabling the integration of renewables. Key technologies such as Energy Management Systems (EMS) and standardized OpenADR protocols are crucial for enabling data centers to communicate with grid operators and optimize energy usage in real time.

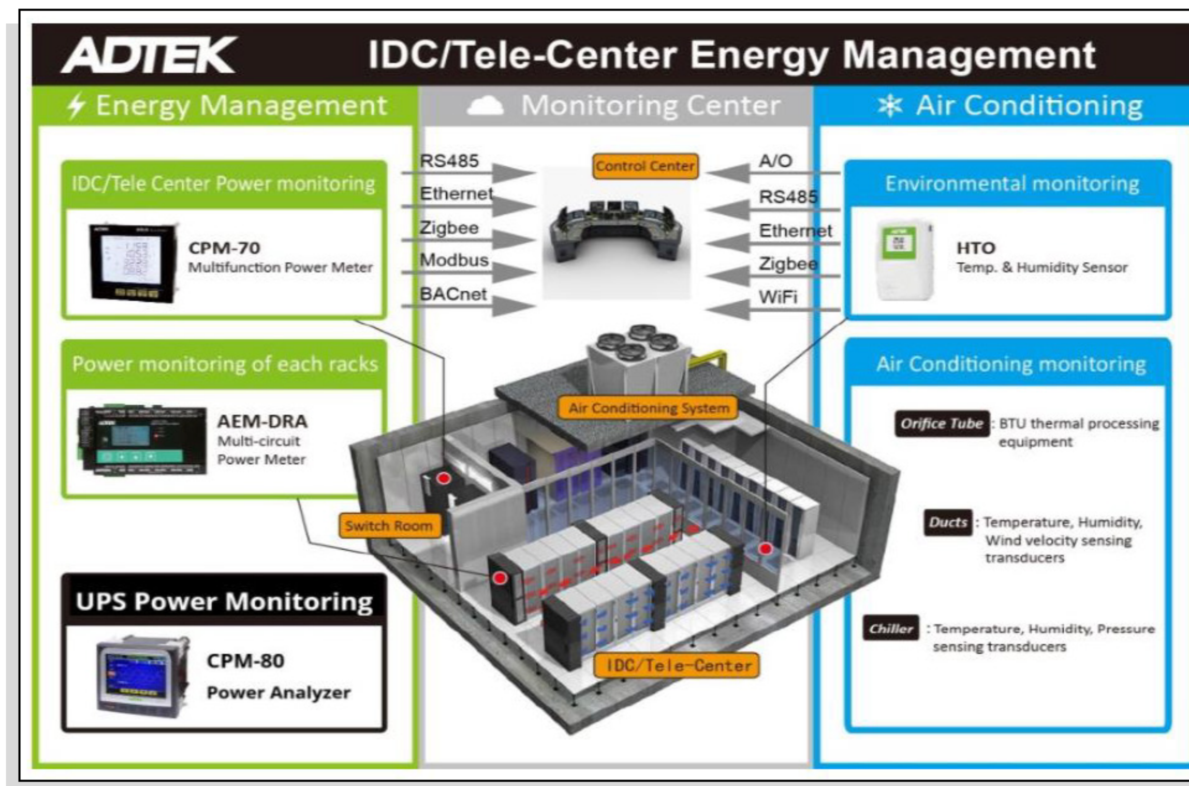


Critical Barriers to Decarbonization

One of the main barriers to ADR implementation is the absence of dynamic electricity pricing. Many utilities continue to rely on flat rate structures that fail to reward load flexibility. Without time of use or real time pricing, data centers lack a financial incentive to curtail or shift energy consumption during peak demand periods. For example, a large-scale data center in Nevada reported that flat rate structures increased operational costs during peak hours, which could have been mitigated with RTP.

Older data centers often lack modern EMS capable of responding to ADR signals

These systems are essential for integrating ADR, as they provide real time monitoring, automated load controls, and predictive analytics for managing IT and cooling loads. Matt Murphy, Chief Technology Officer at Material Sciences Corporation, emphasized the transformative impact of modern EMS: "Overnight, this software became one of the most essential tools in our entire plant ...We're no longer reacting; we're optimizing our production output and driving down energy costs". This shift from reactive to proactive energy management is critical for overcoming operational constraints..

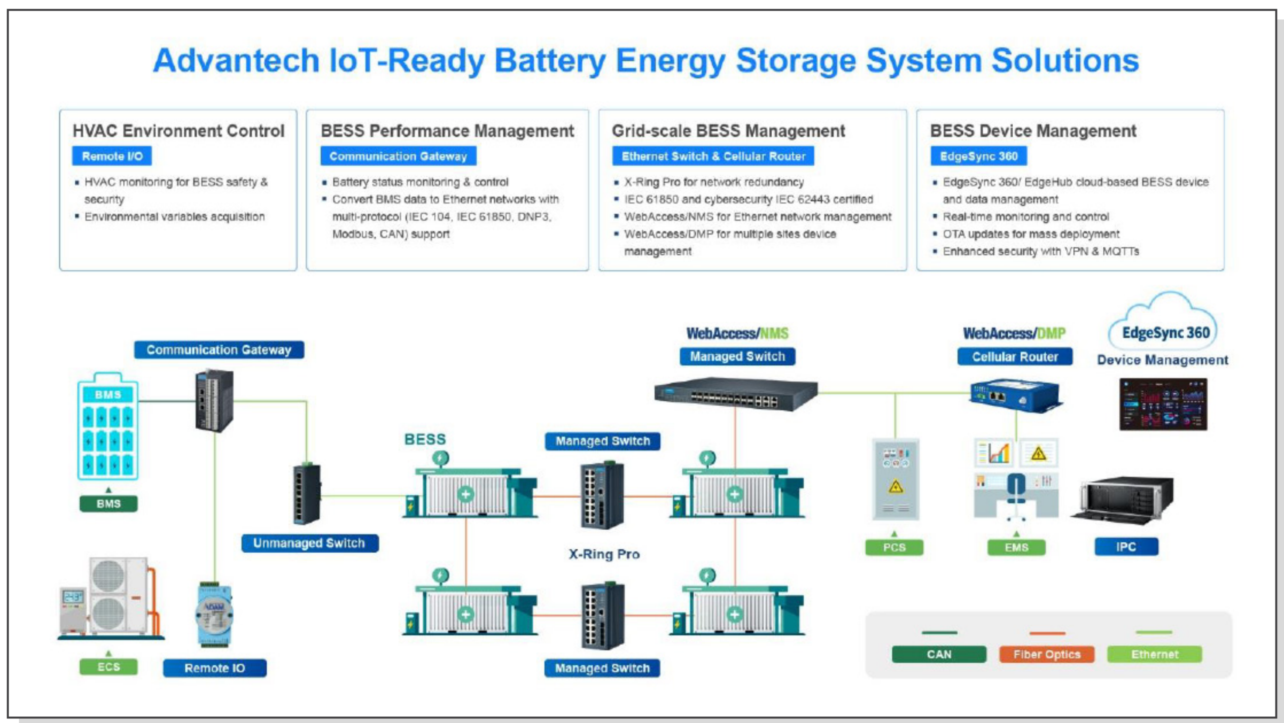


Policy support for ADR varies significantly by region. While states such as California have implemented robust demand response frameworks, other states lack clear regulatory incentives or standardized protocols for ADR participation. This inconsistency limits national adoption and makes it challenging for data center operators to develop unified ADR strategies.

Opportunities for Decarbonization

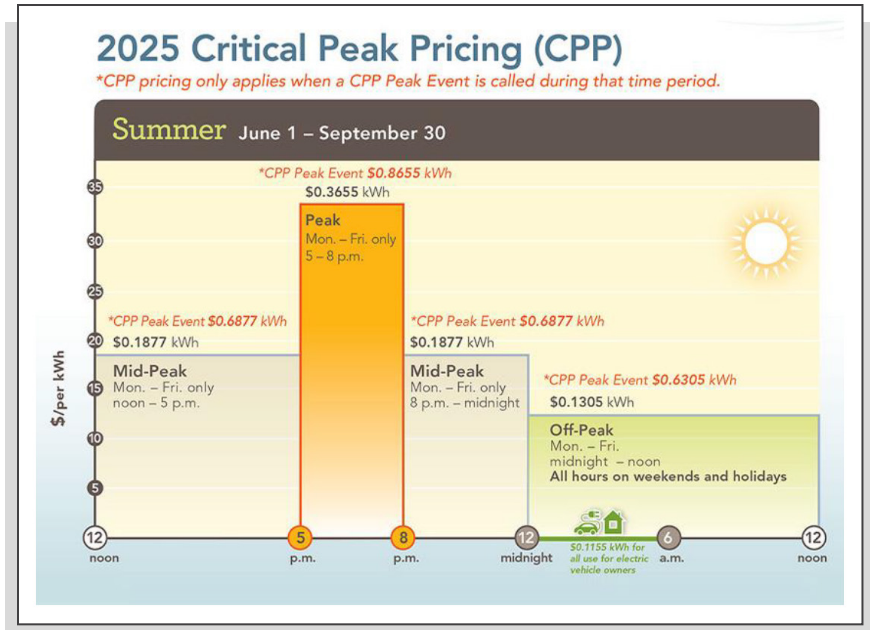
Battery energy storage is a transformative tool for data centers seeking to engage in ADR without compromising reliability. By charging batteries during off-peak hours and discharging them during high-cost periods, data centers can lower peak demand charges while reducing emissions. For instance, Google deployed a 2.5 MW battery system at its Belgium data center to offset peak loads and integrate on site solar power.

Modern EMS platforms are central to implementing ADR. These systems provide granular visibility into power usage effectiveness and allow operators to optimize workloads in response to price signals or grid constraints. EMS solutions integrated with OpenADR, a standardized protocol for automated demand response, enable seamless communication between data centers and utilities. Ashish Goel, CEO of Sanalife, explained: “Demand response only works when decisions are based on reliable, accurate data … With our direct integration with PJM, energy teams gain real time visibility into grid conditions and forecasts they can trust” (Sanalife). This type of reliable data exchange is what enables ADR to function at scale in mission critical environments.



Machine learning and artificial intelligence are revolutionizing ADR participation. Predictive analytics allow data centers to anticipate peak demand periods and schedule computational tasks accordingly. Meta’s Prineville data center, for example, uses AI to dynamically adjust cooling loads, enabling up to 20 percent energy savings during peak periods.

New utility rate structures such as critical peak pricing and performance-based demand response payments are creating powerful financial incentives. Data centers in Texas participating in ERCOT’s response programs receive payments for curtailing load during grid emergencies, providing a clear return on investment for ADR enabling technologies.



The Role of ADR in Renewable Integration

ADR supports the broader integration of renewable energy by aligning demand with periods of high renewable generation. For example, data centers can shift noncritical computing tasks to midafternoon when solar generation is at its peak, reducing curtailment of renewable resources and lowering grid carbon intensity. When combined with OpenADR enabled EMS platforms, this coordination allows operators to automatically schedule energy intensive workloads during times of abundant renewable supply.

Conclusion

Decarbonizing data centers is a complex but achievable goal. While barriers such as outdated infrastructure, insufficient incentives, and regulatory inconsistencies persist, ADR programs provide a clear pathway to cleaner operations. By integrating battery storage, leveraging advanced EMS and OpenADR protocols, and adopting innovative rate structures, data centers can significantly reduce both their energy costs and carbon footprints. To accelerate this transition, policymakers, utilities, and industry leaders must collaborate to remove barriers and create a more flexible, low carbon energy ecosystem.

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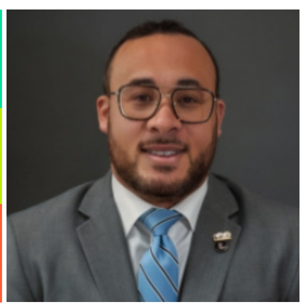


Kenneth A. Cottrell, M.A

Kenneth A. Cottrell, M.A. is a third-year doctoral candidate in Public Policy at the University of Nevada, Las Vegas (UNLV), where his research centers on implementing energy efficiency programs for indoor agriculture facilities and data centers. His academic and professional path highlights a deep commitment to sustainability, social equity, and community progress.

As Co-Founder of GreenChain Incentives, Kenneth leads a consulting and technology platform dedicated to advancing energy efficiency and renewable energy adoption in emerging markets. The company delivers white labeled energy management solutions, integrates blockchain technology for smart metering and energy tokenization, and collaborates with utilities to design innovative incentive programs. GreenChain Incentives primarily serves high consumption sectors such as data centers and indoor agriculture, helping reduce operating costs while strengthening grid resilience and supporting sustainability goals.

Kenneth has contributed extensively to energy efficiency initiatives at both federal and state levels. His expertise includes designing rebate programs, mapping stakeholder networks, and creating educational resources to enhance program compliance and participation. As a published contributor to the Association of Energy Services Professionals (AESP), he has authored multiple articles on demand response and energy efficiency strategies.

His doctoral research focuses on developing an Automated Demand Response (ADR) framework tailored to Nevada's indoor agriculture facilities and data centers. This work examines the stakeholder collaboration required among the Nevada Public Utilities Commission, NV Energy, technology providers, and indoor farming operators to implement ADR successfully. The ultimate aim is to deliver practical models that improve energy flexibility, lower peak demand, and integrate renewable resources into Nevada's rapidly expanding indoor agriculture sector.

Beyond his academic and professional pursuits, Kenneth is a committed community leader. He serves on the executive boards of 100 Black Men of Las Vegas Inc. and Global Paint for Charity Inc., where he drives initiatives focused on mentorship, youth leadership, and sustainable environmental practices.

Kenneth earned a Master of Arts in Urban Leadership and a Bachelor of Science in Urban Studies from UNLV, an Associate of Science in Criminal Justice from Georgia Piedmont Technical College, and previously studied Finance at Morehouse College. His broad educational foundation, combined with extensive professional experience, equips him with a rare blend of strategic insight, analytical expertise, and leadership skills.

From Gaps to Gains: Real-Time Air Sealing Insights for Next-Generation Residential Energy Efficiency

By Sooria Narsiah

Abstract
Air infiltration is a significant yet often overlooked driver of residential energy waste, responsible for roughly 25–40 percent of heating and cooling loads in North American single-family homes. Traditional air sealing efforts rely on pre- and post-EnerGuide audits, which are costly, time-consuming and provide feedback too late to motivate homeowners or guide contractors. To address this gap, Summerhill partnered with Enbridge Gas and the City of Vancouver to test a real-time air-sealing calculator that quantifies energy savings during guided retrofits. This article summarizes the methodology and outcomes from two pilot programs, demonstrating measurable reductions in air changes per hour (ACH), significant natural gas and electricity savings, and the ability to downsize HVAC equipment. Air sealing is not just a low-cost retrofit, but the essential first step toward electrification and performance-based energy-efficiency programs.

Introduction

Uncontrolled air leakage is a major source of energy loss in North America's existing housing stock. Typical homes can lose a quarter to nearly half of their heating and cooling energy through cracks, penetrations and poorly sealed assemblies. Yet air sealing is often sidelined in favor of visible upgrades such as window replacements or new HVAC equipment. Part of the challenge is measurement: conventional approaches require two EnerGuide audits—one before and one after retrofits—costing \$600–\$1,000 per visit and delaying feedback by weeks or months. Such delays reduce contractor motivation and diminish homeowner engagement.

Methodology

Summerhill developed a real-time air-sealing calculator based on the Alberta Air Infiltration Model (AIM-2). Contractors and energy auditors collect blower-door test data along with house characteristics (flue size and height, building type, shielding and terrain conditions) and select the local weather file. The calculator, delivered through a mobile app, applies AIM-2 algorithms to estimate natural infiltration and energy loss. Running blower-door tests before and after sealing key leakage points gives immediate feedback: how much the ACH has dropped and what that means for gas and electricity consumption. **Validation exercises show that the tool's infiltration coefficients and leakage areas match HOT2000 values within ±0.25 percent**; differences in energy-savings estimates arise because HOT2000 combines mechanical and natural ventilation losses, whereas the calculator isolates natural infiltration.

Enbridge Pilot Results

Between 2019 and 2022, the Enbridge Air Sealing Pilot delivered guided retrofits for 97

Ontario homes. Key findings include:

- **ACH improvements**: 41 percent of homes achieved ~10 percent reduction in air changes per hour, 23 percent achieved ~15 percent reduction and 36 percent achieved around 5 percent reduction. Maximum improvements exceeded 50 percent in select cases.
- **Energy savings**: Across all participants, the pilot realized 15,279 cubic metres of annual natural-gas savings, closely matching EnerGuide estimates.
- **Measure distribution:** Of 19 defined air-sealing tasks, penetration sealing
- (electrical outlets, ducts and exhausts) represented 43 percent of all measures. Baseboard and window sealing were also common and impactful.
- **Home archetypes**: Homes built during the 1990s–2000s delivered the highest improvements, likely due to fewer prior renovations compared to older houses.
- **Customer feedback:** With 94 survey responses, 95 percent of participants rated their experience positively and reported improved comfort.

FIGURE 1 Distribution of ACH improvements across 97 pilot homes

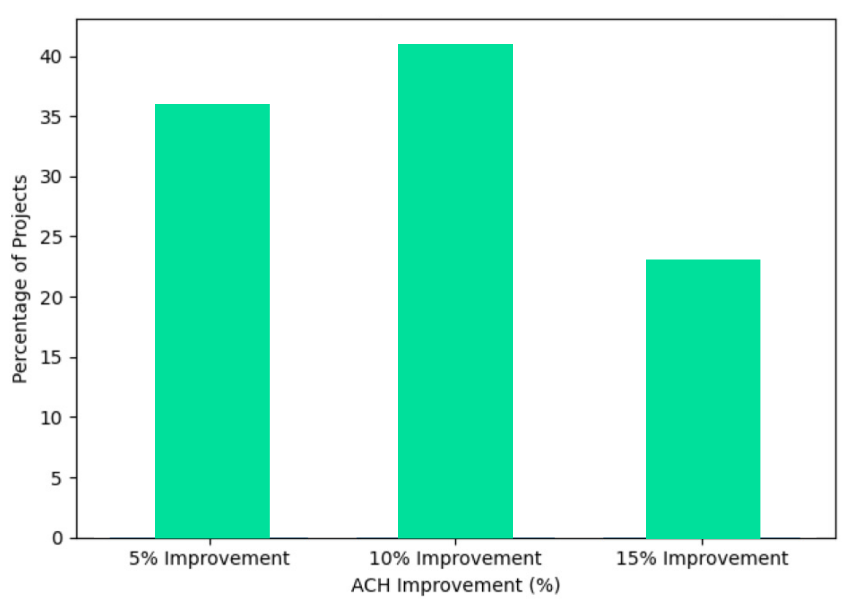


FIGURE 2 Percentage change in ACH versus year of construction, illustrating that homes built from the 1990s onward tended to yield larger relative improvements.

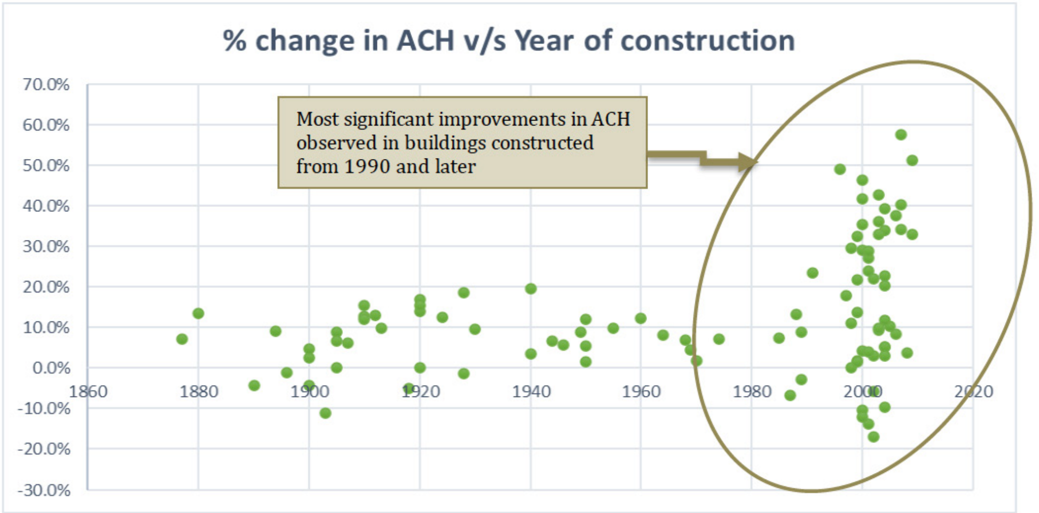
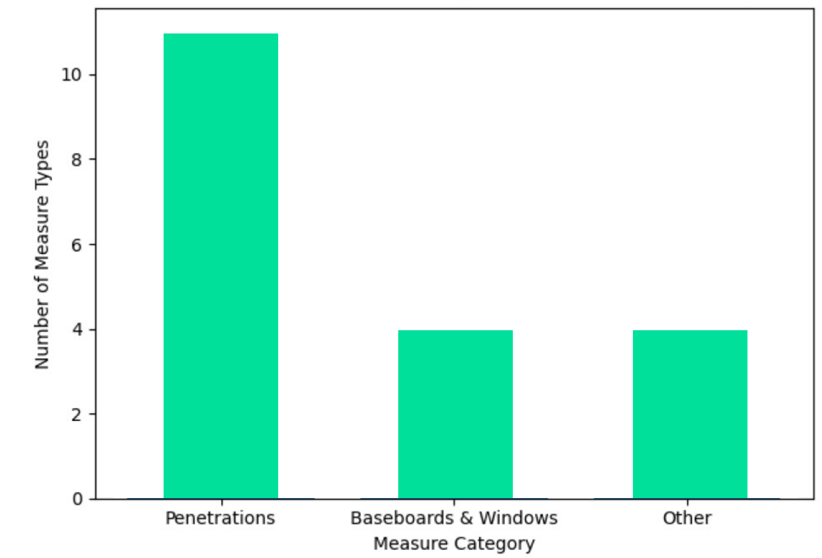


FIGURE 3 Distribution of air-sealing measure categories, aggregated from 19 individual tasks. Penetrations (outlets, ducts, exhausts) account for the majority of measures.



City of Vancouver Pilot Results

A complementary pilot with the City of Vancouver tested three air-sealing approaches—basic guided sealing, spray foam and AeroBarrier—in 24 homes. Unlike the Enbridge program, the Vancouver pilot relied on two full EnerGuide audits (pre- and post-retrofit) to measure ACH reductions and energy use. This highlighted the contrast between traditional audits and real-time diagnostics: the former required booking two separate appointments and waiting weeks for results, which reduced contractor flexibility and homeowner motivation.

- **ACH reductions**: Basic guided sealing delivered 10–15 percent reduction in air leakage. Spray foam sealing achieved 15–25 percent reductions. AeroBarrier reduced ACH by 30–50 percent or more, with one home seeing a 71 percent reduction.
- **Energy and GHG savings:** Some AeroBarrier homes recorded ~21 GJ in annual energy savings, reflecting deeper reductions in infiltration.
- **HVAC downsizing**: In one 1915-built home, the reduction in ACH enabled a
- 0.55 kW reduction in required heating load, allowing installation of a smaller, more efficient heat pump.

TABLE 1 Comparison of air-sealing methods (City of Vancouver pilot)

Method	Typical ACH reduction	Cost Range	Scalability	Best fit housing archetype
Basic guided sealing	10–15 %	\$800 – \$1,250	High	Most single-family homes (1990s–2000s builds)
Spray-foam sealing	15–25 %	\$2,500 – \$4,000	Medium	Homes with accessible attics and rim joists
AeroBarrier	30–50 %+	\$5,000 – \$8,000	Low - Medium	Deep retrofits, new construction, net-zero builds

Guided basic sealing delivered significant reductions at modest cost, making it the most scalable option. Spray foam offered deeper reductions where accessible cavities were present. AeroBarrier achieved the greatest improvements but required specialized equipment and higher cost, making it best suited for deep retrofits and new construction.

EnerGuide Audits vs. Real-Time Calculator

The Vancouver pilot underscored the logistical and motivational challenges of relying solely on EnerGuide audits: participants needed to schedule two separate visits, provide access for blower-door testing, and wait weeks for the results. In contrast, the real-time calculator used in the Enbridge pilot provided instantaneous feedback during the contractor's visit. Table 2 compares the two approaches.

TABLE 2 EnerGuide pre/post audits vs. real-time calculator

Aspect	EnerGuide pre/post audits	Real-time calculator
Time to results	2–4 weeks (two audits and modeling)	Instant (on-site during blower-door test)
Number of visits	Two (pre-retrofit and post-retrofit)	One (integrated with retrofit work)
Cost per home	\$600–\$1,000 per audit × 2	<\$500 incremental cost
Complexity	Requires trained energy advisors	Contractor-friendly inputs
Accuracy	High, standardized	High (infiltration coefficients within ±0.25 %)
Customer engagement	Limited (delayed feedback)	High (immediate results)
Program Scalability	Low	High

Lessons Learned and Policy Implications

Contractor recruitment and training: Building capacity among qualified contractors is essential. Pay-for-performance incentives must cover travel, labour and material costs to make air-sealing services commercially viable.

Customer engagement: Real-time feedback motivates homeowners by showing immediate benefits. Comfort improvements may not always correlate with measured ACH reductions, particularly in already-tight homes.

Targeting housing archetypes: Homes built in the 1990s–2000s deliver the greatest savings per dollar spent. Programs should prioritize these archetypes while offering tailored support for older homes.

Policy and DSM integration: Utilities and policymakers can design performance-based rebates and integrate air sealing into electrification programs. Tightening the envelope enables smaller, more efficient heat pumps, reducing peak demand and emissions.

Conclusion

Air sealing is no longer just a low-cost weatherization measure—it is a measurable, strategic retrofit that unlocks deeper energy savings and paves the way for electrification. Real-time diagnostic tools, validated through multiple pilot programs, transform air sealing into a performance-driven service that benefits homeowners, contractors, utilities and policymakers. By incorporating guided air sealing into DSM portfolios and electrification pathways, the energy-efficiency sector can deliver rapid, scalable reductions in both natural gas and electricity use while preparing homes for the cleaner, smarter grid of tomorrow.

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Sooria Narsiah,
Senior Director of Innovation & Energy Efficiency, Summerhill

Sooria Narsiah is a lifelong champion of energy efficiency and grid modernization. With over three decades of leadership across Canada and internationally, he merges deep technical expertise with an entrepreneurial drive to accelerate the adoption of clean technology.

As Senior Director of Innovation at Summerhill, Sooria has designed and scaled cutting-edge demand-side management and demand response programs that deliver measurable results for utilities and customers. His portfolio includes co-developing Emissions Reductions Alberta's Energy Savings for Business program, leading Yukon Energy's residential demand response pilot, and piloting performance-based guided air sealing for Enbridge—projects that have reduced peak demand, saved energy, and proven the viability of pay-for-performance models.

A certified Professional Engineer and seasoned energy auditor, Sooria has led teams in conducting ASHRAE Level I–III audits across industrial, commercial and residential sectors. He has a knack for turning diagnostics into innovation, from creating a mobile air-sealing calculator and drone-enabled envelope assessments to testing AI-automated blinds and next-generation home energy monitoring systems. His holistic approach integrates behavioral insights, advanced analytics, and community engagement to craft programs that are both technically robust and customer-centric.

Sooria earned a Mechanical Engineering degree from IIT Mumbai, an MBA from Kellogg/Schulich, and an MSc in Project Management. Licensed in Alberta, Ontario, and Manitoba, and accredited as a Certified Energy Manager and Certified Measurement & Verification Professional, he continues to mentor teams and advocate for policies that drive a smarter, more resilient grid.

Advancing Dual-Fuel Residential HVAC to Achieve a Reliable, Resilient and Affordable Energy Future

By Ryan Kerr and Aaron Winer

North America's energy system stands at a pivotal juncture, necessitating innovative and multifaceted approaches to support future resilience and reliability. Integrating natural gas and electricity can be a flexible and resilient solution to meeting the growing needs of our energy system. Dual-fuel residential heating and cooling (HVAC) systems, with their ability to optimize infrastructure utilization and balance peak loads, present a viable path forward. These systems have the potential to enhance energy efficiency, reduce demand during peak events and optimize consumer preferences for comfort and affordability.

Existing Technology Landscape

Over half of North America's residential heating load is served by natural gas. Based on the Residential Energy Consumption Survey (RECS) 2020 data, approximately 16 million homes in the U.S. use electric heat pumps and around 53 million use natural gas furnaces.1 Condensing furnaces are standard market practice at 95+% efficiency. Dual-fuel systems can potentially achieve a seasonal efficiency of 200% or more while minimizing cost to homeowners and greenhouse gas emissions relative to single fuel-based systems.

To optimize dual-fuel systems that pair gas furnaces with heat pumps, there are several installation requirements for energy and cost savings that are critical and often overlooked. Early research indicates that these dual-fuel systems often operate far below their achievable, seasonal dual-fuel coefficient of performance (COP) metric. This is typically due to suboptimal choices in equipment sizing and set up, control settings, and misaligning the use of the electric heat pump versus the natural gas furnace for heating.

Control Settings

Most dual-fuel systems available today lack customization, flexibility and broad controllability. However, when installed and configured with a switchover temperature balancing cost-effectiveness and comfort, dual-fuel systems can provide households with more affordable options by shifting space heating loads and reducing operating costs by as much as 50% or more.

Equipment sizing

Proper sizing of heat pumps is critical to a home's overall efficiency, along with other factors including ductwork configuration. A dual-fuel system can aid in rightsizing equipment for heating and cooling loads and reduce inefficiencies in both electric and natural gas systems. For these systems, it is even more crucial that the correct design practices are applied to ensure optimal combined efficiency.

Misaligned motivation

Dual-fuel system efficiency can be compromised when the gas furnace is used during times when the heat pump would be more efficient, and vice versa. Fluctuations in gas and electricity costs compound this problem. As it is difficult to convey these nuances to contractors and consumers, neither are strongly motivated to choose more efficient solutions.

An Overview of Dual-Fuel Systems[3]

The North American market offers many dual-fuel systems with various hardware and control combinations. All dual-fuel systems operate differently. The thermostat controls the furnace and air-source heat pump (ASHP) and their modulation as a function of the logic input variables (i.e., utility rates, setpoint, outdoor air temperature time-of-use, and demand-response calls).

The control strategies for dual-fuel systems can be grouped into three approaches:

Two-stage heating

In this approach, the ASHP is the primary heating source, and the furnace is auxiliary. Two-stage heating is optimized for homeowner comfort but limits optimizations of operating cost and grid emissions.

Outdoor air temperature (OAT) reset

The OAT reset approach achieves economic benefits by adjusting the switchover temperature based on fixed utility rates and manufacturer component efficiencies. This approach has limited capability to optimize time-of-use rates.

Smart dual-fuel switching

This approach can be optimized to achieve the lowest operating cost or grid emissions using advanced thermostats or controls with grid-interactive capabilities. These features maintain comfort while optimizing operation based on OAT, component efficiencies, hourly utility rates and source greenhouse gas emission.

Dual-fuel systems are widely available among major manufacturers in the North American market and are especially popular in cold climates where heat pumps require backup heat on the coldest days. Natural gas backup tends to offer more economical operating costs than electric resistance backup heat. These systems are also common in moderate climates because of the perceived comfort, reliability and lower operating costs on the coldest days. While dual-fuel systems with smart controls are a promising solution to provide efficient space heating that reduces operating costs and manages peak loads, much research and development is needed to foster the adoption of this technology.

Benefits of Dual-Fuel Systems

With increased interest in efficiency and reducing costs in the building energy sector, dual-fuel system research and development has become a priority for manufacturers of HVAC equipment and technology developers.4 These entities have begun realizing the potential to build on an existing and robust value stream in the residential sector by expanding partnerships with utilities. These new relationships can unlock additional utility values including resource adequacy, grid resilience and demand management.

Successful realization of consumer and utility value streams depends on successfully leveraging the benefits for both, as detailed below.

Consumer Benefits

With one control, consumers can select their preferred indoor temperature, and the system automatically adjusts between fuels/equipment to ensure the preferred temperature is maintained.5 This ability also enhances resilience by adapting to energy distribution system issues without impacting consumer comfort.

Dual-fuel systems with smart controls can provide energy savings and even modest consumer utility bill reductions compared to a gas furnace with air conditioning, though this varies with climate, equipment efficiency, rates for fuel, switchover temperature and other considerations. However, energy savings are not guaranteed by simply installing a dual-fuel system with the technology and installation practices of the market today. System efficiency is influenced by several variables, including appropriate selection of dual-fuel equipment hardware and its capacity, controls employed, local utility pricing, and consumer comfort needs. Energy savings of existing dual-fuel equipment is also strongly determined by occupant behavior.

Utility Benefits

Recent research completed by GTI demonstrates that, even in very cold outdoor temperatures, dual-fuel HVAC systems that integrate a heat pump with an existing or new gas furnace and a smart controller are an underutilized tool for managing grid capacity and achieving efficiency (as measured by system COP).[6]

By design, dual-fuel systems rely on gas when outdoor temperatures cross a preset threshold or setpoint. In peak heating times, dual-fuel HVAC systems with grid responsive controls could also switch to gas when the electric grid is constrained, enabling utility demand-response communication like other smart electric appliances (e.g., heat pump water heaters). When paired with variable-speed equipment, these systems can dial back energy use while still delivering heating or cooling.

With many policies moving towards increased use of electricity, efficient use of natural gas can provide significant value as grid infrastructure improvement remains slow, and utilities are capacity-constrained during peak heating and cooling days. Through controlled use of dual-fuel systems paired with smart controls, gas utilities can provide grid resiliency, ensure consumer comfort and reduce electric utility carbon emissions during peak periods. Several utilities in North America have begun to explore and implement innovative collaborations facilitating achievement of carbon reduction requirements through concerted usage of both gas and electricity.

The most significant advantage of dual-fuel systems may be the potential avoided costs on the electric grid, from transmission and distribution to generation. While the costs and benefits for consumers have been explored, the societal costs of adopting a dual-fuel approach versus full electrification requires more research.

Realizing these benefits necessitates innovative collaboration across the supply chain, including consumers. By reimagining the interplay between electric and natural gas systems, we can support a robust and adaptable energy infrastructure.

Technologies on the Horizon

Internet-enabled communications for HVAC systems are an emerging trend. When cloud-connected capability is added to a dual-fuel system, there is the potential to create a grid-enabled, interactive system. Some of the benefits of a grid-enabled system include the ability to apply real-time electrical pricing, enabling the HVAC system to determine the appropriate energy source to meet the heating load at a given time at the lowest cost. A barrier to fully leveraging this capability is restricted access to controls of manufacturer-specific thermostats or smart thermostats controlled by a third party.

In collaboration with Clark Public Utilities and NW Natural, NEEA is currently demonstrating an efficient, flexible and controllable dual-fuel system that provides value to consumers, the market and utilities.

"**Clark Public Utilities sees value in better understanding potential ways to reduce energy waste and maintain energy efficiency with new and adapted technologies,**"

explains Matt Babbitts, Clean Energy Program Manager at Clark Public Utilities. "Partnering with NEEA and NW Natural on this residential dual-fuel heating system pilot is part of our ongoing effort to identify and evaluate viable alternatives for our customers."

In the demonstration project, the innovative controller allows remote setpoint adjustment and simultaneous use of both fuels to provide true fuel flexibility and dynamic, automated management. The demonstration aims to assess energy efficiency, user experiences, and the system's capability to transition between gas and electricity for load flexibility.

"These newly emerging dual-fuel systems provide a stellar opportunity for regional utilities to collaborate and address resource challenges while building solutions that benefit our customers," said Holly Braun, Business Development Manager / Geothermal Lead at NW Natural. "We are invigorated to be working with Clark PUD and NEEA on this pilot and optimistic about the system-wide benefit it could demonstrate."

The demonstration project pairs an ASHP operating in parallel with a tankless gas water heater and hydronic air handler, which is similar in function to a furnace. The demonstration will evaluate the individual component energy use and efficiency compared to a selected baseline along with the overall space- and water-heating efficiency.

Furthermore, the system's ability to respond to remote signals will be evaluated during scenarios developed by the team. These scenarios will assess potential impacts to peak demand constraints, response time, fuel switching dynamics, and simultaneous use of both electricity and gas to provide heating.

This data, along with qualitative results of occupant comfort and ease of installation, will allow NEEA to identify barriers to more sustained market adoption. Demonstration results will be published in 2026 and 2027.

CONCLUSION

Dual-fuel systems are a promising, efficient solution for residential space conditioning to potentially increase consumer comfort while reducing operating costs and electric peak load. Dual-fuel systems are available among major manufacturers in the North American market, but the market demand for dual-fuel technology is modest. This technology has only recently been adopted more rapidly, with the support and incentives of utilities and local and federal governments.

Next steps to support increased market adoption of dual-fuel systems in North America include:

- Comparing these technologies and evaluating their performance against the current market practice to develop competitive performance data.
- Evaluating and modeling to accelerate the development of a standard test method for rating existing dual-fuel systems.
- Developing design guidelines for field implementation based on climate and power generation mix.
- Developing standards and testing methods to help build consumer confidence when comparing one system to another and inform energy efficiency program development.

Dual-fuel systems present a significant, immediate opportunity for natural gas and electricity to be used in concert, adapting and responding to an evolving grid. Dual-fuel systems can help achieve state and regional policy goals, provide the market opportunities to innovate, and support consumer preferences for comfortable, affordable heating and cooling. However, driving greater market adoption requires innovative, collaborative approaches across the supply chain.

Transforming markets through dual-fuel technologies requires a commitment to reimagining how electric and natural gas systems work together to achieve a wide spectrum of goals faster and with greater support from utilities, manufacturers, contractors and consumers. Pairing this reimagined collaboration with evolved systems will provide a balance between consumer satisfaction, market needs and policy drivers.

For more information on NEEA's dual-fuel strategies and other Market Transformation efforts, visit neea.org/market-transformation-portfolio.

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Ryan Kerr,
Director, Emerging Technologies GTI Energy

Ryan Kerr is the director of emerging technologies at GTI Energy, leading business development strategy and execution for GTI Energy's business unit investigating energy efficiency, renewable energy and fuels, and carbon capture across buildings, industry, and mobility end use markets. He founded and continues to lead GTI Energy's Emerging Technology Program, a collaborative of 30+ North American utilities.

Ryan is an industry expert in decarbonizing buildings and industry, including end-use equipment efficiency and integrated energy systems. He is an Advisor to the California Energy Transition Council and serves on the Midwest Energy Efficiency Alliance Board of Directors.

Aaron Winer,
Project Development Manager Northwest Energy Efficiency Alliance (NEEA)

Aaron Winer is a Market Transformation expert with the Northwest Energy Efficiency Alliance (NEEA), an alliance of more than 140 utilities and energy efficiency organizations working on behalf of over 14.5 million energy consumers across the four Northwest states. Aaron has over 20 years' experience in driving successful initiatives both within and outside of the organization's regular scope of business. Experienced in design and implementation of complex utility DSM energy efficiency programs as well as new technology research, evaluation, commercialization, and adoption.