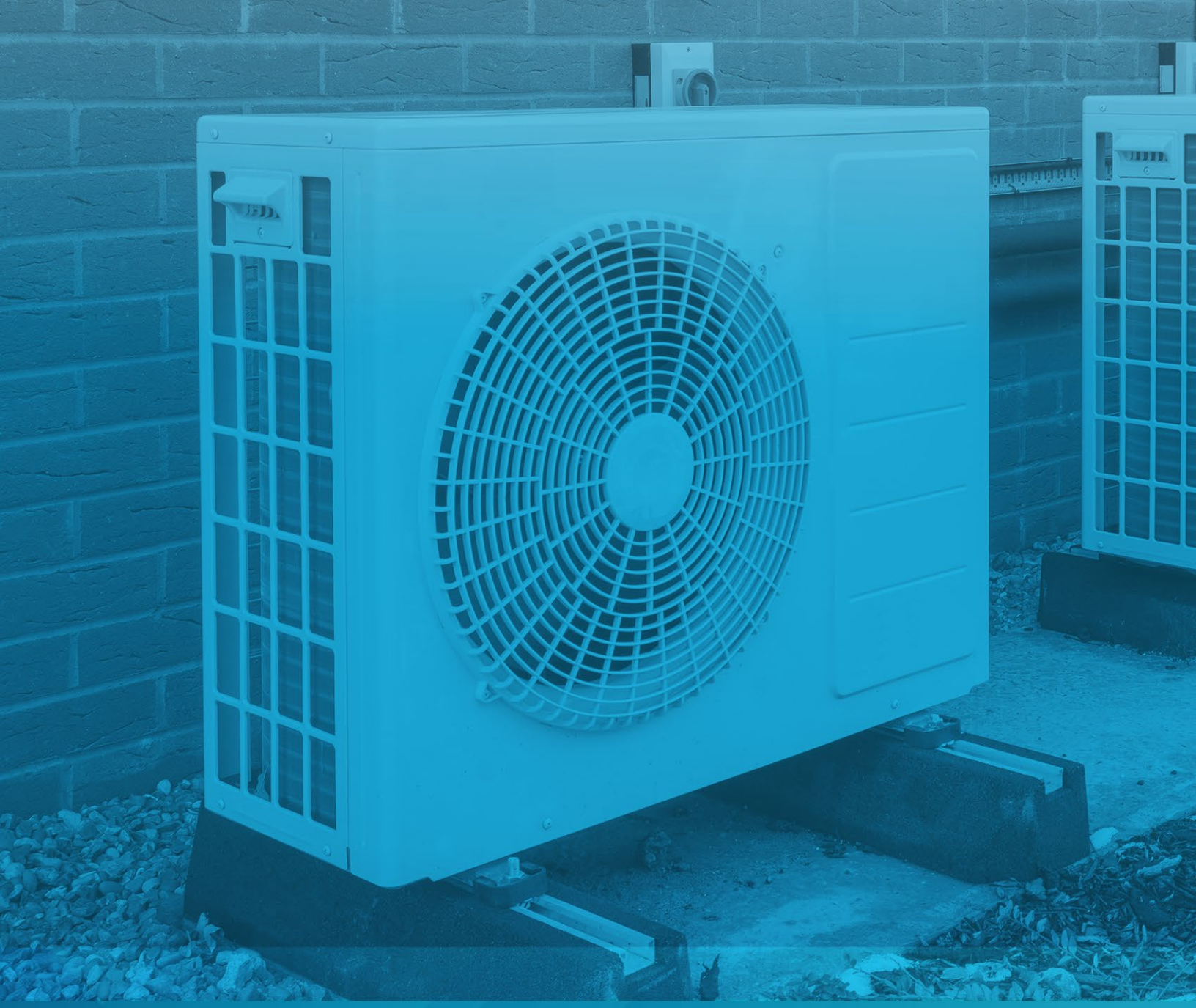

# HEAT PUMP ADOPTION AND BENEFICIAL ELECTRIFICATION

# PLAYBOOK

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When it comes to decarbonization and beneficial electrification, the looming electric vehicle wave receives most of the attention. But reducing building emissions is an equally critical part of the solution. In fact, energy use by buildings – both residential and commercial – contributes approximately 27 percent of global CO2 emissions – much of which stems from heating and cooling.

Beyond carbon reduction, home and building electrification is now being pursued with added urgency as a matter of global security and economic stability amid both gas price and political volatility. Many countries are pivoting away from Russian energy imports and seeking non-fossil-fuel-powered cooling and space and water heating alternatives. In the United States, in June 2022, President Joe Biden authorized using the Defense Production Act to ramp up heat pump production in the U.S. saying that overreliance on fossil fuels leaves the United States and its allies vulnerable to threats and price shocks. Further, the U.S. Inflation Reduction Act passed in August 2022 includes 10 years of tax credits and other incentives designed to make clean energy technology more accessible, including reducing the cost of heat pumps and electric water heaters.

But even as world and local leaders and energy providers increasingly prioritize home and building electrification, the majority of consumers won't be motivated to replace their working HVAC or water heater until their existing systems reach their end of life. Many also aren't familiar with heat pump technology and how it has advanced to make it a more viable option for more geographies, the benefits of electric water heating, or the new incentives that make these appliances more accessible — especially in colder climates where fossil fuel-based heating has been the go-to. Data-driven personalized engagement is the key to educating consumers about their options and inspiring them to take action.

A customer-first, bottom-up approach to grid planning is also an essential part of achieving residential decarbonization goals. As electric appliance adoption scales and the grid is expected to accommodate new electrification-related loads, energy use data should continue to serve as a strategic driver to guide grid planning and enable a more collaborative, agile approach to ongoing demand-side management and non-wires alternatives.

**We've developed this Heat Pump Adoption and Beneficial Electrification Playbook to help energy leaders achieve beneficial electrification goals through hyper-targeted and personalized customer engagement; more accurately forecast electrification-related energy demand; and successfully manage increases in grid load:**

- **Strategy 1:** Accelerate electric appliance adoption using a data-driven approach to customer engagement
- **Strategy 2:** Better inform grid planning with electrification data insights
- **Strategy 3:** Partner with customers in managing growing electrification load

# STRATEGY 1: ACCELERATE ELECTRIC APPLIANCE ADOPTION USING A DATA-DRIVEN APPROACH TO CUSTOMER ENGAGEMENT

Traditional utility mass marketing tactics will not be enough to convince the general public to purchase a new appliance before it is absolutely necessary or to adopt technology with which they are unfamiliar. Instead, data-driven, hyper-targeted, and personalized customer engagement is the lever utilities can rely upon to achieve technology shift.

## ACTION STEPS

Identify and target customers best-suited to electric appliance upgrades

Engage with targeted customers in a more personalized way

Inspire customers to take action by aligning with their individual needs

# IDENTIFY AND TARGET CUSTOMERS BEST-SUITED TO ELECTRIC APPLIANCE UPGRADES

Targeting every household with the same marketing outreach is both costly and inefficient. Some customers, for instance, may already have heat pumps while others may not use enough air conditioning to warrant an appliance upgrade. Utilities are best served to instead hyper-target their program outreach to distinct precisely defined customer segments, such as those with high-use heating and cooling habits and/or inefficient HVAC systems and water heaters.

Leveraging appliance-level energy use data to create a real-world 360° profile for every customer, utilities can segment their customer base by location, appliance ownership, time of usage, as well as type of observed behavior – like higher-than-average cooling, heating or hot water usage.


For example, when it comes to determining which homes should be targeted for heating programs, understanding which homes have electric heating and which homes have gas or oil-based heating is an essential first step. Similarly, it's essential to understand whether a home has a window, mini-split, portable or central air conditioning. Disaggregated household energy use data makes fuel and appliance identification easy.

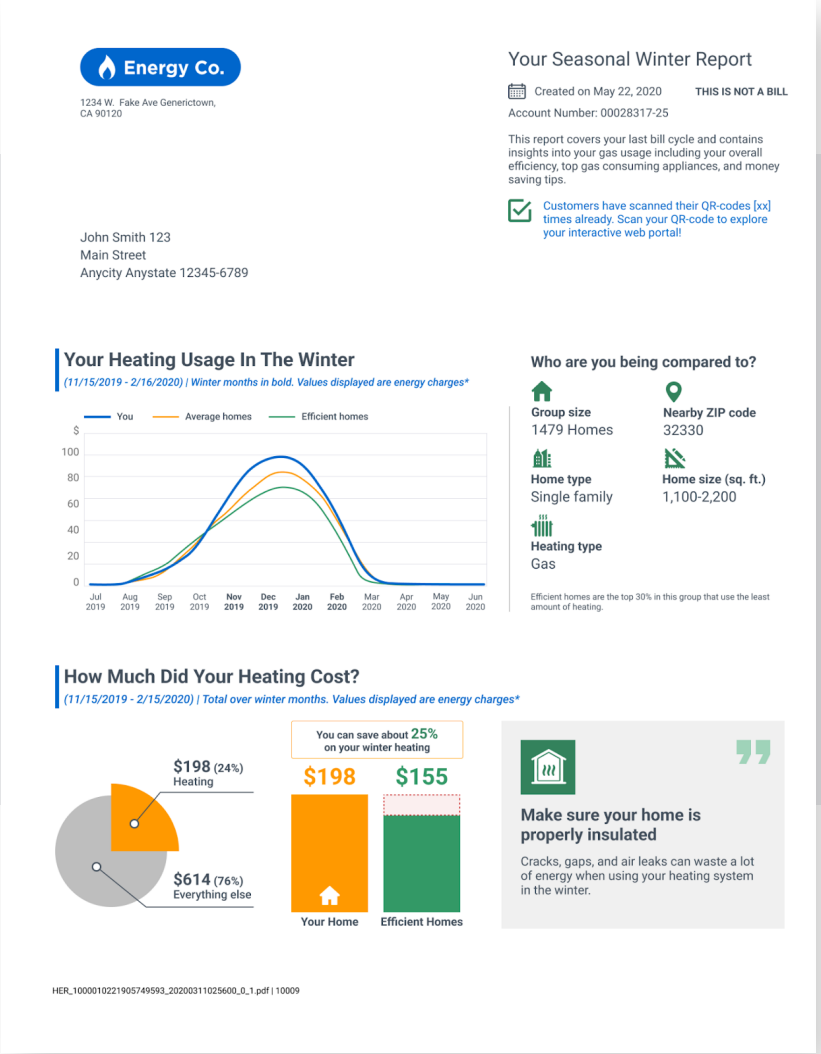
In addition, since appliances often start consuming more energy as they approach end of life due to degradation, utilities can also run queries to identify changes in the duty cycle curve or other cycling patterns to identify inefficiencies.

It's important to note that customers who fall into high use or inefficient appliance categories are better electric appliance targets because their payback period will be faster, even after initial rebate amounts. Demonstrating a clear, measurable, short-term and easily attainable appliance ROI is one of the most effective ways to accelerate electric appliance adoption and beneficial electrification.

# ENGAGE WITH TARGETED CUSTOMERS IN A MORE PERSONALIZED WAY

Once customers with the highest impact value are identified, utilities can then leverage appliance-level energy use insights to personalize both digital and paper communications.

At a foundational level, personalized outreach could, for example, include sending individualized home energy reports that show customers how their actual energy usage – itemized by time and appliance – is impacting their monthly utility bill.

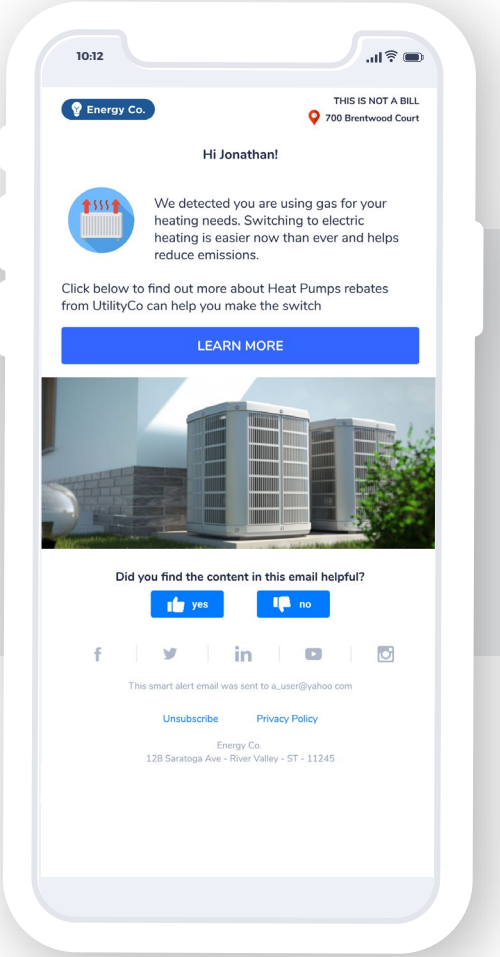



Building on that foundation of understanding appliance-specific usage, energy providers can then layer on one-to-one marketing outreach that highlights the most individually relevant benefits of heat pumps or electric water heaters. Promotions can also include customized purchasing recommendations, such as those for rebates and installation professionals.

# INSPIRE CUSTOMERS TO TAKE ACTION BY ALIGNING WITH THEIR INDIVIDUAL NEEDS

Presenting the right information to the right people is only half the equation. The other half is motivating them to take action, which happens by connecting with the needs and goals that matter to them the most. Making the decision to electrify appliances is driven by a variety of personal factors, including economic and environmental motivations. Energy providers can more successfully capture customers' attention and prompt action using personalized marketing that aligns with each customer's needs, unique circumstances, and values.

Customers who are motivated by sustainability, energy efficiency, savings, and comfort should all be messaged differently. An environmentally conscious customer will find carbon reduction impacts most compelling, while a savings-minded customer is likely to respond best to messages about incentives available to mitigate the costs associated with converting. Further, customers who have already embraced solar and/or electric vehicles are likely to be interested in how switching to a heat pump will further beneficially electrify their lives.




In addition, utilities can leverage customer energy use insights to drive electrification measures that align with their own needs and goals, whether those are driven internally or externally through variables like new regulatory requirements, investor relations or public expectations.

# STRATEGY 2: BETTER INFORM GRID PLANNING WITH ELECTRIC APPLIANCE DATA INSIGHTS

As EV adoption grows and more appliances become electrified, increased grid congestion is almost certain, taxing transformers and grid capacity at levels they were not built to handle. That said, even in the face of growing EV adoption, HVAC-related energy use is expected to continue to be the largest contributor to grid load because heating and cooling systems run for longer periods.

Replacing traditional AC units with heat pumps improves efficiency, while at the same time replacing space and water heating appliances that are fossil fueled with electric systems will increase grid load. With so much in flux, energy providers need appliance-by-appliance grid impact insights to maintain reliability and plan for future infrastructure. AMI data expands and improves the accuracy of the insights energy providers are able to draw upon as part of both real-time grid operations and forward-looking infrastructure planning.

## ACTION STEPS

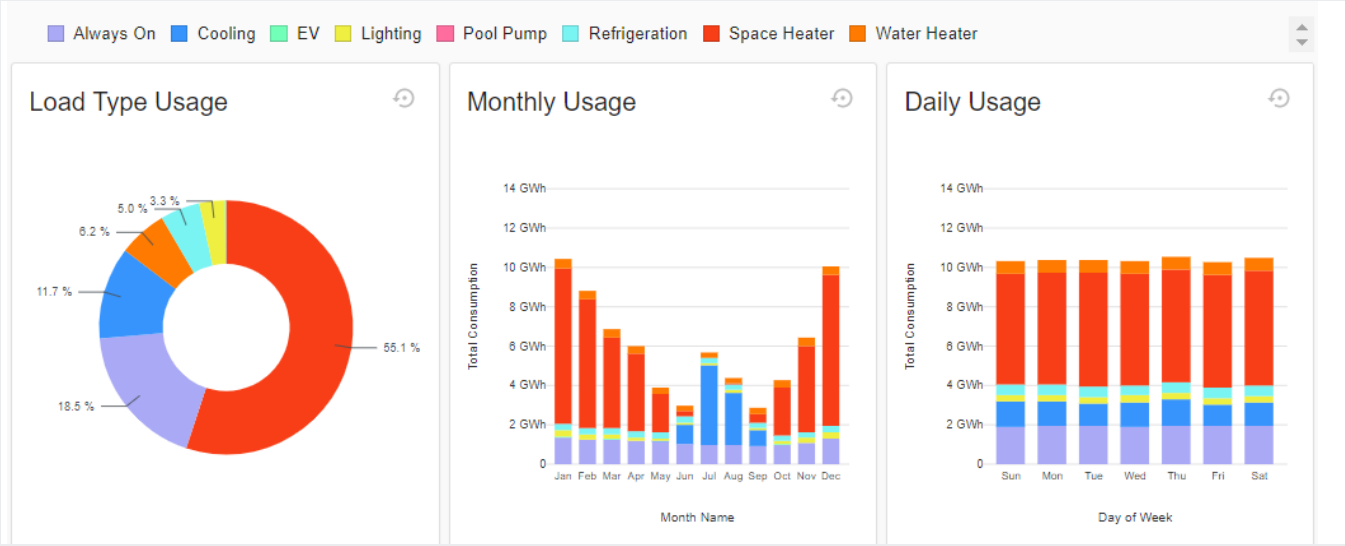
**Identify electric appliance owners, appliance types and usage patterns.**

**Inform and improve grid management and infrastructure planning by leveraging appliance data analytics.**

**Design rates and incentives based on granular usage data.**

## INSPIRE CUSTOMERS TO TAKE ACTION BY ALIGNING WITH THEIR INDIVIDUAL NEEDS

In the same way that appliance-level insights inform personalized customer engagement, that same granular understanding of usage also makes bottom-up grid management possible.




Utilities are able to see the total appliance-specific load by region, zip code, substation, or feeder; the percentage of appliances with a given fuel type or technology; appliance load forecasts; percentage of on vs. off-peak usage; specific geographies with the highest appliance-specific usage; and more.

## INFORM AND IMPROVE GRID MANAGEMENT AND INFRASTRUCTURE PLANNING BY LEVERAGING APPLIANCE DATA ANALYTICS

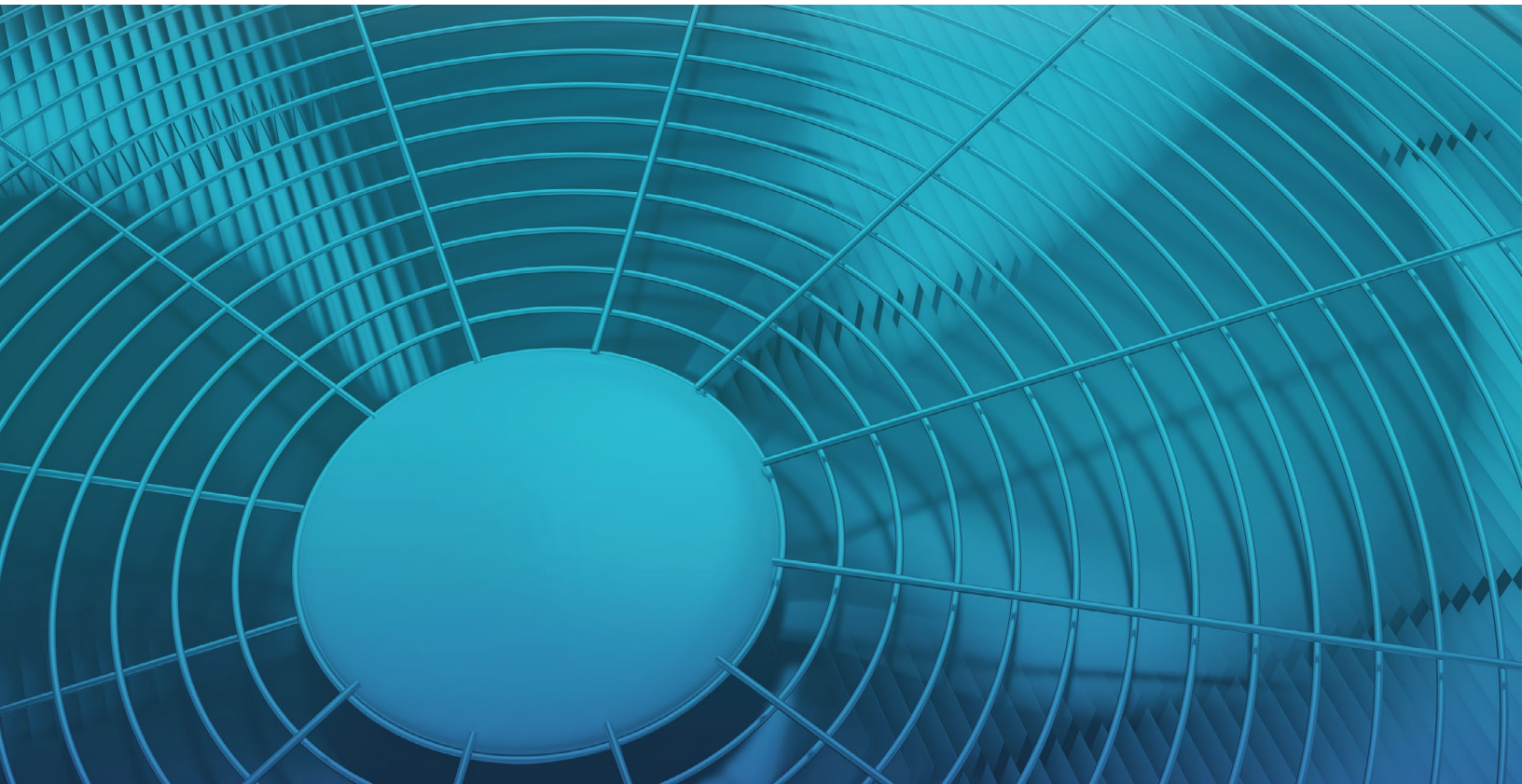
The ability to track customer energy use on an ongoing and iterative basis makes it possible to identify emerging and growing trends before they impact grid operations to enable more accurate and strategic planning.

Historically energy providers have only been able to evaluate energy usage at the substation level, or in some cases, at the feeder level. In addition, the majority of appliance-level information available to utilities is derived from periodic surveys carried out on a subset of ~0.1% of the population, then extrapolated out to the overall population. While the surveys can collect very granular data, they are limited because the information quickly becomes outdated. And, more importantly, the survey sample set is generally not statistically significant or applicable to diverse customer segments.

Now, by applying AI to smart meter data, utilities are empowered to understand load at the per-appliance-use level and more accurately predict future load patterns and determine what kinds of loads are available to shift.


For example, if heat pump ownership is 3% in aggregate across the territory, the utility might determine that heat pump load shifting will not play a valuable part in its non-wires solutions. But what if, in fact, the load-constrained geography ownership is actually >20%? In that case, shifting heat pump load should be a critical component of grid management.

With appliance-level insights, it is possible to identify feeder lines or transformers that are at risk of disruption and develop mitigation strategies before problems arise.



# DESIGN RATES AND INCENTIVES BASED ON GRANULAR USAGE DATA

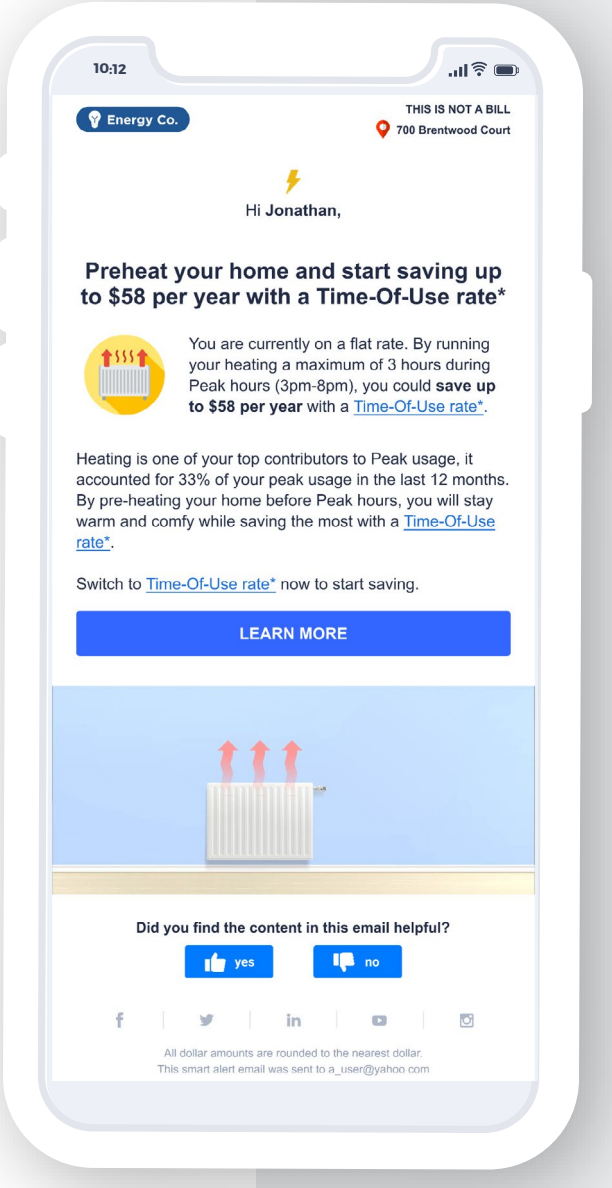
Another benefit of appliance-level analytics is the ability to precisely identify who would benefit from TOU rates and better align customer price signals that incorporate home-specific energy usage data, rather than rate design based around broad classes of customers that may not be relevant to an individual home. Rate design has often been a very difficult process for utilities, because it has been impossible to determine if a rate will have the desired effect until after it has been implemented. Rates designed based on actual energy consumption make the rate design process more accurate and responsive, which ultimately leads to more successful outcomes, including cost efficiencies for customers load shift and more.

Rate design precision becomes even more important as customers adopt more electric appliances, increasing their overall consumption. This also provides the ability for utilities to create more appliance-specific rates (such as for EVs) that link rates to how consumers utilize the numerous appliances within their homes.

One way to support these customers through the transition is to specifically identify those who have the highest shiftable loads and encourage them to sign up for advantageous rates and change their behavior, whether manually or through grid-connected devices. These customers could stand to save significantly on their bill and shift load for the utility.

With TOU rates implemented, we can also analyze customers who are on the TOU rates' peak vs off-peak consumption to look for changes in their usage patterns, down to the appliance level. This insight should inform further rate design and rate targeting. If behavior modification is limited, it may mean that the difference between on- and off-peak rates is not providing enough incentive to change behavior.

At every stage of the rate conversation, make sure that new heat pump users aren't 'wrongly' targeted as inefficient due to their increase in electricity usage. Customers shouldn't be inadvertently penalized for switching to a heat pump, but rather be congratulated and rewarded for their cleaner usage.



# STRATEGY 3: PARTNER WITH CUSTOMERS IN MANAGING GROWING ELECTRIFICATION LOAD

Appliance and transportation electrification and the increased deployment of distributed energy resources like solar, wind and energy storage are introducing more variability into both energy generation and demand. As the grid grows exponentially more complex, customers are increasingly becoming important utility partners who play a pivotal role in resiliency and the energy transition.

The utility-customer relationship is evolving to a point where energy providers are no longer exclusively selling kilowatt hours in a one-way transaction to passive consumers. Instead, consumers now also have a role to play in managing supply and reducing stress on the grid during periods of high demand.

Smart home energy management systems (HEMs), virtual power plants (VPPs) and other connected technology solutions are facilitating utility-consumer load-balancing collaborations, enabling utilities to tap into heat pumps, grid-interactive water heaters, smart thermostats, managed electric vehicle charging and energy storage systems to reduce and reschedule energy use to improve grid reliability.

Successfully changing the utility-customer dynamic requires a deep understanding of how customers use electricity, which technologies they've adopted, and the types of utility programs that could benefit them as detailed in Strategies 1 and 2 above. These granular insights make possible the deeper engagement required to foster long-term HEM, VPP and other load-shifting platform participation.

## ACTION STEPS

- **Manage customer participation in smart home energy management programs**
- **Aggregate heat pumps and grid-interactive water heaters as part of VPPs**

## MANAGE CUSTOMER PARTICIPATION IN SMART HOME ENERGY MANAGEMENT PROGRAMS

There are a growing number of smart energy home management devices that empower energy providers to shift heat pump and other electrified appliance usage to off-peak times and exert other energy usage controls.

As more intermittent renewable energy resources are added to the grid and beneficial electrification scales, energy providers will need to deploy these technologies at scale and leverage data to inform agile customer engagement that builds customer enthusiasm for turning over some degree of control over their appliances to their utility.

After adoption, energy use data becomes even more important to maintain an ongoing positive experience. Utilities need to understand each customer's energy needs on an individual basis combined with other essential data points such as weather forecasts, to ensure that heat and hot water remain available for customer use when needed.

Data science allows utilities to continuously measure and track the impact of home energy management system performance with near-real-time and appliance-specific reporting. At any point, it's possible to determine whether the program is performing well and achieving desired outcomes. If the answer is 'no,' AMI data analytics reveals what steps utilities should take to correct course now — adjusting program strategy, incentives, participants, or any other program element as soon as weeks or months into implementation and on a continuous basis.

Data can also be fed back to customers to help them track their own performance, fostering deeper engagement and collaboration over time.

## AGGREGATE HEAT PUMPS AND GRID-INTERACTIVE HEAT PUMP WATER HEATERS AS PART OF VPPS

In the same way that batteries and electric vehicles provide VPP storage, so too do heat pump water heaters. The water in the tank acts as a storage device for the energy used to heat it.

When hundreds or thousands of grid-interactive heat pump water heaters are aggregated, they become like a fleet of batteries that can be tapped to meet grid demand.

Heat pumps can also play a part in VPPs. For example, aggregating 10,000 heat pumps would yield a shiftable load in the 10-30 MW range.

The foundation for successful VPP administration is appliance-level energy insights. This data identifies potential consumer participants, informs personalized customer communications and rate designs to maximize participation, and allows ongoing monitoring of program performance to increase the likelihood of successful outcomes.

Disaggregated information about behind-the-meter appliances allows utilities to accurately assess load elasticity and calculate over time how well individual customers actually responded to demand response events or were able to participate as part of a VPP.

# LOOKING FORWARD

Data science makes it easier to achieve home and building electrification goals on or ahead of schedule through hyper-targeted and personalized customer engagement, more accurate electrification-related grid forecasting, and more successful demand side management.

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For more information about how Bidgely's Analytics Workbench can inform data science-driven customer engagement and grid planning, download our **Analytics Workbench Solution Brief**.